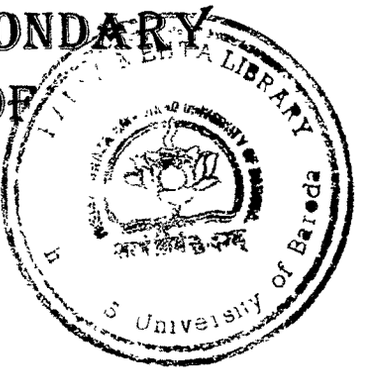
A STUDY OF SCIENTIFIC ATTITUDE AND ITS CORRELATES AMONG SECONDARY SCHOOL STUDENTS OF BARODA



An
ABSTRACT
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AN ABSTRACT

INTRODUCTION

There has been repaid growth of knowledge to the world of science. Great achievements of Science, technology and the use of these scientific achievements in promoting the well-being of mankind through their application in the field of industry, communication, transport, engineering, agriculture, defense and medicine have made science more important than ever before. Science has, in fact, radically transformed the material environment of the citizens of the modern world ; and, of course, it has its significant role in promoting culture and spiritualism either directly or indirectly. Science has shrunk the world and has contributed in changing the human outlook. In fact, science now has all pervading influence on every sphere of human activity. Further, modern science is no longer confined to the surface of this globe, its sphere of achievements reached beyond the earth.

Teaching of everyday science for everybody has become an unavoidable part of general education. No body questions its inclusion as a subject in the school curriculum. It is included in school curriculum for the same reasons as any other subject, but in addition, science inculcates certain special values peculiar to

its and which no other subjects can. Besides satisfying the usual needs for its inclusion as a subject in the school curriculum such as intellectual, cultural, moral, esthetic, utilitarian as well as vocational values, science learning provides training in scientific method, and also helps to develop scientific attitude. Therefore, science is now a compulsory subject in every system of school education right from the elementary level upto the secondary level.

The National Policy on Education (1986), has been adopted by the parliament to bring about a fundamental change in Indian Education. It aims at excellence in all fields, science, technology, the arts, humanities, and philosophical thought. The National Policy on Education (1986), envisaged a national system of education based on the fundamental principles embodied in the constitution of India. The concept of a national system of education implies that upto the given level, all students, irrespective of caste, creed, location or sex, have access to education of a comparable quality. It highlights the acculturating role of education and its role in refining sensibilities and perceptions that contribute to national cohesion, a scientific temper and independence of mind and spirit. It envisages to promote scientific attitude and national outlook, knowledge of

procedures involved in scientific method of inquiry and its use in solving problems.

The NPE (1986), has put forth the idea of core-curriculum with a hope for minimum learning outcomes at all levels of education in all schools. Science is made an integral part of such core-curriculum with a hope to developing certain abilities and values such as spirit of inquiry, creativity, objectivity, courage to question and aesthetic sensibility.

The significant outcomes of science education are development of scientific attitude and favourable attitude towards science. But through researches it has been found that the possession of scientific attitude by the majority of secondary school students is upto an average level. Only a few students possess it upto high level. It has also been found that even the teachers possess it upto an average level. It is true that Indian schools need much improvement in all educational inputs, including science curriculum, science textbooks, and the science teacher. The learner - centered approach to education with teacher as a facilitator in the learning process of students is envisaged to be a key to the strategy in the transition to the renovated and restructured curriculum. This also demands evolution of an appropriate training mechanism for the prospective as

well as in-service teachers. This is so because it is a well accepted fact that teachers will be able to inculcate scientific attitude in the students if its correlates are known. For instance, if it is known that scientific attitude is correlated with certain background variables of students like their achievement in Science, Mathematics, their socio-economic status, gender, medium of instruction, facilities available in the school and so on. Out of such a list of back-ground variables, some are beyond the control of the teacher like the socio-economic status, gender. However, there are certain variables like achievement in school subjects, facilities available in school and so on, over which the teacher has a control. That is, to say, the teacher can help the students to nourish and promote such variables, which, in turn, would contribute to the development of scientific attitude in the students.

In the present study, an attempt has been made by the investigator to construct a scientific attitude scale in Gujarati language. Scientific attitude of the secondary school students of Baroda district has been measured with the help of the constructed scientific attitude scale. The relationship of scientific attitude with the variables such as gender, location of school, socio-economic status, achievement in science and general achievement of students has been studied.

In the light of the above, the present investigation has focused on the scientific attitude of secondary school students of Baroda and the problem is stated as:

STATEMENT OF THE PROBLEM

A STUDY OF SCIENTIFIC ATTITUDE AND ITS CORRELATES AMONG SECONDARY SCHOOL STUDENTS OF BARODA

OBJECTIVES OF THE STUDY

The study has been carried out with the following objectives :

1. To construct and standardize an instrument to measure scientific attitude of secondary school students.

2. To measure the scientific attitude of secondary school students of Baroda.

3. To study the nature of distribution of scientific attitude scores of secondary school students of Baroda.

4. To study the relationship of scientific attitude score with socio-economic status, achievement in science, general achievement of students.

5. To compare the scientific attitude of students with,

   a) High, average and low SES students.

   b) High, average and low science achievers.

   c) High average and low general achievers.

   d) Boys and Girls

   e) Rural and Urban Students.

HYPOTHESES

Ho 1 : There will be no significant relationship between the scientific attitude and socio economic status (SES) of students.

Ho 2 : There will be no significant relationship between the scientific attitude and achievement of students in science.

Ho 3 : There will be no significant relationship between the scientific attitude and general achievement of students.

Ho 4 : There will be no significant difference in the mean scientific attitude of boys and girls.

Ho 5 : There will be no significant difference in the mean scientific attitude of urban and rural students.

Ho6 : There will be no significant difference in the mean scientific attitude of high socio economic status (SES) students, average social economic status (SES) students and low social economic status (SES) students.

Ho7 : There will be no significant difference in the mean scientific attitude of high achievers in science, average achievers in science and low achievers in science.

Ho8 : There will be no significant difference in the mean scientific attitude of high general achievers, average general achievers and low general achievers.

Ho9 : There will be no significant difference in the mean scientific attitude of urban and rural students with respect to their gender.

Ho10 : There will be no significant difference in the mean scientific attitude of urban and rural students with respect to their SES.

Ho11 : There will be no significant difference in the mean scientific attitude of boys and girls with respect to their SES.

H_o12 : There will be no significant difference in the mean scientific attitude of urban and rural students with respect to their achievement in science.

H_o13 : There will be no significant difference in the mean scientific attitude of boys and girls with respect to their achievement in science.

H_o14 : There will be no significant difference in the mean scientific attitude of urban and rural students with respect to their general achievement.

H_o15 : There will be no significant difference in the mean scientific attitude of boys and girls with respect to their general achievement.

H_o16 : There will be no significant difference in the mean scientific attitude of urban and rural boys and girls with respect to their SES.

H_o17 : There will be no significant difference in the mean scientific attitude of urban and rural boys and girls with respect to their achievement in science.

H_o18 : There will be no significant difference in the mean scientific attitude of urban and rural boys

and girls with respect to their general achievement.

METHODOLOGY

The methodology adopted in the present study to achieve the stated objectives has been described in brief in what follows:

The data required for the present study were scientific attitude score, socio-economic status, achievement in science, general achievement, gender and location of school of students. The number of schools in each taluka of Baroda District and Baroda city and the population of the villages of the selected schools were required.

The data were collected from the students, the result of the public examination conducted by Gujarat Secondary Education Board, Gandhinagar during the academic year 1995-96, and the office of the District Education Officer, Baroda.

Sample

All the students who were studying in STd.:X of thirteen selected schools formed the sample. In order to keep approximately the same number of students from the schools located in urban and rural area, six schools from

urban area and seven schools from rural area were selected randomly. Thus the students were selected by Cluster sampling technique. The sample consisted of 596 students, of whom 304 students were from urban area while 292 students were from rural area. There were 334 boys and 262 girls in the sample.

Tools

The tools required to collect data were scientific attitude scale was constructed by the investigator while Desai's (1986-87) standardized socio-economic status scale was adopted after bringing about the required modification in the income slab. The major steps of construction and standardization of scientific attitude scale have been described in what follows :

* The following components of scientific attitude were identified by the investigator.

Rationality
Curiosity
Objectivity
Openmindedness
Criticalmindedness
Intellectual Honesty
Observation
Humility

Environmental Awareness

Courage to question

The identification was followed by a related exercise of listing behaviours to describe a particular component.

* Opinions of experts in the fields were collected on the ten identified components and behaviours under each component with regard to their:

  - appropriateness
  - relevance,and
  - capacity to describe scientific attitude.

* Ninety statements out of which forty six with positive polarity and forty four with negative polarity were prepared by the investigator and were then submitted to experts for editing.

* To make a selection from the pool of ninety statements, a pilot study was conducted on 379 students of Std: X and were scored on five point scale.

* By item analysis, 't' value of the statements was calculated and all those statements which had 't' value greater than 1.75 were selected for the final scale.

* Psychometric Properties of developed scale

The validity and reliability of the developed scale were estimated.

- Validity

  - Logical validity was established.

  - Factorial validity was established by computing the coefficient of correlation between the total score and score on each component. The coefficients of six components of scientific attitude were ranging from 0.74 to 0.86.

- Reliability

  The reliability of Scientific Attitude Scale as calculated by split- half method was found to be 0.91.

The data regarding scientific attitude score, SES, gender & location of school of student were collected by administering the scientific attitude scale and socio-economic status scale individually to each students. The data pertaining to achievement in science and general achievement of student were obtained from their

respective school's record of the result of the public examination.

The collected data were analysed through applying appropriate statistical techniques. To study the relationship of scientific attitude with SES, achievement in science and general achievement of students, Pearson's product-moment correlation coefficients were computed. To study the difference in the mean scientific attitude of different groups, ANOVA was applied.

MAJOR FINDINGS AND CONCLUSIONS

The major findings of the study were as follows:

The mean scientific attitude of the students was 257.76. The mean scientific attitude of girls was more than that boys. The mean scientific attitude of urban students was more than that of rural students. The mean scientific attitude of urban students was maximum and that of rural students was minimum. The nature of distribution of scientific attitude of all the five groups. viz., the entire sample, the boys, the girls, the urban students and the rural students was platykurtic.

30.99% of the students hold low scientific attitude, 49.58% of the students hold average scientific attitude,

and only 19.43% of the students hold high scientific attitude.

The coefficient of correlation of scientific attitude with SES of students was 0.4853 which was significant at 0.01 level with df=594. Hence, it was concluded that there was a significant relationship between scientific attitude and SES of students.

The coefficient of correlation of scientific attitude with achievement of students in science was 0.5409 which was significant at 0.01 level with df=594. Hence, it was concluded that there was a significant relationship between scientific attitude and achievement of students in science.

The coefficient of correlation of scientific attitude with general achievement of students was 0.5426 which was significant at 0.01 level with df=594. Hence, it was concluded that there was a significant relationship between scientific attitude and general achievement of students.

The mean scientific attitude of boys and girls was 254.10 and 262.42 respectively. The t-value was 3.2383 which was significant at 0.01 level with df=594. Hence it was concluded that there was a significant difference in the mean scientific attitude of boys and girls students.

The mean scientific attitude of girls students was more than that of boys students.

The mean scientific attitude of urban and rural students was 275.31 and 239.43 respectively. The t-value was 17.0076 which was significant at 0.01 level with df=594. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban and rural students. The mean scientific attitude of urban students was more than that of rural students.

The mean scientific attitude of high, average, and low SES students was 276.90, 262.50, and 237.32 respectively. The t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of high SES students, average SES students, and low SES students. The mean scientific attitude of high SES students was more than that of average SES students and was least for the low SES students.

The mean scientific attitude of high, average, and low achievers in science was 279.52, 260.31, and 237.71 respectively. The t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of high achievement in science students, average achievement in science students and low achieves in science students.

The mean scientific attitude of high achievers in science was more than that average achievers in science and was least for the low achievers in science.

The mean scientific attitude of high, average, and low general achievers was 282.01, 259.85, and 238.21 respectively. The t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of high general achievers, average general achievers, and low general achievers. The mean scientific attitude of high general achievers was more than that of average general achievers and was least for the low general achievers.

The mean scientific attitude of urban boys, urban girls, rural boys, and rural girls was 274.30, 276.26, 238.02, and 241.92 respectively. The t-values for urban boys and urban girls; and for rural boys and rural girls were not significant. The rest of the t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban students and rural students with respect to their gender. The mean scientific attitude of urban girls was maximum and that of rural boys was minimum.

The mean scientific attitude of urban high SES, urban average SES, urban low SES, rural high SES, rural average SES, and rural low SES was 278.70, 276.35, 263.15, 257.51, 240.58, and 227.62 respectively. The t-values for urban high SES and urban average SES; and for urban low SES and rural high SES were not significant. The rest of the t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban students and rural students with respect to their SES. The mean scientific attitude of urban students with high SES was maximum and that of rural students with low SES was minimum.

The mean scientific attitude of boys high SES, boys average SES, boys low SES, girls high SES, girls average SES, and girls low SES was 275.04, 260.43, 236.89, 276.97, 252.85, and 239.12 respectively. The t-values for boys high SES and girls high SES; and for boys low SES and girls low SES were not significant. The rest of the eleven t-values were significant at 0.01 level and remaining two t-values were significant at 0.05 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of boys and girls students with respect to their SES. The mean scientific attitude of girls with high SES was maximum and that of boys with low SES was minimum.

The mean scientific attitude of urban high achievers in science, urban average achievers in science, urban low achievers in science, rural high achievers in science, rural average achievers in science, and rural low achievers in science was 282.95, 271.68, 261.75, 258.78, 245.56 and 232.40 respectively. The t-values for urban low achievers in science and rural high achievers in science was not significant. The rest of the eleven t-values were significant at 0.01 level and the remaining three t-values were significant at 0.05 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban and rural students with respect to their achievement in science. The mean scientific attitude of urban high achievers in science was maximum and that of rural low achievers in science was minimum.

The mean scientific attitude of boys high achievers in science, boys average achievers in science, boys low achievers in science, girls high achievers in science, girls average achievers in science, and girls low achievers in science was 276.09, 254.14, 234.97, 284.41, 268.41, and 240.77 respectively. The t-value for boys low achievers in science and girls low achievers in science was not significant. The rest of the twelve t-values were significant at 0.01 level and remaining two t-values were significant at 0.05 level. Hence it was concluded

that there was a significant difference in the mean scientific attitude of boys and girls students with respect to their achievers in science was maximum and that boys low achievers in science students was minimum.

The mean scientific attitude of urban high general achievers, urban average general achievers, urban low general achievers, rural high general achievers, rural average general achievers, and rural low general achievers was 284.11, 271.10, 267.05, 262.64, 243.40 and 232.32 respectively. The t-values for urban average general achievers and urban low general achievers; urban average general achievers, and rural high general achievers; and urban low general achievers, and rural high general achievers were not significant. The rest of the twelve t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban students and rural students with respect to their general achievement. The mean scientific attitude of urban high general achievers was maximum and that of rural low general achievers was minimum.

The mean scientific attitude of boys high general achievers, boys average general achievers, boys low general achievers, girls high general achievers, girls average general achievers, and girls low general

achievers was 279.09, 253.89, 236.81, 285.79, 267.29, and 240.01 respectively. The t-values for boys high general achievers and girls high general achievers; and boys low general achievers and girls low general achievers were not significant. The rest of the thirteen t-values were significant at 0.01 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of boys and girls student with respect to their general achievement. The mean scientific attitude of girls high general achievers was maximum and that of boys low general achievers was minimum.

The mean scientific attitude of urban boys high SES, urban boys average SES, urban boys low SES, urban girls high SES, urban girls average SES, urban girls low SES, rural boys high SES, rural boys average SES, rural boys low SES, rural girls high SES, rural girls average SES, and rural girls low SES, was 276.53, 273.90, 270.57, 281.16, 278.24, 253.67, 253.96, 242.03, 226.08, 261.60, 238.47, and 233.11 respectively. The t-values for twenty two pairs were not significant. The rest of the thirty eight pairs of t-values were significant at 0.01 level and the remaining six pairs of t-values were significant at 0.05 level . Hence it was concluded that there was a significant difference in the mean scientific attitude of urban and rural, boys and girls with respect to their

SES. The mean scientific attitude of urban girls with high SES was maximum and that of rural boys with low SES was minimum.

The mean scientific attitude of urban boys high achievers in science, urban boys average achievers in science, urban boys low achievers in science, urban girls high achievers in science, urban girls average achievers in science, urban girls low achievers in science, rural boys high achievers in science, rural boys average achievers in science, rural boys low achievers in science, rural girls high achievers in science, rural girls average achievers in science, rural girls low achievers in science, was 279.97, 267.98, 270.40, 285.69, 274.97, 258.42, 257.20, 241.68, 231.24, 263.29, 254.45, and 234.01 respectively. The t-values for twenty seven pairs were not significant. The rest of the thirty six pairs of t-values were significant at 0.01 level and the remaining three pairs of t-values were significant at 0.05 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban and rural, boys and girls students with respect to their achievement in science. The mean scientific attitude of urban girls with high achievement in science was maximum and that of rural boys with low achievement in science was minimum.

The mean scientific attitude of urban boys high general achievers, urban boys average general achievers, urban boys low general achievers, urban girls high general achievers, urban girls average general achievers, urban girls low general achievers, rural boys high general achievers, rural boys average general achievers, rural boys low general achievers, rural girls high general achievers, rural girls average general achievers, rural girls low general achievers, was 281.69, 266.12, 275.60, 286.96, 275.25, 261.27, 261.59, 240.73, 230.16, 269.67, 246.49, and 235.59 respectively. The t-values for twenty three pairs were not significant. The rest of the thirty six pairs of t-values were significant at 0.01 level and the remaining seven pairs of t-values were significant at 0.05 level. Hence it was concluded that there was a significant difference in the mean scientific attitude of urban and rural, boys and girls students with respect to their general achievement. The mean scientific attitude of urban girls with high general achievement was maximum and that rural boys with low general achievement was minimum.

DISCUSSION

Science education has become part and parcel of human life, without which one cannot live comfortably. Identifying the multifarious values of science education,

it is included in the school curriculum as a compulsory subject.

Scientific attitude is necessary to an individual to lead a smooth and comfortable life in the society like ours in which there are people with different religion, culture, beliefs, customs and so on. An individual with a high degree of scientific attitude can understand the people of such society in a better way and can contribute to the development of society which, in turn, would lead to the nation's progress. Besides this, an individual with a high degree of scientific attitude can understand the phenomena of nature and human behaviour, and accordingly one will behave to prove oneself an ideal individual in ones own family as well as in the society in which one lives.

The present study has resulted in drawing the following conclusions which may be utilized in improving the present state of affairs in the school science education.

The scientific attitude of secondary school students of Baroda was average.

Bhaskara Rao (1996), found that the secondary school students of Guntur District of Andhra Pradesh had an average scientific attitude. As the construct

""Scientific attitude" is complex in nature and there is a great diversity in the components constituting it, the lower score of an individual on one or more components may lead to the reduction in scientific attitude score. For instance, an individual may be rational, curious to a high degree but, at the same time may be weak in observation, may be believing more in superstitions or vise-versa, such situations lead to reduction in scientific attitude. Patel (1991), found that female pupils are more superstitions than male pupils. It was also found that pupils studying in the schools situated in urban area are less superstitious than pupils attending the school situated in rural area. A similar conclusion has been arrived at by Nickell (1992), in the developed country like U.S. that adults and teen-agers believe in a variety of pseudoscientific phenomena.

Here, our problem is why this sample hold an average level of scientific attitude and how it can be developed and promoted more than the existing level ? The facilities like library, laboratory, audio-visual aids, exposure to eminent personalities, participation in fairs, quiz, exhibitions, etc., will help in the inculcation and promotion of scientific attitude in the individuals. The above mentioned facilities are not so adequately available in our schools. Another significant feature is the possession of scientific attitude by the

teachers, who teach it, has influence directly or indirectly in the classrooms. A teacher without proper scientific attitude cannot develop or promote it in the students. The studies of Bhaskara Roa et. al. (1986), and Bhaskara Roa et. al. (1989), have found that the experienced and prospective science teachers hold low scientific attitude respectively. The above mentioned factors may be the reasons for the average level of scientific attitude possessed by the secondary school students.

"There exists a significantly positive correlation of scientific attitude with SES, achievement in science and general achievement of the students."

The studies of Srivastava (1980), Ramachary (1982), and Vardhini (1983), revealed that the amount of scientific knowledge or general exposure to science courses made an impact on scientific attitude positively. The relationship of scientific attitude with achievement in science may be due to the very nature of science itself. Because through learning of science, data can be more easily and extensively gathered, readily manipulated, controlled and properly checked than in other area of school curriculum. However, the development of scientific attitude is not limited to contacts with natural environment and the study of science only. All

subject of study, all experiences and activities lend themselves to the practice of scientific attitude. This has been strengthened by the positive correlation of scientific attitude with general achievement of students by the present study.

In the present study, general achievement of students was operationalized as the average score obtained by the students in all the compulsory school subjects at the examination conduct by Gujarat Secondary Education Board during March,96. As Science is one of the five compulsory subjects at STd.X , in the calculation of general achievement of students, the achievement in science of students was also considered. This might have lead to the significantly positive correlation of scientific attitude not only with the achievement in science but also with the general achievement of students.

The significantly positive correlation of scientific attitude with SES of student might have been obtained due to the following reason.

Like any other society, in the Indian society too there are people with varied socio-economic status. Baroda is not distinctly different from the rest of the Indian Society. That is to say, the people of Baroda district also have varied socio-economic status. Now, it

is a well recognised fact that the people with low socio-economic status do not hesitate in overtly expressing their pseudoscientific beliefs or superstitions. This is normally not the case with the people having average or high socio-economic status. Hence, low socio-economic status people overtly believing more in superstitions tend to show less scientific attitude. Whereas high socio-economic people though might be believing more in superstitions but having a tendency of not overt expressing it tend to show more scientific attitude.

"Boys and girls significantly differ with respect to their scientific attitude and the mean scientific attitude of girls was more than that of boys."

The study of Srivastava (1980), revealed that boys and girls differ with respect to their scientific attitude, but contrary to this the studies of Vyas (1981), Sindhe (1982), Ghosh (1986), and Bhaskara Roa (1996), have reported that the two groups do not differ significantly with respect to their scientific attitude. Such inconclusive finding demand further investigations by taking large samples from different parts of our country. This conclusion of the present investigation contradicts the proposition that if the opportunities are equal to either sex, they can compete with each other equally in any area. However, educators in general and teachers in

particular should try to take care of providing equal opportunities to both the sex and help them in inculcation and promotion of scientific attitude.

"The urban and the rural students significantly differed with respect to their scientific attitude and the mean scientific attitude of urban students was more than that of rural students."

Contrary to this, the study of Bhaskara Roa (1996), revealed that the rural pupils hold high level of scientific attitude than Urban pupils. The result of this study is in accordance with the belief of many people that the urban schools are supposed to be equipped well with the required facilities, and the quality of teaching may also be good. The exposure to different educational facilities of urban student is more than their counterparts. Such exposure might have helped the urban students to possess more scientific attitude than the rural student.

So far the findings of the present study have been discussed separately with respect to the variables of the study. However, the discussion to follow have been clubbed together based on similarity in findings of SES, achievement in science, and general achievement.

"The students with different levels of SES significantly differed with respect to their scientific attitude and the mean scientific attitude high SES students was more than that of averages SES students and was least for the low SES students."

"The students with different levels of achievement in science significantly differed with respect to their scientific attitude. The mean scientific attitude of high achievers in science was more than that of average achievers in science and was least for the low achievers in science."

"The students with different levels of general achievement significantly differed with respect to their scientific attitude. The mean scientific attitude of high general achievers was more than that of average general achievers and was least for the low general achievers.

Sindhe (1982), found that students with high academic achievement had high scientific attitude, students with average academic achievement had average scientific attitude and the low achievers had average scientific attitude. From the present study also it has been found that scientific attitude of the students is not only correlated with SES, achievement in science and the general achievement of the students but it is more when SES, achievement in science and general achievement of

the students is more as compared to the average SES, achievement in science and general achievement of students. Scientific attitude of the student is less when SES, achievement in science AND general achievement is less. This indicates that if adequate educational facilities are provided which would help on promoting the achievement of students which, in turn, would lead the students to possess scientific attitude to a high degree.

As the following findings of the present study related to location of school, SES, achievement of students have similarity in nature, they have been discussed together.

"The mean scientific attitude of urban and rural students with respect to their gender significantly differed. The mean scientific attitude of urban girls was maximum and that of rural boys was minimum."

"The mean scientific attitude of urban and rural students with respect to their SES significantly differed. The mean scientific attitude of urban students with high SES was maximum and that of rural students with low SES was minimum. "

"The mean scientific attitude of urban and rural students with respect to their achievement in science significantly differed. The mean scientific attitude of

urban high achievers in science was maximum and that of rural low achievers in science was minimum."

"The mean scientific attitude of urban and rural students with respect to their general achievement significantly differed. The mean scientific attitude of urban high general achievers was maximum and that of rural low general achievers was minimum.

These findings were similar to the findings which have been discussed so far. The similarity exists in terms of high scientific attitude of urban girls when the scientific attitude of students was studied with respect to their location of school and gender, higher scientific attitude of urban students with high SES, when the scientific attitude of students was studied with respect to their location of school and SES, higher scientific attitude of urban high achievers in science when scientific attitude of student s was studied with respect to their location of school and achievement in science, and higher scientific attitude of urban high general achievers when scientific attitude of students was studied with respect to their location of school and general achievement. So, it is indicative of the dominant role played by the location of school of students in terms of inculcation of scientific attitude. Especially the students of urban schools have scored

better on scientific attitude compared to their counter parts.

The following discussion of findings related to gender, SES, achievement in science and general achievement of students having similar nature have been presented together.

" The mean scientific attitude of boys and girls with respect to their SES significantly differed. The mean scientific attitude of girls with high SES was maximum and that of boys with low SES was minimum".

" The mean scientific attitude of boys and girls with respect to their achievement in science significantly differed. The mean scientific attitude girls high

achievers in science was maximum and that of boys low achievers in science was minimum."

"The mean scientific attitude of boys and girls with respect to their general achievement significantly differed. The mean scientific attitude of girls high general achievers was maximum and that of boys low general achievers was minimum."

With respect to the above mentioned three conclusions, a similarity is observed with what has been discussed so far. When scientific attitude of the students was studied

with respect to their gender and SES, achievement in science and general achievements, girls have been found to score higher on scientific attitude than boys. Inspite of the fact that the educational facilities are nearly same in the same location of schools, girls have shown more scientific attitude than boys. It was beyond the scope of the present study to find out the reasons for the same hence more studies are required to unreveal the reasons.

Keeping in mind the similarity in the nature of findings related to location of school, gender, SES, achievement in science and general achievement of students, they have been discussed together.

The mean scientific attitude of urban and rural, boys and girls with respect to their SES significantly differed. The mean scientific attitude of urban girls with high SES was maximum and that of rural boys with low SES was minimum."

"The mean scientific attitude of urban and rural, boys and girls with respect to their achievement in science significantly differed. The mean scientific attitude of urban girls with high achievement in science was maximum and that of rural boys with low achievement in science was minimum."

"The mean scientific attitude of urban and rural boys and girls with respect to their general achievement significantly differed. The mean scientific attitude of urban girls with high general achievement was maximum and that of rural boys with low general achievement was minimum."

With respect to the above mentioned findings it has been observed that the trend in the scientific attitude is not different from what has been discussed so far. The urban girls with high SES, achievement in science and general achievements were found to have possessed maximum scientific attitude with respect to the rest of the students. Whereas the rural boys with low SES, achievement in science and general achievement were found to have possessed minimum scientific attitude compared to the rest of the students.

Contrary to this trend, the mean scientific attitude of rural girls with high SES, achievement in science and general achievement was not significantly different from the majority of the rest the groups. This indicates that girls with high SES, achievement in science and general achievement from both the urban and the rural location of schools could possess scientific attitude which is comparable to the other groups.

To summarise the major findings of the present study it was found that the urban students, the girls, the students with high SES, the high achievers in science and the high general achievers were found to have possessed more scientific attitude than their counterparts.

On the basis of the above mentioned major findings of the present study and the investigator's own experience as a teacher and teacher educator, the investigator feels the necessity of the following factors for the nourishment and promotion of scientific attitude among secondary school students. They are :

Informative experience about the attitude object, situations arising in solving a problem, pleasant emotional experiences, well equipped science laboratories, group decision making, encouragement in the cultivation of desirable attitudes, engaging in wide reading in general and science in particular, preservation of democrating procedures, suggesting problems that need to collect evidences to arrive at conclusions, stressing the need for adequate data before arriving at conclusions, through assimilation of environment, through the emotional effects, through traumatic experiences, through direct intellectual processes, providing opportunities for the analysis of problem, amount of scientific knowledge or exposure to

general science courses, work experience, taking the students to fairs, exhibitions, excursions, field trips, zoos, parks, industries, natural habitats of plants and animals, quiz competitions ; through direct teaching of the required scientific attitude, allowing the students to mingle with various peer and intellectual groups ; exposing them to the eminent personalities like scientists, social reformers etc. allowing and encouraging them to ask questions to satisfy their curiosity, stressing the importance of when to ask, how to ask question ?

All educators in general and teachers in particular shall try to nourish and promote the scientific attitude in the students by implementing the above mentioned factors that are feasible in their own educational set up.

SUGGESTIONS FOR FURTHER RESEARCH

The present study brings to light a good number of new areas to be studied by the future researchers. The areas and variables which are not covered by the present study may be put to test to enlighten the factors associated with the inculcation and development of scientific attitude of the students.

1. The scientific attitude of students of other educational levels, viz., primary and college levels at district and state level may be studied.

2. The scientific attitude of teachers may be studied as this factor is expected to play a great role in the inculcation and promotion of scientific attitude in the students.

3. The scientific attitude of students with other variables like medium of instruction, parents qualification, parents occupation, teachers qualification, teachers scientific attitude, achievement in other school subjects, availability of educational facilities in school and even at home, participation in non-formal science activities like, science quiz, science debate, science exhibition, etc. may be studied.

4. Componentwise distribution of scientific attitude of students and teachers may be studied which can throw light on the problem "why scientific attitude of students is average ?

5. Studies may be conducted on construction and standardization of more scientific attitude scale for different educational level of students, for teachers and in different languages.

6. The present study has resulted in consistency in findings with respect to urban and rural students. Similar type of studies shall be conducted in order to strengthen the existing findings which may help in the process of curriculum designing.

7. Studies may be conducted on development and effectiveness of educational programmes to inculcate scientific attitude in the students.