INTRODUCTION

CHAPTER: I

1.0 Introduction:

Science has left no aspect of human being untouched. Modern science has been enlarging our knowledge of the environment on an ever increasing pace, and society has become more dependent on the practical effects of science. After the Second World War scientific temper has been developed in a progressive way. In the middle of 19th century South Korea and China have made tremendous development in industrial sphere. In short period of time Russia become powerful due to scientific temper and attitude. The rise of modern science in Europe during seventeenth century had an impact on progress of science education at global level.

Science has long been taught in different branch such as physics, chemistry, botany, zoology etc. in an isolated way without bringing any correlation or integration between them. However, in the later half of this century a new concept of science with compounded curriculum has been evolved and causes were developed in integrated science i.e. general science.

1.1 PROGRESS OF SCIENCE EDUCATION: In 1968 the first international conference on the teaching of integrated science was held in Bulgaria which was sponsored by UNESCO in cooperation with Integrated Council of Scientific Unions (ICSU) and committee on the teaching of science (CTS). The conclusions of this conference were:

1) Teaching of integrated science emphasizes the fundamental unity of science and leads towards an understanding about the place of science in modern society.
2) Teaching of integrated science avoids unnecessary repetitions and permits the introduction of intermediate disciplines.
3) It is necessary to compile the course in such a manner that the course be judiciously chosen and compiled by the teachers and other specialists.
4) Science is an important part of primary education, as it can grow scientific curiosity and develop scientific attitudes and skills.

The International Congress of Science and Technical Education by UNESCO in 1981 made numerous recommendations for UNESCO's future role in this broad field of activity. Studies were carried out regarding the place of science in curriculum in various countries. Following generalizations were made according to different regions:

1) **Africa**: The set of data was provided by 21 countries. Most of the countries adopted integrated approach for teaching of science at primary level and middle level. In secondary level general science is a permitted alternative to integrated science. (Integrated science includes elements of geology, agricultural science, home science and economics in addition to physics, chemistry and biology.)
2) **Arab states**: 10 countries of this region were considered. In intermediate and secondary level integrated course, and in 10th, 11th and 12th, separate science subjects were provided.
3) **Asia and the Pacific**: 17 countries including India participated in survey. Here also integrated science course was implemented at early secondary stage. The three science disciplines - physics, chemistry and biology were offered as optional courses during the late secondary school stage.

In 1972, the UNESCO International Commission recommended that science be incorporated as a single science. The Commission stated that "Science and Technology must become essential components in any educational enterprise. They must be incorporated into all educational activities introduced for children. Young people and adults in order to help the individual to control social energies as well as natural and productive ones thereby achieving mastery over himself, his choices and actions and finally, they must help man to acquire a scientific turn of mind so that he becomes able to promote science without being enslaved by it."(Kulshrestha and Pasrichs, 2006)

After that in 1978 a major international conference on integrated science was held in Netherland which was organised by the International Council of Association for

Science Education (ICASE) in cooperation with UNESCO. In July 1988, the most important international gathering related with integrated science took place in Australia, which made a distinction between 'Integrated' science and multidisciplinary science.

Teaching general Science at school level: Methods are important factor for effective teaching and learning. Selection of method, proper use of method, identification target group, classroom management, use of teaching aids, objectives of teaching etc. are inter linked.

All the International Committee and organisation has made numerous recommendations to achieve the goal of science education, which can reflect the scope of science and its relation with the society. For this purpose emphasis has been given in teaching learning process of science at different levels. Different scholars and specialists have conducted different studies on teaching and learning of science with adoption of methods at school levels. Among them Prof. Socrates Armstrong, W.H. Kilpatric (1918), Leonard Douglas, Lee, Hammonds Cazsie, Lwrance Urelang, Garg J.S. Bruner (1961) etc. have given immense contribution towards science teaching and emphasis was given on effectiveness of methods**.**

In Britain Canon Wilson (1867) published an essay on science teaching. He also wrote a book on chemistry with his friends in which he encouraged the pupils to search for facts or cause by own efforts. He introduced modified form of heuristic method**.**

The BSCS Biology Teachers' Handbook (1970), presents "Invitations to Inquiry" in which student tries to do an experiment or any activity in the laboratory, where he learns through active participation. The study of science is based on students' active participation such as engaged in laboratory work, searching new ideas from environment, identifying problems, developing hypothesis, planning experiments, conducting experiments, gathering data, making generalization.

This view is supported by Carin & Surd (1984), Voss and Brown (1968) have observed science Teaching for a long time and found that the focal point for teaching

science as ‘inquiry’ is found in the laboratory. Students can find opportunities to discover scientific truth with the help of laboratory experiences. It can enhance scientific knowledge and better understanding of general science. He preferred enquiry method in school stage instead of lecture method which is traditional one

In case of discovery or inquiry learning is a process of investigation, a search for truth. Bruner(1961) says, “ I do something that before was unknown to mankind but rather include all forms of obtaining knowledge for oneself by the use of one’s mind permitting the student to put things together for himself or to be his own discoverer.”

According to Gagne (1963) enquiry is apparently a set of activities followed by problem solving approach in which each newly encountered phenomenon becomes a challenge for thinking.

Carin and Sund (1984) have identified the processes of discovery which are observing, classifying, measuring, predicting, describing and inferring. They found that discovery only occurs when a student is mainly involved in using his cognitive processes to discover some concept or laws. Similarly, inquiry involves these processes which are known as: Identifying problem, formulating hypothesis, designing experiment, conducting experiment, gathering data and drawing conclusions. An inquiry method spontaneously involves discovery method.

Schwab (1962) opined that enquiry approach helps students to see science in operation. Otherwise in traditional (lecture) approach simply that talk about science.

An English scientist, Robert Hook (1665) conducted an experiment. He observed a cork under the microscope, and sow empty cavities surrounded by walls of tissues. He called it ‘empty cell’. He first observed the cut piece under microscope then repeated and rendered the observations carefully. Then he recorded his data to draw inferences. Further, he suspected that passage existed in the cell wall. He tested his hypothesis by looking for the passage with his microscope. But he could not locate these passages. After use of sophisticated tools and new evidences he finally concluded the nature of a cell. He ultimately invented the ‘cell’ through enquiry approach.

Pestalozzi, Herbert, Frobel and Dewey etc suggested for arousing the learners' capacities though practical work, which is a best way of teaching. According to Bush (1987) the problems of the classroom teaching, the teachers, the students, child development, process of learning and changing needs should find place in educational research.

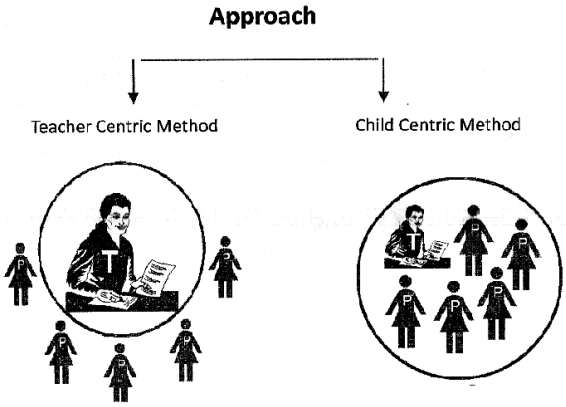
Coulter conducted a research on the use of laboratory and demonstration method in biology class. Though he found minimum difference in the use of laboratory method and demonstration method, yet he suggested laboratory method to be more effective. He used the same teacher and same course for using both methods in his study.

Another extensive study was conducted by Sorenson. He selected 20 sections of biology students. 10 sections were taught by lecture approach and another 10 sections were taught by laboratory approach. 16 teachers were involved in the experiment. The finding showed that the laboratory group displayed significantly better development in terms of critical thinking and understanding the subject.

In ancient India prime importance was given to the studies of science and mathematics. Just after independence Tara Devi Committee (1956) and Secondary Education Commission (1952-53) emphasized on science education at primary and secondary level respectively. During 1964-66 the Kothari commission recommended science as compulsory subject in school education at secondary level. In 1986 The New Education Policy laid stress on development of scientific temper among the students of all classes, considering the utility and value of science from different dimensions. Similarly, 1992 Programme of Action, Sarva Siksha Abijan (SSA) in 2001 followed by National Curriculum Frame Work 2005 and Rashtriya Madhyamic Siksha Abijan 2009 (RMSA-India, 2012) also given stress on science education at secondary level. So, Science education is considered as an integral part of our school curriculum. Therefore every effort should be made to extend science education even to those quarters, where it could not reach till now.

The competency and efficiency of the science teachers can be enhanced through the use of appropriate methods of teaching. The organized and systematic scheme of

interpreting the world of knowledge to the child's mind is called the method of teaching.Teaching is an art and science also. Methods are based on two approaches 1)Teacher Centric (traditional) and 2) Child Centric or Pupil Centric(modern).In the teacher centric approach there are three methods ,these are-Lecture, Demonstration and Historical method. On the other hand child centric approach consists of numerous methods namely, Heuristic, Enquiry, Problem-Solving, Project, Dalton-plan, Program Learning, Team-teaching etc. In teaching science, activity methods are more preferable.Method of teaching should be flexible according to the need and capabalities of students' , the specific demand of the environment and the aim of teaching Science.The teacher should be able to use proper combination of methods, devices and techniques to make teaching of different subjects or topics interesting,vital and living.



Methods are the windows of effective teaching .The appropriate use and application of different methods in science teaching have been explained by different experts like Siddiqi& Siddiqi, Kohli, Yadav, Soni, Walia and Sharma. Various commissions and committees laid emphasis on different teaching methods.

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 influence the student teachers during training situation which will motivate them to use the proper 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 favour of demonstration method.

To study the academic achievement of the students, Goyal (1975) completed a study, on methods which indicate a trend of improvement in students` performance from lecture to discovery method in science teaching, and findings are in favor of discovery method.

According to Bush (1987) the problems of the classroom teaching, the teacher and the students, child development and process of learning and changing needs should find place among the priority areas of educational research.

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

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 (2005) showed the effectiveness of lecture cum demonstration method over the lecture method. She suggested that in case of lower classes lecture cum demonstration should be used in place of traditional method, which creates better teaching- learning process in science stream. An effective use of method in teaching may raise the mental ability of students, so students may think and learn better than by the traditional methods.

Teaching methods can help in choosing right kind of teaching aids and techniques for the science teaching .It also can help a science teacher for better planning and better learning sequence in class room teaching. Teaching methods can help the teachers in training period hence it has an impact in secondary teacher training programmes.

1.2: **Need and Justification**:

For teaching science at secondary level, activity methods are highly preferable. All the scientific methods are logical as well as psychological to teach science in effective way.

In our secondary schools it is observed that for teaching science and mathematics, appropriate methods and strategies are generally not adopted. Therefore learning outcomes are not satisfactory. It is an urgent need to adopt an innovative approach in teaching science in secondary schools. The suitable and proper use of teaching methods can make the teaching-learning process effective one. Hence attempt has been made to find out the effective methods of teaching science in secondary schools.

In India research in science education is still in progressing stage particularly at secondary level.In our State Assam, it is still in an embryonic stage.Very few studies have been reported in this field.But it is an well-known fact that research findings in science teaching at secondary level enable us to understand the changes created by educational programme and policies in case of learners' terminal behavior, teachers' attitude and changes in society. In this regard, research work is quite inadequate and a great deal of work is yet to be done. Hence a number of exploratory studies and experiment need to be undertaken.

Therefore, the investigator has tried to make a humble effort to change the mindset of the teachers in use of appropriate methods for achieving the goal of science teaching.

1.3: **Statement of the problem**:

On the basis of the justification it is proposed to make a comprehensive study on the topic entitled ''A comparative study on the effectiveness of Lecture Cum Demonstration Method, Inquiry Method and Laboratory Method for Teaching General Science in Secondary Schools.

1.4: The objectives of the study:

Keeping in view the statement of the problem the objectives are:

(1) To find out the effectiveness of the three different methods of teaching General Science at the Secondary level :

(I) Lecture Cum Demonstration Method

(II) Inquiry Method, and

(III) Laboratory Method.

(2) To make a comparative study of the effectiveness of Lecture Cum Demonstration and Inquiry method in teaching General Science.

(3) To make a comparative study of the effectiveness of Lecture Cum Demonstration and Laboratory method in teaching General Science.

(4) To make a comparative study of the effectiveness of Inquiry and Laboratory method in teaching General Science.

(5) To investigate the relative effectiveness of

(I) Lecture Cum Demonstration method

(II) Inquiry method and

(III) Laboratory method in relation to school:

(i) Type of Management (Government and Private Schools)

(ii) Locality (Urban and Rural Schools)

(iii) Board/Certificate (SEBA, CBSE and ICSE).

(6) To find out the problems faced by the teachers in teaching General Science by using three different methods (Lecture Cum Demonstration, Inquiry and Laboratory) at the secondary level.

Thus the present study has 6 objectives.

Hypothesis testing is an essential procedure in research work. Hypothesis makes a research activity to the point and relevant. Research without hypothesis is like a sailor in the sea without compass. Therefore keeping in view its importance, depending on the objectives, following hypotheses are formulated:

1.5: The Hypotheses of the study:

H_{01} **:** There exists no significant difference in academic achievement of students if they are taught by using Lecture Cum Demonstration method, or by Inquiry method or by Laboratory method of teaching General Science.

H_{02} **:** There exists no significant difference in academic achievement of students if they are taught by using Lecture Cum Demonstration method or by Inquiry method of teaching General Science.

H_{03} **:** There exists no significant difference in academic achievement of students if they are taught by using Lecture Cum demonstration method or by Laboratory method of teaching General Science.

H_{04} **:** There exists no significant difference in academic achievement of students if they are taught by using Inquiry method or by Laboratory method of teaching General Science.

H_{05} **:** There exists no significant difference in academic achievement of students if they are taught by using Lecture Cum Demonstration method or Inquiry method or Laboratory method with respect to -

(i)Management (Government and Private Schools)

(ii) Locality (Urban and Rural Schools) and

(iii) Board/Certificate. (SEBA, CBSE, ICSE).

(SEBA: State Board of Secondary Education, Assam,
CBSE: Central Board of Secondary Education,
ICSE: Indian Certificate of Secondary Education.)

$\mathbf{H_{06}}$: The secondary level teachers face various problems while using different methods of teaching General Science in their respective schools which can be identified from their responses.

1.6: **Delimitation of the study**:

The present study has been undertaken to assess the use of methods in secondary schools where the focus is on how this method help the teachers in teaching-learning process resulting in the academic achievement of the students. Due to certain factors the study suffers from certain limitations, out of which the majors are listed below:

The first delimitation was found necessary in case of the geographical area. The investigator had delimited the area to metro and rural part of Kamrup district, Assam. (Map of Kamrup district is attached).

The second delimitation was that only 60 schools situated in metro and rural part of kamrup district were covered in the study. In selecting schools for the present study certain criteria have considered to maintain homogeneity:

a) The school must have adequate number of teachers to teach science

b) The teacher must be trained,

c) The school must have a laboratory and

d) The schools must have at least some teaching aids for teaching general science.

The third limitation was done in category of the samples.(i) All The students of the sample Secondary Schools studied in class-x were included in the sample. Thus the total numbers of students were 3069. (ii) The trained teachers of the sample secondary schools who teach general science in class-x were included in the sample. The total numbers of teachers were 76.

The fourth delimitation was done in the category of the methods of teaching. This study is confined to three methods of teaching general science, where one was selected from teacher-centered approach and the other two from learner-centered

approach, i.e. (i) Lecture cum Demonstration method (ii) inquiry method and (iii) Laboratory method.

The fifth delimitation was done according to type of management of schools. Out of 60 selected schools, 48 government and 12 private schools. Among the selected schools 21 were higher secondary and 39 were high schools.

The sixth delimitation was done on locality, 33 schools belongs to urban area and 27 from rural area, of kamrup district.

The final delimitation was related to schools under different boards /certificate etc. i.e. SEBA, CBSE and ICSE. The total number of schools under SEBA was 52, CBSE were 07 and ICSE was 01.

1.7: **Operational definition**:

1) **Secondary school**: Secondary Schools are meant for providing secondary education i.e. four years of secondary education comprising two years of both Junior and senior secondary education. Junior Secondary Schools covering up to IX and X standards.
2) **Management**: (a) **Government Schools**: Schools under administration and management of government. (b) **Private Schools**: Schools under administration and management of private sector .They are fee-paying and provide education for the age of 3-18.Again they are known as private or public schools although they do not receive any public funding(Dictionary of Education.2015).

Locality-(a) **Urban Schools**: Schools in urban area. (b)**Rural Schools**: Schools in rural area.

3) **Board**-(a) **SEBA**: The Board of Secondary Education, Assam. The Board regulates, supervises and develops secondary education in the state of Assam (en.wikipedia.org). (B) **CBSE**: The Central Board of Secondary Education .It is a board of education for public and private schools under the union government of India (en.wikipedia.org).(c) **ICSE**: Indian Certificate of

Secondary Education. It is a private non-governmental Board of School Education in India for Secondary stage (en.wikipedia.org).

4) **Method**: A strategy, activity, or procedure for teaching or supporting learning. (Dictionary of Education, 2015).
   (i) Lecture cum Demonstration method
   (ii) Inquiry method and
   (iii) Laboratory method of teaching science

DESCRIPTION OF THE POPULATION: A BRIEF NOTE ON KAMRUP DISTRICT:

LOCATION:

Kamrup District is situated between 25.46 and 26.49 North Latitude and between 90.48 & 91.50 East Longitude.

The District is bounded by:-

North : Udalguri and Baska District.
South : Meghalaya.
East : Darrang District.
West : Goalpara and Nalbari District.

CLIMATE & RAINFALL:

Climate	:	Sub tropical with semi-dry summer & cold in winter.
Annual Rainfall	:	Ranges between 1500 mm to 2600 mm.
Natural Calamity	:	Flood occurs generally in the low lying areas of the district during May to August every year. Late flood during the later part of September & October also occurs. The occurrence of flood in the district is due to the river Brahmaputra and its Tributaries.
Average humidity	:	75%
Max. Temperature	:	38.5 C.
Min. Temperature	:	7.C.

IMPORTANT RIVERS:

- Brahmaputra
- Puthimari
- Bornoi
- Nona
- Kulsi
- Pagladiya
- Kalajal

LAND UTILISATION:

a. Geographical Area - 4, 34,500 ha.

b. Net cultivated area -1, 81,608 ha

c. Forest Area -1, 16,694 ha.

d. Fallow Land- 7.110 ha.

e. Land not available for cultivation- 89,542 ha.

f. Others -1, 08,000 ha.

g. No. of Tea Gardens.- 15 Nos.

AREA UNDER TEA CULTIVATION- 3,660 HA

Total tea production -7, 72,640 kg.

h. Overall land utilization- 1,304

IRRIGATION:

The District has 58,239 ha. of irrigated land. The bifurcation as per 1999-2000 data is as under

a) By canals/surface 18,681 ha.

b) By wells (DTW) 818 ha.

c) By lift irrigation 6,841 ha.

d) By other sources (STW+LLP etc.) 39,630 ha

In 1834, the first Assamese medium secondary school of Kamrup district which is also the first secondary school of Assam was established. This is known as Cotton Collegiate Higher Secondary school. The present strength of government and provincialised secondary schools in Kamrup district is 121 in metro and 295 in rural area. Now-a-days the private secondary schools are playing a major role in the development of secondary education district, Assam .

Figure :1 Showing Kamrup District as the place of investigation