CHAPTER – VII

SUMMARY

7.0 Introduction:

Science education is one of the important potential instruments in nations’ technical and scientific advancements. Science has been given due place in our school education program making it a compulsory subject till X standard. It has been necessitated to lay due emphasis to teaching of science right from the primary stage. The success of teaching learning phenomena is judged by progress level of students and their learning outcomes. Teaching of science will never be fruitful just by explaining the subject matter and asking the students to learn. It always include the development of interest, values, attitudes, aptitudes and appreciation. If science is taught keeping these factors in mind more number of students will develop interest in subject. Thus it becomes perennial responsibility of a school/educational institution to promote and develop interest in science subject amongst students so that they can score high in it. Science as a subject has three very important virtues peculiar to it. The study of science imparts training in scientific method and develops scientific attitude and scientific aptitude in the learners. These qualities, viz., scientific attitude and
scientific aptitude are the major aspects to qualify an individual to live as truly efficient citizen in the present day scientific society (Bhaskar Rao, 2003)

Thus looking into the factors like scientific attitude and scientific aptitude effecting the achievement in science subject, narrowing to the region selected for the study carries paramount importance. The investigator has taken references from fore going studies in concerned field and found that the present area of concern was untouched in this aspect. The present study is unique in itself as it envisages the individual and multiple effect of scientific attitude and scientific aptitude on achievement in science subject of class X students.

7.1 **Need and Justification of the Study:**

Achievement in subject of science is the core of science education at all the levels. The academic achievement in science is the resultant of complete teaching learning phenomena. Each and every student holds different levels of competence and his achievement is affected by the same despite going through the same subject matter. These variations can be caused by social and environmental reasons. Achievement in science is not the indicator of pupils’ educational outcomes but it is a decisive factor for their career growth. Science
stream offers wide variety of career opportunities still it is seen that less number of students opting for science stream for higher studies.

The inquisitiveness to find the reason for the same became the need for this study as to where are we lacking in inculcating this interest amongst the students? Where we are missing to develop the kind of scientific culture amongst students so that they have innate interest to study science and achieve well?

This all has provoked the thought process to research the factors which influence science interest and achievement level of students. The science educators have recognized that scientific attitude and scientific aptitude are among the major factors which should result from science teaching. There is general agreement among the science teaching faculty that an individual with scientific attitude is open minded, critical, free from biases and has intellectual honesty which make him learn and retain science comparatively in a better manner. Along with scientific attitude scientific aptitude is another ability of future accomplishment in science. If an individual endowed with higher scientific aptitude he will be in a position to pursue science education with ease and effect.

Knowing about these two factors i.e. scientific attitude and scientific aptitude, it develops a query as to how much they influence
learning in science. Thus the study was planned to judge the effect of these potentialities of mind on academic achievement in science subject.

7.2 **Statement of the Problem:**

In view of the background as described above, the problem under study is specifically titled as follows:-

“Effect of Scientific Attitude and Scientific Aptitude on the Academic Achievement in Science Subject of Class X Students in East Khasi Hills District of Meghalaya”.

7.3 **Operational Definitions of the key Terms Used:**

The present study involves the following key terms which are operationally defined as follows.

(i) **Effect**

It refers to the influence of naturally occurring independent variables (i.e. Scientific Attitude and Scientific Aptitude) on the dependent variable (i.e. Achievement)

(ii) **Scientific Attitude**

Scientific attitude can be defined as a generalized disposition towards science, which can be measured in terms of its favorableness estimated from the scores obtained on a scientific attitude scale by testing the components like curiosity, open-mindedness, faith in
scientific methods, cause and effect relationship, critical mindedness, seeking evidence, objectivity, suspended judgment & aversion to superstition.

(iii) **Scientific Aptitude**

Scientific aptitude can be defined as a special intellectual ability to comprehend the scientific knowledge which can be measured in terms of its favorableness estimated from the scores obtained on a scientific aptitude scale by testing the components like reasoning, special visualization, scientific vocabulary and numerical ability along with the information about scientific events.

(iv) **Academic Achievement**

It refers to the students’ ability to achieve academically. It is reflected in terms of the percentage of marks obtained by class-X students in the subject of science in their SSLC examination conducted by MBOSE.

**7.4 Objectives of Study:**

a) To find out the scientific attitude, scientific aptitude and the level of academic achievement in science of class X students in East Khasi Hills Districts of Meghalaya.
ii) To study the relationship between scientific attitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

iii) To study the relationship between scientific aptitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

iv) To study the multiple effect of scientific attitude and scientific aptitude on academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

v) To study the effect of scientific attitude on the academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

vi) To study the effect of scientific aptitude on the academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

vii) To suggest measures to improve the quality of science education in schools in East Khasi Hills District of Meghalaya.
7.5 **Hypotheses of the Study:**

(A) **Research Hypotheses**

(i) There is significant relationship between the scientific attitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

(ii) There is significant relationship between the scientific aptitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

(iii) There is significant multiple relation between academic achievement and the variables of scientific attitude and scientific aptitude taken together of class X students in East Khasi Hills District of Meghalaya.

(iv) There is significant difference in scientific attitude of class X students between high and low achievers.

(v) There is significant difference in scientific aptitude of class X students between high and low achievers.

(B) **Null Hypotheses**

(i) There is no significant relationship between the scientific attitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya.
(ii) There is no significant relationship between the scientific aptitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya.

(iii) There is no significant multiple relation between academic achievement and the variables of scientific attitude and scientific aptitude taken together of class X students in East Khasi Hills District of Meghalaya.

(iv) There is no significant difference in scientific attitude of class X students between high and low achievers.

(v) There is no significant difference in scientific aptitude of class X students between high and low achievers.

7.6 Delimitation of the study:

The study is delimited to the students of class X belonging to different secondary schools of East Khasi Hills District of Meghalaya under The Meghalaya Board of Secondary Education (MBOSE).

7.7 Design of the Study:

The present study is designed as follows:

(i) **Population**

The population of study is comprised of students of class X of the schools affiliated to MBOSE, situated in the East Khasi Hills District of Meghalaya. The district of East Khasi Hills has total of 202
secondary schools under MBOSE and the total enrolment in class X is approximately 5651 in year 2009.

(ii) Sample

The sample for the present study is consisted of 553 students, from 22 schools, studying in class X. These schools were selected randomly by giving fair representation to all types of schools.

(iii) Tools Used

In order to obtain the required data the following tools were used in the present study;

(a) Scientific Attitude Scale constructed by Dr. S. C. Gakhar and Dr. Amandeep Kaur.

(b) Scientific Aptitude Test Battery constructed by Dr. K.K. Agarwal, and Dr. Saroj Aurora.

(iv) Method of Study

For the present study, ex-post-facto method of research has been used. The term ex-post-facto is used to refer to an experiment in which the researcher, rather than creating the treatment, examines the effect of a naturally occurring treatment after it has occurred. In the present study, the effect of two naturally occurring treatment variables viz.:
scientific attitude on the academic achievement in science subject of class X students is being studied.

(v) **Statistical Techniques Used**

The present study has used the following statistical techniques;

(a) Mean and Standard Deviation.

(b) Percentage was also used for calculation.

(c) Pearson’s Coefficient of Correlation

(d) Multiple Correlation and F test.

(e) Z test.

7.8 **Analysis and Interpretation of Data:**

The analysis and interpretation of data is given as below:-

(i) **Status of Scientific Attitude, Scientific Aptitude and Level of Academic Achievement in Science of class X Students.**

The research findings with regard to status of scientific attitude, scientific aptitude and the level of academic achievement in science of class X students in East Khasi Hills District of Meghalaya are as follows;

(a) **Scientific Attitude**

The sample of 553 students were tested on standardized SAS (scientific attitude Scale) and classified as per the manual into 5 categories viz. strongly unfavorable, unfavorable, neutral, favorable
and strongly favorable. The entire scores of scientific attitude were classified as per the above mentioned categories and it was judged that there is no student who has strongly favorable scientific attitude whereas 24.23% students have shown favorable attitude towards science subject. The maximum number i.e. 74.32% had neutral scientific attitude. This indicates that maximum number of students possess neutral scientific attitude which is neither towards favorable nor towards unfavorable.

(b) Scientific Aptitude

The sample of 553 students were tested on standardized SATB (scientific aptitude test battery) and classified as per the manual into three categories viz. low, average and high scientific aptitude. The classification indicates that almost all the students (99.81%) except one (.19%), of the entire sample fell in low scientific aptitude category. This means that the entire sample of students possessed low scientific aptitude.

(c) Academic Achievement in Science

The science marks obtained by 553 students were classified into three categories viz. high achievers, low achievers and medium achievers and statistical techniques of mean and SD were employed on them. Analysis of data showed that there were more low achievers
(i.e. 45.93%) than high achievers (i.e. 26.40%). However 27.66% students came under the category of medium achievers.

(ii) Relationship between Scientific Attitude and Academic Achievement in Science of class X Students.

To examine the relationship between scientific attitude and academic achievement, the following null hypothesis was formulated.

**Null Hypothesis No.1**

“There is no significant relationship between the scientific attitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya”.

To test this hypothesis Pearson’s coefficient of correlation was calculated between academic achievement and scientific attitude. The analysis showed that the computed value of r was significant at .01 level of significance. It shows that there is a significant relationship between scientific attitude and academic achievement. It indicates that higher the scientific attitude of students higher will be their achievement in science. Similarly lower the scientific attitude of students lower will be their achievement in science.
(iii) Relationship between Scientific Aptitude and Academic Achievement in Science of class X Students.

To examine the relationship between scientific aptitude and academic achievement, the following null hypothesis was formulated.

**Null Hypothesis No.2**

“There is no significant relationship between the scientific aptitude and academic achievement in science of class X students in East Khasi Hills District of Meghalaya”.

To test this hypothesis, Pearson’s coefficient of correlation was calculated between academic achievement and scientific aptitude. The analysis showed that the computed value of r was significant at .01 level of significance. It shows that there is a significant relationship between scientific aptitude and academic achievement. It indicates that higher the scientific aptitude of students higher will be their achievement in science. Similarly lower the scientific aptitude of students lower will be their achievement in science.

(iv) Multiple Effect of Scientific Attitude and Scientific Aptitude on Academic Achievement in Science of class X Students.

To examine the multiple effect of scientific attitude and scientific aptitude on academic achievement, the following null hypothesis was formulated.
Null Hypothesis No.3

“There is no significant multiple correlation between academic achievement and the variables of scientific attitude and scientific aptitude taken together of class X students in East Khasi Hills District of Meghalaya”

To test this null hypothesis, the statistical technique of multiple correlation was employed to establish the relationship between academic achievement with two variables viz. scientific attitude and scientific aptitude taken together and F test was employed to test its significance. The value of R & F were found significant at point .01 level of significance. This implies that there is significant multiple correlation between academic achievement and variables of scientific attitude and scientific aptitude taken together. This indicates that scientific attitude and scientific aptitude effect the achievement in science subject.

(v) Effect of Scientific Attitude on the Academic Achievement in Science of class X students.

To examine the effect of scientific attitude on academic achievement the following null hypothesis was formulated;
Null Hypothesis No.4:

“There is no significant difference in scientific attitude of class X students between high and low achievers in science”

To find the significant difference in scientific attitude of class X students between high and low achievers in science, Z value was calculated which was significant at .01 level of significance. It shows that there is significant difference in scientific attitude of students between high and low achievers in science subject. This difference was in favor of high achievers in science subject it indicates that high achievers posses high scientific attitude as compare to low achievers. From this we conclude that scientific attitude influences the achievement in science subject.

(vi) Effect of Scientific Aptitude on the Academic Achievement in Science of class X students.

To examine the effect of scientific aptitude on academic achievement the following null hypothesis was formulated.

Null Hypothesis No.5:

“There is no significant difference in scientific aptitude of class X students between high and low achievers in science”

To find the significant difference in scientific aptitude of class X students between high and low achievers in science, Z value was
calculated which was significant at .01 level of significance. It shows that there is significant difference in scientific aptitude of students between high and low achievers in science subject. This difference was in favor of high achievers in science subject it indicates that high achievers posses high scientific aptitude as compare to low achievers. From this we conclude that scientific aptitude influences the achievement in science subject.

7.9 Findings and Conclusion:

The findings and conclusion resulting from the investigation are given as below:-

(i) Status of Scientific Attitude, Scientific Aptitude and Level of Academic Achievement in Science of Class X Students.

The research findings with regard to status of scientific attitude, scientific aptitude and the level of academic achievement in science of class X students in East Khasi Hills District of Meghalaya are as follows;

(a) Scientific Attitude

The sample of 553 students were tested on standardized SAS (Scientific Attitude Scale) and classified. After analysis it is found that most of students i.e. 74.32% had neutral scientific attitude and 24.23% have favorable scientific attitude whereas only negligible number of
students fell in category of unfavorable and strongly unfavorable attitude. The value of mean of entire scientific attitude score was calculated = 203.1 and SD 18.43.

(b) **Scientific Aptitude**

The sample of 553 students were tested on standardized SATB (Scientific Aptitude Test Battery) and classified. Out of the entire sample 99.81% i.e. 552 came in low scientific aptitude category were as 0.19% i.e. only one student scored to be in average scientific aptitude category. None of the students scored to be in high scientific aptitude category. The calculated value of mean of scientific aptitude score is equal to 64.23 and SD is equal to 26.59.

(c) **Academic Achievement**

The marks (in percentage) obtained from the sample of 553 students on academic achievement (i.e S.S.L.C. exam under MBOSE year 2012) and were classified under three categories namely high achievers, medium achievers and low Achievers. In the entire sample, there were more low achievers (i.e. 45.93%) than high achievers (i.e. 26.41%). However 27.66% students came under the category of medium achievers with an overall mean of achievement scores equal to 49.90 and SD equal to 15.93.
(ii) Relationship between Scientific Attitude and Academic Achievement in Science of class X students.

Following are the findings and conclusions with regards the relationship between scientific attitude and academic achievement:

The research findings reveal that there is positive correlation between academic achievement and scientific attitude. It shows that there is a significant relationship between scientific attitude and academic achievement. This further indicates that higher the scientific attitude of the students higher will be their achievement in science. Similarly lower the scientific attitude of students lower will be their achievement in science. Thus those students who have high scientific attitude will grasp the subject matter easily, learn faster and with interest and retain for longer time. These students with higher attitude are likely to achieve better in science subject than those who have low scientific attitude.

(iii) Relationship between Scientific Aptitude and Academic Achievement in Science of class X students.

The research findings reveal that there is positive correlation between academic achievement and scientific aptitude. It shows that there is a significant relationship between scientific aptitude and academic achievement. This further indicates that higher the scientific
aptitude of the students higher will be their achievement in science. Similarly lower the scientific aptitude of students lower will be their achievement in science. Thus those students who have high scientific aptitude will grasp the subject matter easily, learn faster and retain for longer time. These students with higher aptitude are likely to achieve better in science subject than those who have low scientific aptitude.

(iv) Multiple Effect of Scientific Attitude and Scientific Aptitude on Academic Achievement in Science of class X students.

The research findings with regard to the multiple effect of scientific attitude and scientific aptitude on academic achievement in science are as under:-

The study reveals that there is significant multiple correlation between academic achievement and the variables of scientific attitude and scientific aptitude taken together. This implies that there is positive multiple effect of scientific attitude and scientific aptitude on academic achievement in science of class X students. This justifies that all those students who possess high scientific attitude and scientific aptitude are found to achieve high in science subject. The qualities of scientific attitude and scientific aptitude help them to take on study of science subject with interest, keenness and enthusiasm. These two factors put
together can enhance achievement level of the students in the subject of science.

(v) **Effect of Scientific Attitude on Academic Achievement in Science of class X students.**

The research findings of examining the effect of scientific attitude on academic achievement are as under:

The findings reveal that there is significant difference in scientific attitude of students between high and low achievers in science subject. As this difference in favor of high achievers in science subject, it indicates that high achievers possess high scientific attitude as compare to low achievers. From this we conclude that scientific attitude influences the achievement in science subject. Thus in order to make students score high in science there is a need to enhance scientific attitude of students.

(vi) **Effect of Scientific Aptitude on Academic Achievement in Science of class X Students.**

The research findings of examining the effect of scientific aptitude on academic achievement are as under:

The findings reveal that there is significant difference in scientific aptitude of students between high and low achievers in science subject. As this difference in favor of high achievers in science,
it indicates that high achievers possess high scientific aptitude as compare to low achievers. From this we conclude that scientific aptitude influences the achievement in science subject. Thus in order to make students score high in science there is a need to enhance scientific aptitude of students.

7.10 Implications and Recommendations:

The present study has elicited some important results that have implication upon scholastic performance of students in subject of science. It has helped in comprehending the constraints the student face in the learning process of science subject. The findings of the research support the proposition that scientific attitude, scientific aptitude and achievement in science subject are correlated to each other.

(i) The present study indicates that scientific attitude can be developed by exposing the students to such an environment where they can freely venture into the scientific world. By doing so the students can be made more comfortable to study science and can easily score high in the subject.

(ii) The outcome of the present study reveals that scientific aptitude which is a special intellectual ability to comprehend the scientific knowledge is constituted of components like reasoning, numerical
ability and information about scientific events. If these qualities are nurtured and enhanced in a student then learning of science can be made easy for them.

(iii) Scientific attitude, scientific aptitude and academic achievement in science are significantly correlated to each other. This implies that putting students into such an environment which can help in increasing scientific attitude and scientific aptitude, by making them read books or by showing scientific movies, can develop more inclination in them towards science subject which can lead them to achieve high score in science subject

(iv) Learning of science and understanding the concepts of science needs a special bent of mind of students which can be developed by creating an environment which can help them to study the subject willingly and not as a burden to score marks. At initial stages of studying of science, developing scientific attitude and scientific aptitude hold paramount importance. It will then be subsequently easy for the students when this bent of mind is developed, that they start learning with interest for achieving high in exams.

(v) Learning of science not only develop intellectual ability among students but also opens avenues for them for their bright future in particular and developmental avenues for the state and country in
general. Interest in science subject if developed at earlier level of studies will help more number of students to take science as a subject at higher level of studies.