**SCIENTIFIC ATTITUDE AMONG HIGHER SECONDARY SCHOOL STUDENTS OF KERALA**

**RYNI K.K.**

**Dissertation**

**Submitted in partial fulfilment of the**

**requirements for the Degree of**

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**D E C L A R A T I O N**

I, RYNI, K.K., do hereby declare that this dissertation, **"SCIENTIFIC ATTITUDE AMONG HIGHER SECONDARY SCHOOL STUDENTS OF KERALA"** has not been submitted by me for the award of any Degree, Diploma, Title or Recognition before.

Farook Training College,

.07.2005.  **RYNI K.K.**

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**CERTIFICATE**

I, **Abdul Gafoor, K.,** do hereby certify that this dissertation, "SCIENTIFIC ATTITUDE AMONG HIGHER SECONDARY SCHOOL STUDENTS OF KERALA" is a record of bonafide study and research carried out by Ryni, K.K., under my supervision and guidance.

Farook Training College **Dr. ABDUL GAFOOR K.**

07-2005 Supervising Teacher

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**INTRODUCTION**

Knowledge is a collection of facts, values and information to which man has access through study, intuition or experience. Science is a body of knowledge, a way of investigation and a way of thinking in the pursuit of an understanding of nature. "Science is an interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observation." (Conant, 1951).

According to secondary education commission (1952-53), science teaching at secondary stage, should initiate the student into the use and appreciation of the scientific method by which facts are discovered, relationships established, and sound conclusions reached. Pupils should be encouraged to explore every opportunity to develop the attitude of critical inquiry.

The major objectives of teaching science in the schools should be the following : knowledge, understanding, application, skill, interest, attitudes and appreciations. Science must develop certain attitudes among the learners. These attitudes are popularly known as scientific attitudes, it is one of the most important functions of science teaching to develop and train the students for this attitude or way of life. After having attained these qualities, the students behave in the following manner. They will base their judgement on verified facts not on opinion, be free from prejudices and always welcome new ideas and discoveries, react favourably to efforts made to use science towards human welfare, be ready to consider their own judgements, be free from superstitions, be active in approach, be honest and truthful in recording and collecting data, believes in cause and effect relationships, selects simple explanation to the complex, be curious to know more about the natural wonders, recognize his own limitations as well as the limitations inherent in science itself, willing to stay with a task until it is completed and accepts the responsibility of caring for the natural and man-made environment.

**1.1 NEED AND SIGNIFICANCE OF THE STUDY**

One of the major objectives of teaching science is the development of scientific attitude. It can contribute to the national development through the irradication of superstitions and by developing objectivity, open mindedness, critical thinking and adopting scientific method in solving problems. But there are many problems that prevent the national development and integration. Some of them are casteism, communalism, Regionalism, provincialism, linguism, frustration among the youths, lack of ideas and values, economic inequality, poverty, social and cultural lag, explosion of population, unemployment, polluted environment, vested interests, narrow politics and political corruption.

It seems that the major objectives of science teaching i.e. scientific attitude is neglected. For eg: parochialism due to the lack of open mindedness, persuasion in 'Human Gods' due to Superstitions, increasing crimes, thefts and bribe among officers and politicians due to the lack of honesty and persistence, suicidal extravagance due to the lack of humility, aggressive crowd distruct public properties without seeking the evidence behind the facts, reluctance to experience the nature due to the lack of curiosity, sadistic approach towards organisms due to the lack of environmental caring, fanaticism due to the lack of objectivity, population explosion due to the lack of critical thinking etc. reflects the lack of scientific attitude among people. Reluctance to the application of inventions and new ideas in agriculture, health, industry and technical fields adversely affects the economic well being of citizens.

There is a need of making changes in the basic structure of our society in order to solve the above said problems in our country. Therefore there is a need of the active co-operation of educationists and other people linked with the educational world directly or indirectly to develop scientific attitude. So it is worth while to investigate the scientific attitude of the school students in Kerala.

Eventhough, the scientific attitude is one of the major objectives of teaching and learning of science, the academic tests centres on scientific knowledge and other cognitive outcomes and neglects the values of science, ie, the scientific attitude. The present study is conducted to know the extent to which the important objective of teaching science ie, attaining scientific attitude is achieved by students who have successfully completed secondary education and those who are pursuing the study in Higher secondary schools. Only a few students stick to the study of science after their secondary education. Others persue different streams of knowledge. They are completely denied the opportunity further to science education. So it will be meaningful to get a clear idea regarding the extent of scientific attitude among students who have completed the secondary school education.

Till yet, there is no standardised tool to measure the scientific attitude of secondary school students in kerala. So, the investigator decided to construct and standardise a tool to measure the scientific attitude among Higher Secondary School students of Kerala.

Previously, Swarnnamma (1978) conducted a study among upper primary school pupils. The result of the study was the following Teachers failed to develop scientific attitude among upper primary school pupils. Review of related studies reveals that Gender differences are not significant in scientific attitude (Martin, 1972; Shinde, 1982; Dani, 1984; Ghosh, 1989; Rao, 1996; Jayasree, 1998; Rani & Rao, 2002; Marice, 2004). But some of the studies indicated that there exists Gender difference in scientific attitude (Kumar, 1991; Shrivastava, 1983). Achievement in Science helped in the formation of Scientific attitude (Shrivastava,1980; Shinde, 1982; Koushik, 1988; Marice, 2004) some studies revealed that scientific attitude varies according to the locality (Rao, 1986; Sinha,1991; Rani and Rao, 2000). But another studies reveals that there is no variation in scientific attitude according to the locality (Kumar, 1991; Marice, 2004). Non SC/ST and SC/St students differ significantly in their scientific attitude (Shrivastava, 1983). Significant difference exists between type of management of school in scientific attitude (Rao, 1996). Scientific attitude varies according to the medium of instruction (Rao, 1996; Jayasree, 1998; Rani & Rao, 2000). There is no significant difference exists among rural students belongs to high SES ad low SES in their scientific attitude (Gosh, 1989).

The investigator has selected Higher Secondary School students as sample for the present study because, the young generation ie, adolescents needs scientific attitude to understand the world around us and to improve the quality of life of the society. During adolescence intellectual powers like critical thinking, logical thinking and abstract reasoning are developed, span of concentration widens, depth of understanding increases and functioning of memory sharpens. The adolescents develop a fine imagination. They are eager to know about things around them. Improper channelization of imagination may lead an adolescent to day dreaming. The ability to solve problems increases during adolescence. Scientific qualities if developed in the minds of the adolescents and instilled in their behaviour pattern solve many problems-individual and social. Every citizen should have scientific attitude to take intelligent decisions and for solving personal, social as well as environmental problems. Hence the investigator wished to find out the extent of scientific attitude of Higher secondary school students in Kerala and selected subsamples based on Gender, Subject of specialisation at Higher secondary school, Type of management of school, Religion, Community category, Medium of instruction at secondary level, Academic achievement at secondary level, Achievement in science at secondary level, Level of education of parents and their Family income.

The investigator being a native of Wayanad district, is more interested to know the extent of scientific attitude in that specific population. The district is characterised by higher density of tribals in its population. The goal of national development cannot be complete without a major proportion of its population, such as STs being denied the virtues of science education. So the investigator wants to know the extent of scientific attitude of STs, SCs and other categories as one of the dimension of the study. Besides, this district is a collaboration of different Religions.

It can be realized that without developing scientific attitude, any amount of knowledge in science contributes little to national development and to the process of social change. Scientific attitude will be the basement for modernisation putting an end to superstitions implanted in our countrymen from time immemorial. Hence, scientific attitude-an offshoot of the learning of science, is the present need of our study.

**1.2 STATEMENT OF THE PROBLEM**

The problem of the present study is entitled as SCIENTIFIC ATTITUDE AMONG HIGHER SECONDARY SCHOOL STUDENTS OF KERALA.

**1.3 DEFINITION OF KEY TERMS**

**1.3.1 Scientific Attitude**

Attitude is an orientation toward certain objects or situations that is emotionally toned and relatively persistent (Scott, 1999).

Scientific Attitude refers to the scores obtained by the students in the scientific Attitude scale (SAS) prepared by the investigator with the help of supervising Teacher, which involves the following components curiosity, caring, persistence, critical thinking, open mindedness, Honesty, Humility, Rationality, Objectivity, Follows scientific method in solving problems, Precision and parsimony.

**1.3.2 Higher Secondary School Students**

Higher secondary school students are those students who are studying in standard XI and XII classes of higher secondary schools of Kerala. In this study, only standard XI students are taken as the Higher secondary school students.

**1.4 VARIABLE OF THE STUDY**

The only variable of the study is "Scientific Attitude".

The variables considered in sampling and for classification of the sample into subsamples are:

i. Gender,

ii. Subject of specialisation at Higher secondary level,

iii. Type of management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

**1.5 OBJECTIVES OF THE STUDY**

The objectives of the present study are the following.

1. To construct a standardised tool to measure the scientific attitude among Higher secondary school students.

2. To find out the extent of scientific attitude among Higher secondary school students in the total sample and subsamples based on:

i. Gender,

ii. Subject of specialisation at Higher secondary level,

iii. Type of management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

3. To find out whether there exists significant difference in mean scores of scientific attitude between the relevant sub samples based on:

i. Gender,

ii. Subject of specialisation at Higher secondary level,

iii. Type of management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

**1.6 HYPOTHESIS OF THE STUDY**

There exists significant difference between the mean scores of Scientific Attitude among Higher secondary school students of the relevant subsample based on

i. Gender,

ii. Subject of specialisation at Higher secondary level,

iii. Type of management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

**1.7 METHODOLOGY**

The study which is descriptive in nature, employs survey design. The detailed procedure is as follows.

**1.7.1 Sample**

The sample is 875 students studying in Standard XI of 13 Higher secondary schools in the Wayanad revenue district of Kerala. In these 13 Higher secondary schools, two schools belongs to unaided, three schools belongs to Aided and eight schools belongs to Government sector. The sample for the study was selected using stratified sampling technique. The strata considering in sampling are based on Gender, Type of Management of school and Subject of specialisation.

**1.7.2 Tool**

The tool used for the study was scientific attitude scale constructed by the investigator under the guidance of supervising Teacher.

**1.7.3 Statistical techniques used for analysis**

The statistical analysis involves:

i. Calculation of mean,

ii. Percentiles,

iii. Test of significance of difference between means for large independent samples.

**1.8 SCOPE AND LIMITATIONS OF THE STUDY**

Till now there has been no tool to find out the extent of Scientific Attitude among Higher secondary school students of Kerala. So the investigator constructed a tool which is applicable for Higher secondary school students of Kerala. Wayanad being populated by migrants presents a kaleidoscope picture of the entire state and 1/5 of the tribal population of the state belongs to this district. So the investigator assumes that the sample collected from Wayanad district is applicable to the entire state in general. The sample used in the present study is standard XI students. The subsamples used are:

i. Gender,

ii. Subject of specialisation at Higher secondary level,

iii. Type of management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

Every attempt has been made to make the study as objective and precise as possible. But there are some limitations

1. The sample of the study is limited to the pupils of Wayanad District. The sample is restricted to standard XI alone and standard XII in the Higher secondary school system is not considered due to time and financial constraints.

2. In this study percentage of marks of the S.S.L.C. examination of previous year is taken as the scores on Academic achievement instead of preparing and administering an Achievement test.

3. The Wayanad district being predominantly rural. Hence the investigator didn't take locality as a criterion for forming subsample.

In spite of the above limitations, the study is done paying utmost care in sampling, inclusion of relevant variables and systematic data collection. The sample for the study was selected using proportionate stratified sampling techniques based on Gender, Subject of specialisation at Higher Secondary level and Type of Management of school. Therefore it is hoped that the findings of the study will be valid to a great extent.

**1.9 ORGANIZATION OF THE REPORT**

Chapter I of the report contains a brief introduction of the problem, need and significance of the study, statement of the problem, definition of key terms, variables, objectives, hypotheses, methodology, scope and limitations of the study.

In Chapter II, a theoretical framework regarding scientific attitude, survey of studies related to scientific attitude and a conclusion are given.

In Chapter III, a methodology of the study is described in detail consisting of the variables, objectives, hypotheses of the study, tools used for the study, selection of the sample, data collection procedure, scoring procedure and statistical techniques used for analysis of data.

Statistical analysis of data and discussion of results, findings of the study as per the objectives of the study are given in chapter IV.

Chapter V gives the summary of the study, major findings, conclusions, Educational implications and some suggestions for further research in this area.

**REVIEW OF RELATED LITERATURE**

The review of related literature is of immense importance and is inevitable to a well designed research study. A careful review of related literature on the problem to be investigated is one of the important steps in the planning of any research. It helps the investigator acquaint himself with the latest trends and developments in the field or area in which he is going to conduct the research. It is a valuable guide in defining the problem, in understanding its scope, re-organizing its significance, suggesting data gathering devices, making appropriate study design and sources of data.

The reviewed literature related to the scientific attitude are discussed in this chapter under two headings viz;

1. Theoretical framework Regarding Scientific Attitude.

2. Survey of studies related to Scientific Attitude.

**2.1 Theoretical frame work Regarding Scientific Attitude**

Attitude is a relatively stable and enduring predisposition to behave or react in a certain way towards persons, objects, institutions or issues (Atkinson *et al.,* 1988). There are a number of attitudes that can be developed through learning of various subjects in the School curriculum. Scientific attitude is most important among these and it can be developed mostly through the learning of science.

Many researchers, have been conducted studies in this area of scientific attitude. In Abroad, Lampkin and Caldwell & Curtis are the important researchers in the field.

Lampkin (1938) through an extensive study brought out 92 scientific attitudes. The second study of Lampkin revealed that there had been fairly general recognition and acceptance of the scientific attitudes grouped under following topics.

i. Applicability of the scientific method

ii. Limitation of perception

iii. Materials of Science are drawn from sensitive accurate and objective perception

iv. Hypotheses and laws must be compatible with accepted concepts.

v. Tests by experiment

vi. Guarding against error

vii. Persistent search for adequate concepts

According to Lampkin, two components which have been neglected are

viii. Laws and hypotheses are based on sampling of experience.

ix. No conception can be demonstrated to be necessarily true.

Caldwell and Curtis (1943) gave the following list of components of scientific attitude

1. Curiosity to know about one's environment
2. The belief that nothing can happen without a cause and those occurrences that seem strange and mysterious can always be explained by natural causes
3. An unwillingness to accept as facts and statements that are not supported by convincing proof
4. The determination not to believe in superstitions of any sort
5. The belief that truth itself never changes, but that our ideas of what is true change as we gain more and more knowledge
6. An intention not to experiment on to work blindly and carelessly, but to begin only after careful observation.
7. The determination to be careful and accurate in all one's observations
8. A willingness to consider all the evidence and try to decide whether it really relates to the matter which is being considered, whether it is sound and sensible, and whether it is complete enough to allow a conclusion to be made
9. A determination not to base final conclusions on one or a few observations, but to work as long as may be necessary in order to secure answer to a problem
10. The desire to do one's own observation and experimentation but a willingness to use results of other scientists work
11. The willingness to change an opinion or a conclusion if later evidence shows that it is wrong
12. The intention to respect another's point of view
13. The determination to prevent one's own likes and dislikes from influencing one's judgment

National Society of the study of Education (NSSE), (1960) USA, has defined scientific attitude as open mindedness, a desire for accurate knowledge, confidence in procedures for seeking knowledge and the expectation that the solution of the problem will come through the use of verified knowledge." Like this, in India also from the part of NCERT, has taken some steps to define it. In 1971, National Council of Educational Research and Training (NCERT) expressed the views regarding scientific attitude. It can be summarized as follows. A pupil who has developed scientific attitude:

1. is clear and precise in his activities and makes clear and precise statements
2. always bases his judgment on verified facts and not on opinions
3. prefers to suspend his judgment if sufficient data is not available
4. is objective in his approach and behavior
5. is free from superstitions
6. is honest and truthful in recording and collecting scientific data
7. after finishing his work takes care to arrange the apparatus, equipments etc. at their proper places
8. Shows a favorable reaction towards efforts of using science for human welfare

In India, among the researchers, Rao made significant contribution in this area. Rao (1996) identified the components of scientific attitude. They are:

i. open mindedness

ii. Critical mindedness

iii. Respect for evidence

iv. suspended judgment

v. Intellectual honesty

vi. Willingness to change opinion

vii. Search for truth

viii. Curiosity

ix. Rational thinking

Some other researchers in India and abroad have also identified the above mentioned components of scientific attitude. The common components that has been found from the review of related literature are: Critical thinking (Noll, 1935; Sharma, 1975; Vasundhara, 1997; Vasanthi, 2002; Marice, 2004), Open mindedness (Davis, 1935; Noll,1935; Heiss *et al.,* 1950 Vaidya, 1970; Nair, 1971; Saheb & Rajan, 1979; Shrivastava, 1983; Sharma, 1975; Diederich, 1987; Vasundara, 1997; Rani & Rao, 2000; Vasanthi, 2002; Marice, 2004), Objectivity is the loyalty to reality or search for the whole truth regardless of personal, religious or social prejudice (Davis 1935, Heiss *et al.,* 1950; Vaidya, 1970; Nair, 1971; Saheb & Rajan, 1979; Shrivastava, 1983; Sharma, 1975; Diederich, 1987; Vasundhara, 1997; Rani and Rao*,* 2000; Marice, 2004), Rationality is the freedom from superstition and belief in cause and effect relationships (Davis, 1935; Heiss *et al.,* 1950; Shrivastava, 1983; Sharma, 1975; Diederich, 1987; Vasundhara, 1997; Rani & Rao*,* 2000; Vasanthi, 2002), Follows scientific method in solving problems (Noll, 1935; Dewey, 1946; Heiss *et al.,*  1950; Vaidya, 1970; Nair, 1971; Shrivastava, 1983; Sharma, 1984; Diederich, 1987; Vasundhara, 1997; Rani et al., 2000; Vasanthi, 2002), Intellectual honesty in observations and drawing conclusions based on accurate facts (Noll, 1935; Vaidya, 1970; Nair, 1971; Saheb & Rajan, 1979; Shrivastva, 1983; Diederich, 1987; Vasanthi, 2002), Curiosity is the desire for accurate knowledge (Dewey, 1946; Heiss *et al.,*  1950; Vaidya, 1970; Shrivastava, 1983; Sharma, 1975; Diederich, 1987; Rani & Rao*,* 2000;Vasanthi, 2002; Marice, 2004), Persistence is pursing activities with consistency (Nair, 1971; Saheb & Rajan, 1979), Precision and parsimony (Nair, 1971; Diederich, 1987), Humanity (Diederich,1987).

Apart from the above components which are listed by majority of authors, the components mentioned for scientific attitude are: Preparedness to face hard ships and difficulties, Self help and self reliance (Nair,1971). Saheb & Rajan (1979), identified the following components. They are Creativity, Concept of self, Self actualization and Achievement motivation. Diederich (1987) identified the following components. They are: Liking for new things and Respect for quantification. Some recent studies sited in ERIC (2004) contain the following components. They are: Humility, caring and empathy.

After going through all of these lists and definitions, for the present study the investigator has identified the following components: Curiosity to know the 'Why' 'what' and 'how' of observed phenomena (Caldwell & Curtis 1943; Heiss, *et al.,* 1950), Caring about the environment, Persistence is pursuing activities with consistency (Nair, 1971), Critical thinking, Open mindedness in receiving new ideas and facts (Nair 1971), Honesty in recording and reporting of observation (Vaidya, 1970; Nair, 1971), Humility, Rationality, Objectivity, Following scientific method in solving problems ie the selection of most recent, authoritative and accurate evidence related to the problem (Heiss *et al.,* 1950) and confidence in procedures for seeking knowledge (NSSE, 1960). Precision and parsimony in explanations, (Diederich, 1987) which means being clear and precise in one's activities and making clear and precise statements (NCERT, 1971).

**2.2 SURVEY OF STUDIES RELATED TO SCIENTIFIC ATTITUDE**

Saxena (1972) studied social background, values and aspirations in an Indian Town and found that faculty wise (arts/science) difference were found in their scientific attitude.

Martin (1972) noticed in a study of the effect of Blue, Green and Yellow versions of BSCS Biology on the Scientific attitude of Tenth Grade students that there was no significantly different change in scientific attitude of male and female students combined, male students only or female students only among the three versions. With in each of the three versions there was no significantly different change in scientific attitude between male and female students.

Kulkarni (1975) investigated the attitudes of pupils of standards IV to VII, parents and teachers towards work experience and noticed the work experience was effective in inculcating in the pupils love for labour, curiosity, scientific attitude and such other characteristics.

Swarnnamma (1978) studied the teaching of Biology in the upper primary Schools of Kerala and found that the teachers in general failed to develop scientific attitude among the pupils of upper primary classes.

Srivastava (1980) noticed in the study of the scientific attitude and its measurement that the boys and girls and science and non-science students differ in respect of scientific attitude and that scientific knowledge helped in the formation of scientific attitude.

Shinde (1982) studied non-formal science activities in Secondary Schools and found that the boys and girls did not differ in their scientific attitude and students with high academic achievement had high scientific attitude, students with average and low academic achievement had average and low scientific attitude respectively. Girls showed a better relationship between scientific attitude and academic achievement than Boys. Scientific attitude of the students differed from region to region.

Srivastava (1983) conducted a study on scientific attitude of science and arts students belonging to scheduled caste and scheduled tribes vis-a-vis non scheduled caste communities. The major findings are the following. Mean Scores of science students on the scientific attitude scale were higher than those of the arts students. Boys scored consistently higher than girls. Higher Secondary School girls belonging to SC/ST or non SC/ST of science or arts faculties, and higher secondary schools boys belonging to Non-SC/ST of science faculty scored consistently higher scores on the scientific attitude scale than their counterparts. Non-Sc/ST students had a more positive scientific attitude than their counterparts belonging to SC/ST.

Dani (1984) Studied scientific attitude and cognitive styles of Higher Secondary students noticed boys and girls did not differ in scientific attitude scores. The scientific attitude of the Science students was higher than that of the arts and commerce students.

Kaushik (1988) studied the long term effect of advance organizers upon achievement in biology in relation to reading ability, intelligence and scientific attitude and noticed the achievement of learners in biology was found to be highly positively correlated with their intelligence, reading comprehension and scientific attitude.

Ghosh (1989) conducted a critical study of scientific attitude and aptitude of the students and determination of some determinants of scientific attitude and found that boys did not possess better scientific attitude than girls and rural students belonging to the high SES group did not show better scientific attitude than rural students belonging to the low SES group.

Kumar (1991) conducted a study on the teaching of general science and the development of Scientific attitude in Secondary School students in relation to achievement in general science and noticed the scientific attitude test scores of boys and girls of the average group differed significantly and there was no significant difference between the means of scientific attitude test scores of the pupils of urban and rural areas of the scores of the pupils of urban and rural areas of the average group. The mean scores of the scientific attitude test of boys and girls did not differ significantly in the high group and the mean scores of the scientific attitude test of the pupils of urban and rural areas in the high group differed significantly.

Sinha (1991) conducted a cross sectional study of the impact of scientific attitude, motivation and self concept in Science upon the achievement of the students of science and found that physical science urban boys achieved higher than rural boys and urban girls, urban students achieved better than rural students.

Nelliappan (1992) studied scientific attitude and scientific interest among higher secondary biology students in relation to their learning environment and the scientific attitude and scientific interest of the higher secondary biology students were significantly related in respect of the entire sample and of the various categories of sub samples.

Paulose (1995) studied the influence of scientific attitude of University entrants on their process outcomes in Physics and noticed scientific attitude exerted a significant influence on the process outcomes in physics scores.

Rao (1996) conducted a comparative study of scientific attitude, Scientific aptitude and achievement in biology at Secondary level and found that there was no influence of gender on scientific attitude. But the pupils studying in private schools, rural schools, English medium Schools and residential schools held relatively better scientific attitude than their counter parts.

Jayasree (1998) studied socialization ability, scientific attitude and attitude towards science in Junior college students found that the trait scientific attitude was not distributed normally and there was no association between socialization ability and scientific attitude in all the variables except discipline. Scientific attitude and attitude towards science were associated in sub samples of boys, girls, co-education, Telugu medium, non-residential institution and science students.

Rani and Rao (2000) studied educational aspirations and scientific attitude and found that the level of scientific attitude of urban students tends to be higher. The trait distribution is not normal and is positively skewed. Gender, medium of learning and level of schooling are not influencing the scientific attitude. The two traits educational aspirations and scientific attitude are not associated with each other in secondary level and higher secondary level students. Scientific attitude do not show any association in the age groups 13+ and 17+.

Vidyapati and Rao (2003) studied gender and socio-cultural differences in scientific attitude, creative ability and science achievement of ninth Graders found that a significant correlation exists between creative ability and scientific attitude in many categories of students.

Marice (2004) studied achievement in science as related to scientific aptitude and scientific attitude among XIth Std students in Tamil Nadu and found that boys and girls are on par in scientific attitude. Students hailing from rural and urban areas have similar scientific attitude. Students from matriculation Schools have higher scientific attitude than the students from state Board Schools. Students from different types of schools (gender wise) differ in their achievement in Science favoring girls schools but they are found on par in their scientific aptitude and scientific attitude. There is significant association between gender and scientific attitude. Achievement in science and scientific attitude are found to be significantly associated with school type (gender wise).

**2.3 CONCLUSION**

Theoretical overview helped the investigator to formulate the conceptual frame work of Scientific Attitude. For the present study, the components identified were: Curiosity, Caring, Persistence, Critical thinking, Open mindedness, Honesty, Humility, Rationality, Objectivity, Follows scientific method in solving problems and Precision and parsimony.

Majority of reviewed studies reveals that there exists no significant difference between male and female students in their scientific attitude (Martin, 1972; Shinde, 1982; Dani, 1984; Rao, 1996; Ghosh, 1989; Jayasree, 1998; Rani & Rao, 2000; Marice, 2004). But some of the studies indicated that there exists gender difference in scientific attitude (Kumar, 1991; Shrivastava, 1983). Science students have more scientific attitude than non-science students (Saxena, 1972; Shrivasthava, 1980; Dani, 1984). Achievement in Science helped in the formation of Scientific attitude (Shrivastava, 1980; Shinde, 1982; Koushik, 1988; Marice, 2004). Some studies revealed that scientific attitude varies according to the locality (Rao, 1996; Sinha, 1991; Rani & Rao, 2000). But another studies reveals that there is no variation in scientific attitude according to the locality (Kumar, 1991; Marice, 2004). Non SC/ST and SC/St students differ significantly in their scientific attitude (Shrivastava, 1983). Significant difference exists between type of management of school in scientific attitude (Rao, 1996). Scientific attitude varies according to the medium of instruction (Rao,1996; Jayasree, 1998; Rani & Rao, 2000). There is no significant difference exists among rural students belongs to high SES and low SES in their scientific attitude (Ghosh, 1989). Co-education is not related to scientific attitude (Jaysree, 1998). Work experience helped in the formation of scientific attitude (Kulkarni, 1975). Level of Schooling and age are not related to scientific attitude (Rani & Rao 2000). There is a positive correlation between scientific attitude and scientific interest (Nelliappan, 1992). Scientific attitude influences process outcomes in physics. There exists significant correlation between creative ability and scientific attitude (Vidyapati & Rao, 2003). The study of Swarnnamma (1978) revealed that, teachers in general failed to developing scientific attitude among the pupils of upper primary classes.

There is lack of studies regarding the Scientific Attitude of Higher Secondary School students in Kerala. Scientific attitude can contribute to the national development through the irradication of superstitions, and through developing objectivity, open mindedness, critical thinking and adopting scientific method in solving problems so it will be worthwhile to investigate the scientific attitude of Higher Secondary School students in Kerala.

**METHODOLOGY**

The methodology of the present study is described under the following headings viz,

1. Variable
2. Objectives
3. Hypotheses
4. Procedure of the construction of the tool
5. Statistical Techniques used

Each of the above is described in detail as follows:

**3.1 VARIABLE**

The only variable of the study is "Scientific Attitude". The variables considered in sampling and for classification of the sample into subsample are:

1. Gender,
2. Subject of specialization at Higher Secondary level,
3. Type of management of school,
4. Religion of student,
5. Community category,
6. Medium of instruction at secondary level,
7. Academic achievement at secondary level,
8. Achievement in science at secondary level,
9. Level of education of father,
10. Level of education of mother and
11. Family income.

**3.2 OBJECTIVES**

The objectives of the present study are the following

1. To construct a standardized tool to measure the Scientific Attitude among Higher Secondary school students.
2. To find out the extent of Scientific Attitude among higher secondary school students in the total sample and sub samples based on
3. Gender,
4. Subject of specialization at Higher Secondary level,
5. Type of management of school,
6. Religion of student,
7. Community category,
8. Medium of instruction at secondary level,
9. Academic Achievement at secondary level,
10. Achievement in science at secondary level,
11. Level of education of father,
12. Level of education of mother and
13. Family income.
14. To find out whether there exists significant difference in mean scores of Scientific Attitude between the relevant sub samples based on
15. Gender,
16. Subject of specialization at Higher Secondary level,
17. Type of management of school,
18. Religion of student,
19. Community category,
20. Medium of instruction at secondary level,
21. Academic Achievement at secondary level,
22. Achievement in science at secondary level,
23. Level of education of father,
24. Level of education of mother and
25. Family income.

**3.3 HYPOTHESES**

There exists significant difference between the mean scores of Scientific Attitude among Higher Secondary School students of the relevant sub samples based on

1. Gender,
2. Subject of specialization at Higher Secondary level,
3. Type of management of school,
4. Religion of student,
5. Community category,
6. Medium of instruction at secondary level,
7. Academic Achievement at secondary level,
8. Achievement in science at secondary level,
9. Level of education of father,
10. Level of education of mother and
11. Family income.

**3.4 PROCEDURE OF THE CONSTRUCTION OF THE TOOL**

Since the purpose of the study is to construct and standardize a Scientific Attitude scale for Higher Secondary School pupils of Kerala, the construction procedures of the Scientific Attitude scale have been described under the following major heads.

**3.4.1 Planning of the Scientific Attitude Scale**

The first step of construction and standardization of Scientific Attitude scale is the planning for the preparation of scale. When planning the investigator reviewed theories, related studies and previous attitude scales and also consulted with experts and accepted their valuable suggestions for the construction of Scientific Attitude scale items.

Inorder to attain the goal of scaling Scientific Attitude in students, proper consideration of the components of Scientific Attitude was taken. In the present study the investigator has selected eleven components viz; Curiosity, Caring, Persistence, Critical thinking, Open mindedness, Honesty, Humility, Rationality, objectivity, Follows scientific method in solving problems and Precision and parsimony.

The investigator decided to include atleast 30-50 items in the final scale. Therefore, the investigator decided to prepare double the number of items, ie; 60 items included in the preliminary scale.

**3.4.2 Description of Scientific Attitude scale (Draft)**

The scale items were prepared in accordance with the components involved in Scientific Attitude. After preparing the scale items the investigator had consulted with experts and in accordance with their opinion avoided ambiguous and vague items and initially pooled 60 items. The scale contains two types of items. Among these, 57 items are statement type and 3 situational items.

Each of the eleven components with examples are described below.

**1. Curiosity:** An intellectual drive for understanding natural wonder about the world around us.

Eg: Filling a crossword in science is an enjoyable hobby (Positive statement No: 4)

**2. Caring:** Caring is the concern for living things and the quality of the environment

Eg: Tourist centres should be established inside the dense forests to earn foreign currency (Negative statement No: 2)

**3. Persistence:** Persistence is the willingness to pursue a problem until a personally satisfying solution is found.

Eg: It is useless to seek answers for questions that cannot be answered easily (Negative statement No: 25)

**4. Critical thinking:** Critical thinking is reasonable reflective, and skillful thinking that is focused on deciding what to believe or do/correct thinking in the pursuit of relevant and reliable knowledge and values about the world.

Eg: "After the tsunami disaster in 2004, people in some area, decided to stop the use of seafood temporarily ". This decision is reasonable (Negative statement No: 7)

**5. Open-mindedness:** Open-mindedness is the willingness to consider new ideas and discoveries/willingness to revise opinions and conclusions.

Eg: AIDS affected children should be admitted to schools (Positive statement No: 26)

**6. Honesty:** Reluctance to compromise with truth/reports all observations in a truthful manner.

Eg: At times lying can be accepted to establish that science is true (Negative statement No: 17)

**7. Humility:** Humility is recognition of our own limitations as well as limitations inherent in science itself.

Eg: It is impossible to invent a new device more efficient than the computer (Negative statement No: 24)

**8. Rationality:** Rationality is the freedom from superstitions, believes in cause and effect relationships/acceptance of scientific facts and explanation.

Eg: Keeping scare crow do not avoid damage that may occur to buildings (Positive statements No:1)

**9.** **Objectivity :** Free from personal pride and biases in observing and recording facts and not allowing any change in interpreting data.

Eg: There is no need for further evidence on matters we feel to be true (Negative statement No: 27)

**10. Follows scientific method in solving problems:** It is the adoption of a planned procedure in solving a problem, suspended judgement, seek the facts and avoid exaggerations and accepting no conclusions as ultimate or final

Eg: Suppose one of your family members is bitten by a dog, you would;

1. Wash the wound with water and take the person to the   
    hospital.
2. Not take any actions
3. Wash the wound with water, then with antiseptic lotion   
    apply bandage and take the person to the hospital.
4. Wash the wound with water, apply bandage and take the   
    person to the hospital.
5. Console the bitten person, wash the wound with plenty of  
    water, then with antiseptic lotion, apply bandage and   
    watch the dog for 10 days. If it dies take the patient to  
    the hospital for antirabies injection (No: 59)

**11. Precision and Parsimony:** Specific in explanations and prefer simple explanation to the complex.

Eg: To study the concept of 'photosynthesis' which one of the following will you select.

1. The process by which plants prepare food using water   
    and carbon dioxide.

B. The process by which plants prepare Carbohydrates and Oxygen using Carbon dioxide, water and sunlight in the presence of chlorophyll.

C. It is the process by which plants prepare Carbohydrates and Oxygen by absorbing Carbon dioxide from the atmosphere, water and minerals from the soil in the presence of sunlight and chlorophyll present in leaves.

light energy

D. Water + Carbondioxide Carbohydrate + Chlorophyll Oxygen

light energy

E. 6H2O+6CO2 C6H12O6 +6O2 Chlorophyll (Item No.58)

The eleven dimensions of the Scientific Attitude and the numbers of items belonging to each of the dimensions are summarised in table 1.

**TABLE 1**

**The eleven dimensions of the**

**Scientific Attitude scale and the numbers**

**of items belonging to each of the dimensions**

|  |  |
| --- | --- |
| Components of Scientific Attitude | Item numbers |
| Curiosity | 4, 18, 29, 37, 38, 45, 52 |
| Caring | 2, 11, 22, 31, 40, 47, 54, 56 |
| Persistence | 8, 14, 25 |
| Critical thinking | 7, 28, 44 |
| Open-mindedness | 5, 15, 26, 35, 43, 50 |
| Honesty | 3, 12, 17, 23, 32, 41, 48 |
| Humility | 13, 24, 33, 34, 42, 49, 55 |
| Rationality | 1, 10, 20, 21, 30, 39, 46, 53 |
| Objectivity | 6, 16, 27, 36, 51, 57 |
| Follows scientific method in solving problems | 9, 19, 59 |
| Precision and parsimony | 58, 60 |

A copy of the Draft of Scientific Attitude scale is given as appendix I.

**3.4.3** **Try out of the Scientific Attitude scale**

The tryout of the scale is accurately a trial administration of the scale to know how the scale will function in actual use. The tryout scale will help to find out the discriminating power of scale items. For this, the scale was administered to a selected group of 370 students of standard XI students from 6 schools.

**3.4.4 Sample selected for Tryout Scale**

The sample for the tryout was selected by stratified random sampling techniques. In selecting the sample, representation was given to factors like Gender, Subject of specialization at Higher Secondary level and Type of management of school. The details of sample for tryout is given in table 2.

**TABLE 2**

**Sample for tryout of the Draft Scale**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Gender | | Subject of specialization at higher secondary level | | | Type of management of school | | |
| Male | Female | Science | Humanities | Commerce | Aided | Govt. | Unaided |
| 182 | 188 | 177 | 102 | 91 | 93 | 256 | 21 |
| 370 | | 370 | | | 370 | | |

**3.4.5 Administration of the Tryout Scale**

The scale was administered for tryout during the third week of January. After the selection of schools, for conducting the tryout scale, the investigator contacted the headmasters of the schools and sought permission and co-operation. The students of the particular classes where the scale was to be administered were met by the investigator and the importance of the scale was explained to them, so that the pupils were properly motivated.

Besides the instructions given in the scale book let, oral instructions were also given at the beginning. Separate scale booklet and response sheets were given to each student.

**3.4.6 Scoring of tryout scale**

The sheets were scored using the scoring scheme, for each positive item, a score of '5' was given to the response 'Strongly Agree', and for other entries 'Agree', 'Undecided', 'Disagree', and 'Strongly Disagree' were given '4', '3', '2' and '1' respectively. For negative items reverse scoring procedure was adopted. For situational items the student is to respond by selecting most suitable response from A B C D & E. The score of 1,2,3,4 and 5 was given to A B C D E for 58, B A D C E for 59 and E B D C A for 60. The scores of the individual items were summed to give total scores of the students for the tryout section. A copy of Scientific Attitude Scale, Response Sheet (Preliminary) is given as Appendix III.

**3.4.7 Finalisation of the scale**

For the finalisation of the scale, item analysis was done. The procedure suggested by Edwards (1957) was followed.

The scored response sheets were arranged in the descending order, on the basis of scores obtained. Then the subjects having top 27% and low 27% scores were taken as high and low group respectively. Under each group, the score obtained for each individual for each item were presented in a chart; the number of subjects marking 'Strongly Agree', Agree', 'Undecided', 'Disagree' and 'Strongly Disagree' were calculated. For each item, the mean, standard deviation and 't' value were calculated by the computer using SPSS package.

The details and the result of item analysis is summerised in Table 3. Table shows the Discrimination Power of the item in terms of critical ratio, item no: in the final scale of selected items as well.

**TABLE 3**

**The 't' value and item numbers in the final scale of selected items**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sl. No. | 't' | Question no. in final Scale |  | Sl. No. | 't' | Question no. in final Scale |
|  | 5.42 \* | 1 |  |  | 1.59 | - |
|  | 3.16 \* | 2 |  |  | 2.79 \* | 24 |
|  | 1.37 | - |  |  | 3.99 \* | 25 |
|  | 4.44 \* | 3 |  |  | 4.61 \* | 26 |
|  | 5.26 \* | 4 |  |  | 2.52 | - |
|  | 3.45 \* | 5 |  |  | 4.59 \* | 27 |
|  | 4.45 \* | 6 |  |  | 3.96 \* | 28 |
|  | 4.07 \* | 7 |  |  | 3.35 \* | 29 |
|  | 0.93 | - |  |  | 5.86 \* | 30 |
|  | 6.30 \* | 8 |  |  | 5.50 \* | 31 |
|  | 5.32 \* | 9 |  |  | 3.76 \* | 32 |
|  | 6.29 \* | 10 |  |  | 4.72 \* | 33 |
|  | 3.70 \* | 11 |  |  | 2.81 \* | 34 |
|  | 2.53 | - |  |  | 2.96 \* | 35 |
|  | 2.35 | - |  |  | 5.57 \* | 36 |
|  | 7.20 \* | 12 |  |  | 3.63 \* | 37 |
|  | 7.12 \* | 13 |  |  | 3.30 \* | 38 |
|  | 7.07 \* | 14 |  |  | 6.81 \* | 39 |
|  | 5.79 \* | 15 |  |  | 3.07 \* | 40 |
|  | 5.35 \* | 16 |  |  | 2.75 \* | 41 |
|  | 5.82 \* | 17 |  |  | 4.45 \* | 42 |
|  | -1.97 | - |  |  | 4.35 \* | 43 |
|  | 6.26 \* | 18 |  |  | 6.61 \* | 44 |
|  | 7.03 \* | 19 |  |  | 0.97 | - |
|  | 8.78 \* | 20 |  |  | 2.97 \* | 45 |
|  | 3.26 \* | 21 |  |  | 2.83 \* | 46 |
|  | 6.85 \* | 22 |  |  | 5.28 \* | 47 |
|  | 4.27 \* | 23 |  |  | -0.58 | - |
|  | 2.53 | - |  |  | 3.02 \* | 48 |
|  | -1.44 | - |  |  | 2.19 | - |

According to Edwards (1957) statements with 't'-value equal or greater than 1.75 can be selected. But, as the 't'-value obtained for the statements in the present scale are relatively high the investigator selected 2.58 as the 't' value required for items to be included in the scale. Thus 12 items were rejected, including the component 'Precision and parsimony'. Then the final attitude scale consisted of 48 items. A copy of final Scientific Attitude scale is given as Appendix 2.

**3.4.8 Reliability**

For the Scientific Attitude scale reliability was determined by test - retest method. The attitude scale was retested on a sample of 30 students after an interval of two weeks. The correlation between the first test scores and the re - test were calculated. Thus test-retest reliability was found to be 0.77, which indicates that the scale is reliable.

**3.4.9 Validity**

The prepared tool was given to science teachers and experts in the area of science education and they have accepted it as a valid tool for measuring Scientific Attitude.

The Scientific Attitude scale was prepared after thorough review of literature and identification of components of Scientific Attitude mentioned by multiple authors. Hence it possess content validity.

The researcher has found coefficient of correlation between the science achievement at secondary level and the score obtained on the scale. It was obtained as 0.39 which can be considered as an index of criterion validity.

**3.4.10 Sample Selected for the Final Administration**

The investigator intended to collect data of 900 students from Wayanad district. In selecting the sample, due representation was given to factors like Gender, Subject of specialisation at Higher Secondary level and Type of management of school. The final sample consisted of 875 pupils of standard XI selected from 13 higher secondary schools of Wayanad district. In Kerala the government and private school ratio is 1:2. But in the case of Wayanad district, more schools belongs to the government sector. The government and private school ratio is 2:1. The private sector involves aided and unaided schools. In the present study, the investigator gave more weightage to government schools than the aided and unaided schools. The ratio selected is 8:3:1.

**TABLE 4**

**Details of the school selected for the final administration of the scale**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sl.No. | Name of schools | Type of  Management of school | Total No.of school | Subject of specialisation at higher secondary level | Gender | | Total No.  of students | Total number of students in each subject | | |
| Male | Female |  | Science | Humanities | Commerce |
| 1 | G.H..H.S. Panamkandy | Govt. |  | Science | 22 | 16 |  |  |  |  |
| 2 | G.H.H.S. Kaniyambetta | Govt. |  | Science  Humanities  Commerce | 21  23  26 | 27  32  27 |  | 439 | 217 | 219 |
| 3 | G.H.H.S. Cheeral | Govt. |  | Science | 10 | 25 |  |
| 4 | G.H.S.S. Meenangadi | Govt. |  | Commerce | 20 | 30 |  |
| 5 | G.H.S.S. Padincharathara | Govt. | 8 | Science | 16 | 14 | 580 |
| 6 | G.H.S.S. Panamaram | Govt. |  | Humanities | 24 | 24 |  |
| 7 | G.M.H.S.S. Thariode | Govt. |  | Science | 26 | 26 |  |
| 8 | G.H.S.S. Vellmunda | Govt |  | Science  Humanities  Commerce | 22  24  36 | 25  36  24 |  |
| 9 | S.K.M.J.H.S.S.Kalpetta | Aided |  | Science | 22 | 38 |  |
| 10 | S.N.H.S.S. Poothadi | Aided | 3 | Commerce | 21 | 35 | 229 |
| 11 | Vijaya H.S.S. Pulpalli | Aided |  | Science  Humanities | 22  28 | 39  24 |  |
| 12 | ST.Peters and ST.Pauls E.M.H.S.S. Meenangadi | Unaided | 2 | Science | 16 | 18 | 66 |
| 13 | ST. Joseph's E.M.H.S.S. S.bathery | Unaided | Science | 16 | 16 |
|  |  |  |  | Total | 395 | 480 | 875 |  |

**3.4.11 Administration of the final scale**

After the selection of the sample, the investigator contacted the heads of the concerned institutions and obtained their permission for collecting data. Students were informed about the purpose of the scale. The scale was administered by the investigator with the co-operation and help rendered by the teachers. Proper directions and instructions were given to the pupils about how to answer the scale with in the prescribed time. Each student was given the booklet containing the items and response sheet.

**3.4.12 Scoring and consolidation of data**

The data collected from various schools were taken for scoring. The general data sheet was used to collect general information regarding the subject's such as name, gender, name of school, subject of specialization at secondary level, type of management of school, religion, community category, medium of instruction at secondary level, percentage of total mark obtained in S.S.L.C, percentage of mark in science, education of father, education of mother, and family income.

Response sheets of the Scientific Attitude scale were used for scoring. Scores '5', '4', '3', '2' and '1' were given to positive statements for responses 'Strongly Agree', ' Agree', 'Undecided', Disagree and 'Strongly Disagree' respectively. For the negative items this scoring is in reverse. For situational item 1,2,3,4 and 5 was given to the responses B A D C and E. The scores obtained for individual subjects were summed up to get score of Scientific Attitude of individual students. A copy of Scientific Attitude Scale Response Sheet is given as Appendix IV. While scoring only completed answer sheets were taken for tabulation and analysis. Thus the sample size was reduced to 875. The data were classified and consolidated in order to do the analysis in the computer.

**3.4.13 Classification of students based on Academic achievement, Achievement in science, Father's and Mother's education and Family income**

Students were grouped in to Low, Average and High achievers in science based on the percentage score obtained for science subjects in the secondary school public examination. For this the method of σ deviation from the mean was adopted. So, students with a score below M-σ score were grouped Low achievers in science, students who have scores in between M-σ and M+σ scores were classified Average achievers and students who obtained a score above M+σ scores were classified as High achievers in science.

The same procedure as above was adopted to classify students into Low, Average and High achievers based on total achievement at secondary level. For this the percentage of aggregate marks obtained for secondary school public examination was taken as the criterion.

Fathers with no formal education or with primary education were grouped as Low father's education group, fathers with secondary or Higher Secondary education were treated as Average Father's education group and fathers with higher education were treated as high father's education group. Same procedure was applied to categorise students in to Low, Average and High mother's education groups.

Students were classified into Low and High income groups based on their annual family income. Students with less than or equal to Rupees 15,000 were classified in to Low family income group and more than Rupees 15,000 classified into High family income group.

**3.4.14 Norm**

A scale is said to be standardised when it undergoes all the statistical procedures meant for it and when the appropriate norms are calculated for the test.

The study was confined to the standard XI students were age does not vary much. There fore age norms are not calculated. Gender norms, norms according to the Subject of specialization at Higher Secondary level and norms according to the Type of management of schools were determined in addition to the percentile norms for the scale as a whole. A percentile norm is a standard index of interpreting the score of an individual in terms of his relative standing or rank position in some particular group. Before calculating percentile norms, the mean, median, mode and standard deviations were calculated. The investigator has calculated the Critical Ratio on the difference between means of comparable sub samples based on Gender, Subject of specialisation at Higher Secondary level and Type of management of School. The percentile norms will be calculated only if there exists significant difference between these sub sample, with regard to Scientific Attitude. The details of fixing norms are presented in succeeding chapter.

**3.5 STATISTICAL TECHNIQUES USED FOR ANALYSIS**

The statistical analysis involves the

1. Calculation of mean
2. Percentiles
3. Test of significance of difference between means for large independent samples.

**ANALYSIS**

The analysis of the data was done on the basis of objectives. The analysis of data and discussion of results are presented under the following heads.

**1. Preliminary Analysis of scale scores**

**2. Analysis of the extent of Scientific Attitude among Higher Secondary school students for total sample and subsamples**

**3. Comparison of mean scores of Scientific Attitude in the relevant sub samples**

Each of the main sections is described in the same order.

**4.1 PRELIMINARY ANALYSIS OF SCALE SCORES**

Before attempting to establish norms preliminary analysis of the scores obtained for the sample was done. This preliminary analysis was meant to check the normalcy of distribution of the scores of Scientific Attitude scale, in the total sample to establish certain representative values such as mean, median and mode of Scientific Attitude scale score and measures of dispersion of the scores such as Standard Deviation for total sample and the sub samples. The skewness and kurtosis of the distribution of scores were also computed.

In addition, the investigator has tested the significance of difference between means of the scores on Scientific Attitude scale obtained for the relevant sub samples. This helped the investigator to find out whether there is significant difference between Gender, Subject of specialization at Higher Secondary level, Type of Management of school, Religion of student, Community Category, Medium of instruction at secondary level, Academic achievement at Secondary level, Achievement in Science at Secondary level, Level of education of father, Level of education of mother and Family income. The specific norms for the sub samples are calculated, only if there exists significant difference between the relevant sub samples.

**4.2 ANALYSIS OF THE EXTENT OF SCIENTIFIC ATTITUDE AMONG HIGHER SECONDARY SCHOOL STUDENTS**

**4.2.1 Extent of Scientific Attitude among Higher Secondary School students for total sample and relevant sub sample**

The scores obtained for the total sample were classified in to frequency distribution and preliminary analysis was done in order to check whether the frequency distribution follows a normal distribution. The statistical constants are presented in Table 5.

**TABLE 5**

**Statistical measures of scores of Scientific Attitude   
among Higher Secondary School students for total sample**

|  |  |
| --- | --- |
| Statistical Constants | Values |
| Mean | 167.29 |
| Median | 167.00 |
| Mode | 165.00 |
| Standard Deviation | 18.84 |
| Skewness | -0.62 |
| Kurtosis | 0.31 |
| SER | 0.64 |

From Table 5 it is clear that the values of mean, median, mode, standard deviation, skewness and kurtosis for the total sample are 167.29, 167.00, 165.00, 18.84, -0.62, 0.31 respectively. This shows that the distribution is approximately normal.

Standard error of mean for total sample provided in the table are 0.64, which shows that the mean is highly significant.

To get an overall view of data, the graphical representation of frequency distribution of scores of Scientific Attitude among Higher Secondary School students is given in Figure 1.

**4.2.2 Norms for the total sample**

For the present study, the investigator selected percentile norms for establishing norms for the total sample. For the present purpose, the percentiles P10, P20, P25, P30, P40, P50, P60, P70, P75, P80, P90 were calculated. Percentiles computed for the total sample are presented in Table 6.

**TABLE 6**

**Percentile norms of Scientific Attitude for the total Sample**

|  |  |
| --- | --- |
| **Percentiles** | **Scores** |
| P10 | 146.00 |
| P20 | 152.00 |
| P25 | 155.00 |
| P30 | 158.00 |
| P40 | 163.00 |
| P50 | 167.00 |
| P60 | 172.00 |
| P70 | 177.00 |
| P75 | 179.00 |
| P80 | 182.00 |
| P90 | 191.00 |

Table 6 shows that percentile values P10, P20, P25, P30, P40, P50, P60, P70, P75, P80, P90  are 146.00, 152.00, 155.00, 158.00, 163.00, 167.00, 172.00, 177.00, 179.00, 182.00, 191.00 respectively for Scientific Attitude among Higher Secondary School students for total sample. The value of P10 obtained for total sample is 146. This means that 10 percent of the students lies below the score or a person having a score greater than 146 is situated above the lowest 10 percentage of the group. In the same way all the percentiles can be interpreted. In order to get a clear representation of percentiles, ogives are drawn for the total sample which is given in figure 2.

**4.2.3 Extent of Scientific Attitude in subsamples**

The mean score of the Scientific Attitude obtained for subsamples based on Gender, Subject of specialization at higher secondary level, Type of management of school, Religion of student, Community category, Medium of instruction at secondary level, Academic achievement at secondary level, Achievement in science at secondary level, Level of education of father, Level of education of mother and Family income are summarised in the table 7 along with SER.

**TABLE 7**

**Extent of Scientific Attitude in subsamples**

|  |  |  |  |
| --- | --- | --- | --- |
| Samples | | Mean score | Standard Error of Mean |
| Total Sample | | 167.29 | 0.64 |
| Gender | Male  Female | 168.34  166.42 | 1.01  0.81 |
| Subject of specialisation at Higher Secondary Level | Science  Humanities  Commerce | 169.02  166.21  164.90 | 0.99  1.15  1.07 |
| Type of Management of School | Govt.  Aided  Unaided | 166.46  170.45  163.59 | 0.78  1.25  2.28 |
| Religion of Student | Christian  Hindu  Muslim | 169.33  166.91  165.55 | 1.11  1.01  1.20 |
| Community Category | General  OBC  SC  ST | 170.53  165.86  169.41  159.69 | 0.94  0.92  3.89  2.37 |
| Medium of Instruction at secondary level | English  Malayalam | 171.00  166.89 | 1.95  0.67 |
| Academic Achievement at Secondary level | High  Average  Low | 175.62  167.23  158.73 | 1.50  0.76  1.44 |
| Academic Achievement in Science at Secondary level | High  Average  Low | 176.81  166.93  158.71 | 1.46  0.76  1.42 |
| Level of Education of Father | High  Average  Low | 171.54  167.69  165.04 | 2.32  0.78  1.25 |
| Level of Education of Mother | High  Average  Low | 173.49  168.31  163.80 | 2.36  0.79  1.19 |
| Family Income | High  Low | 169.01  165.76 | 0.88  0.91 |

Table 7 shows the seeming difference among the mean scores of subsamples. The test of significance of difference between means to compare the mean scores obtained for relevant subsamples. The percentile norms for the subsamples which will provide a more clear picture about the extent of Scientific Attitude among subsamples will be developed only if the subsamples are significantly different.

**4.3 Comparison of mean scores of Scientific Attitude among Higher Secondary school students of the Relevant subsamples**

Besides calculating Arithmetic mean, standard deviation, critical Ratio obtained for test of significance of difference between means for the relevant subsamples, the investigator calculated the percentile norms wherever significant difference in means were observed. Detailed discussions are done below.

**4.3.1 Comparison of mean scores of Scientific Attitude among Higher secondary school students based on Gender.**

The values of mean, standard deviation and critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude for the subsample based on Gender are given in Table 8.

**TABLE 8**

**Mean, Standard deviation and Critical  
 Ratio obtained for test of significance of difference between  
 mean scores of Scientific Attitude for subsample based on Gender**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subsamples based on Gender | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples |
| Male | 395 | 168.34 | 20.02 | 1.48 |
| Female | 480 | 166.42 | 17.79 |

Table 8 shows that the values of Arithmetic mean and standard deviation of male students are 168.34 and 20.02 and of female students are 166.42, 17.79 respectively.

Standard error of means for male and female subsamples provided in the table 7 are 1.01 and 0.81 respectively, which shows that the means are highly significant.

The 't' value of male and female students is 1.50 which is less than 1.96, the tabled value required for significance at 0.05 level. This means that there exists no significant difference in Scientific Attitude between male and female subsamples.

**4.3.2 Comparison of mean scores of Scientific Attitude among Higher secondary school students based on Subject of specialization at Higher Secondary level**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude for the subsample based on subject of specialization at higher secondary level are given in Table 9.

**TABLE 9**

**Mean, Standard deviation**

**and Critical Ratio obtained for test of significance of**

**difference between mean scores of Scientific Attitude for**

**subsample based on Subject of specialization at Higher Secondary level**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on subject of Specialization at Higher Secondary level | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| Science  Vs Humanities | Science Vs Commerce | Humanities Vs Commerce |
| Science | 439 | 169.02 | 20.86 | 1.84 | \*2.81 | 0.83 |
| Humanities | 217 | 166.21 | 16.92 |
| Commerce | 219 | 164.90 | 15.88 |

\* Indicates significance at 0.01 level.

Table 9 shows that the values of mean and standard deviation of Scientific Attitude scores of science students are 169.02 and 20.86 and of Humanities students are 166.21 and 16.92 and that of Commerce students are 164.90 and 15.88 respectively.

Standard error of means for Science, Humanities and Commerce subsamples provided in the table 7 are 0.99, 1.15 and 1.07 respectively, which shows that the means are highly significant.

The 't' value obtained for Science and Humanities students is 1.84 and that of Humanities and Commerce students is 0.83 which are less than 1.96, the tabled value required for significance at 0.05 level. This means that there exists no significant difference in Scientific Attitude between Science and Humanities, Humanities and Commerce students.

The 't' value obtained for Science and Commerce students is 2.81 which is greater than 2.58, the tabled value required for significance at 0.01 level. This means that there exists significant difference in Scientific Attitude between Science and Commerce students.

An examination of mean scores shows that Science students have high mean Scientific Attitude score than that of Commerce students.

**4.3.3** **Comparison of mean scores of Scientific Attitude among Higher secondary school students based on Type of Management of School**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude for the subsample based on Type of management of school are given in Table10.

**TABLE 10**

**Mean, Standard deviation**

**and Critical Ratio obtained for test of significance**

**of difference between mean scores of Scientific Attitude**

**for the subsample based on Type of management of school**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on Type of Management of School | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| Aided Vs Government | Aided Vs Un Aided | Govt. Vs Un Aided |
| Government | 580 | 166.46 | 18.70 | \*2.70 | \*2.63 | 1.19 |
| Aided | 229 | 170.45 | 18.95 |
| Un Aided | 66 | 163.59 | 18.56 |

\* Indicates significance at 0.01 level

Table 10 shows that the values of mean and standard deviation of Scientific Attitude scores of Government students are 166.46 and 18.70 and that of Aided students are 170.45 and 18.95 and that of Un Aided students are 163.59 and 18.56 respectively.

Standard error of means for Government Aided and Unaided subsamples provided in the table 7 are 0.78, 1.25 and 2.28 respectively, which shows that the means are highly significant.

The 't' value obtained for Aided and Government students is 2.70 and that of Aided and Unaided students is 2.63 which are greater than 2.58, the tabled value required for significance at 0.01 level. This means that there exists significant difference in Scientific Attitude between Aided and Government, Aided and Unaided students.

The 't' value obtained for Government and Unaided students is 1.19 which is less than 1.96, the tabled value required for significance at 0.05 level. This means that there exists no significant difference is Scientific Attitude between Government and Unaided students.

An examination of means scores shows that Aided School students have high mean Scientific Attitude score than that of Government and Unaided students.

**4.3.4** **Comparison of mean scores of Scientific Attitude among Higher secondary school students based on Religion of student**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Religion are given in Table 11.

**TABLE 11**

**Mean, Standard deviation and Critical Ratio**

**obtained for test of Significance of difference between**

**mean scores of Scientific Attitude for the subsample based on Religion**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on Religion of student | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| Christian Vs Hindu | Christian Vs Muslim | Hindu Vs Muslim |
| Christian | 268 | 169.33 | 18.12 | 1.62 | \*2.31 | 0.86 |
| Hindu | 377 | 166.91 | 19.61 |
| Muslim | 230 | 165.55 | 18.23 |

\* Indicates significance at 0.05 level

Table 11 shows that the values of mean and standard deviation of Scientific Attitude scores of Christian students are 169.33 and 18.12 and that of Hindu students are 166.91 and 19.61 and that of Muslim students are 165.55 and 18.23 respectively.

Standard error of means for Christian, Hindu and Muslim subsamples provided in the table 7 are 1.11, 1.01 and 1.20 respectively, which shows that the means are highly significant.

The 't' value obtained for Christian and Hindu students is 1.62 and for Hindu and Muslim Students is 0.86 which are less than 1.96, the tabled value required for significance at 0.05 level. This means that there exists no significant difference in Scientific Attitude between Christian and Hindu, Hindu and Muslim students.

The 't' value obtained for Christian and Muslim students is 2.31 which is greater than 1.96, the tabled value required for significance at 0.05 level. This means that there exists significant difference in Scientific Attitude between Christian and Muslim students.

An examinations of mean scores shows that Christian students have high mean Scientific Attitude score than that of Muslim students.

**4.3.5** **Comparison of mean scores of Scientific Attitude among Higher secondary school students based on Community category**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Community Category are given in Table 12.

**TABLE 12**

**Mean, Standard deviation**

**and Critical Ratio obtained for test of**

**Significance of difference between mean scores of**

**Scientific Attitude for the subsample based on Community category**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on Community category | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | | | | |
| GEN Vs OBC | GEN Vs SC | GEN Vs ST | SC Vs OBC | OBC Vs ST | SCT Vs ST |
| GENERAL | 369 | 170.48 | 17.97 | \*3.84 | 0.27 | \*4.23 | 1.00 | \*\*2.25 | \*\*2.13 |
| SC | 36 | 169.41 | 23.33 |
| OBC | 404 | 165.43 | 18.57 |
| ST | 66 | 159.69 | 19.28 |

\* Indicates significance at 0.01 level

\* \*Indicates significance at 0.05 level

Table 12 shows that the values of mean and standard deviation of Scientific Attitude scores of General students are 170.48 and 17.97 and that of SC are 169.41 and 23.33 and of OBC are 165.43 and 18.57 and that of ST are 159.69 and 19.28 respectively.

Standard error of means for General, SC, OBC, and ST subsamples provided in the table 7 are 0.94, 3.89, 0.93 and 2,37 respectively, which shows that the means are highly significant.

The 't' value obtained for General and OBC is 3.84 and for General and ST students is 4.23 which are greater than 2.58, the tabled valued required for significance at 0.01 level. This means that there exists significant difference in Scientific Attitude between General and OBC, General and ST students.

The 't' value obtained for OBC and ST is 2.25 and for SC and ST is 2.13 which are greater than 1.96, the tabled value required for significance at 0.05 level. This means that there exists significant difference in Scientific Attitude between OBC and ST, SC and ST students.

The 't' value obtained for General and SC is .27, SC and OBC is 1.00 which are less than 1.96, the tabled value required for significance at 0.05 level. This means that there exists no significant difference in Scientific Attitude between General and SC, SC and OBC students.

An examinations of mean scores shows that General students have high mean Scientific Attitude score than that of OBC and ST students. SC students have high mean Scientific Attitude score than that of OBC and ST students.

**4.3.6** **Comparison of mean scores of Scientific Attitude among Higher Secondary School students based on Medium of Instruction at Secondary level**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Medium of Instruction at Secondary level are given in Table13.

**TABLE 13**

**Mean, Standard deviation and**

**Critical Ratio obtained for test of significance of**

**difference between mean scores of Scientific Attitude**

**for subsample based on Medium of Instruction at Secondary level**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subsamples based on Medium of Instruction at Secondary level | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples |
| English | 85 | 171.00 | 17.99 | \*1.99 |
| Malayalam | 790 | 166.89 | 18.90 |

**\*** Indicates significance at 0.05 level

Table 13 shows that the values of mean and standard deviation of Scientific Attitude scores of English medium students are 171.00 and 17.99 and that of Malayalam medium students are 166.89 and 18.90 respectively.

Standard error of means for English medium and Malayalam medium subsamples provided in the table 7 are 1.95 and 0.67 respectively, which shows that the means are highly significant.

The 't' value obtained for English medium and Malayalam medium students is 1.99 which is greater than 1.96, the tabled value required for significance at 0.05 level. This means that there exists significant difference in Scientific Attitude between English medium and Malayalam medium students at Secondary level.

An examination of mean scores shows that English medium students have high mean Scientific Attitude score than that of Malayalam medium students.

**4.3.7** **Comparison of mean scores of Scientific Attitude among Higher Secondary School students based on Academic achievement at Secondary level**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Academic achievement at Secondary level are given in Table14.

**TABLE 14**

**Mean, Standard deviation**

**and Critical Ratio obtained for test of significance of**

**difference between mean scores of Scientific Attitude for**

**subsample based on Academic achievement at Secondary level**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on Academic achievement at secondary level | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| High  Vs  Average | High Vs Low | Average  Vs  Low |
| High | 164 | 175.62 | 19.22 | \*4.98 | \*8.11 | \*5.21 |
| Average | 555 | 167.23 | 17.86 |
| Low | 156 | 158.73 | 18.03 |

\* Indicates significance at 0.01 level

Table 14 shows that the values of mean and standard deviation of Scientific Attitude scores of High achievers are 175.62 and 19.22 and that of Average achievers are 167. 23 and 17.86 and of Low achievers are 158.73 and 18.03 respectively.

Standard error of means for High, Average and Low achievers provided in the table 7 are 1.50, 0.76 and 1.44 respectively, which shows that the means are highly significant.

The 't' value obtained for High and Average achievers is 4.98, High and Low is 8.11 and that of Average and Low achievers is 5.21, which are greater than 2.58, the tabled value required for significance at 0.01 level. This means that there exists significant difference in Scientific Attitude between High and Average, High and Low, Average and Low achievers.

An examination of mean scores shows that High achievers have high mean Scientific Attitude score than that of Average and Low achievers.

**4.3.8** **Comparison of mean scores of Scientific Attitude among Higher Secondary School students based on Achievement in science at Secondary level**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Achievement in science at Secondary level are given in Table 15.

**TABLE 15**

**Mean, Standard deviation and**

**Critical Ratio obtained for test of significance of**

**difference between mean scores of Scientific Attitude for**

**subsample based on Achievement in science at Secondary level**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on Achievement in science at secondary level | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| High  Vs  Average | High Vs Low | Average  Vs  Low |
| High | 171 | 176.81 | 19.06 | \*6.01 | \*8.90 | \*5.11 |
| Average | 537 | 166.93 | 17.54 |
| Low | 167 | 158.71 | 18.32 |

\* Indicates significance at 0.01 level

Table 15 shows that the values of mean and standard deviation of Scientific Attitude scores of High achievers in science are 176.81 and 19.06 and that of Average achievers in science are 166. 93 and 17.54 and that of Low achievers in science are 158.71 and 18.32 respectively.

Standard error of means for High, Average and Low achievers in science provided in the table 7 are 1.46 and 0.76 and 1.42 respectively, which shows that the means are highly significant.

The 't' value obtained for High and Average achievers in science is 6.01, High and Low achievers in science is 8.90 and that of Average and Low achievers in science is 5.11, which are greater than 2.58, the tabled value required for significance at 0.01 level. This means that there exists significant difference in Scientific Attitude between High and Average, High and Low, Average and Low achievers in science.

An examination of mean scores shows that High achievers in science have high mean Scientific Attitude score than that of Average and Low achievers in science.

**4.3.9** **Comparison of mean scores of Scientific Attitude among Higher Secondary School students based on Level of education of father**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Level of education of father are given in table 16.

**TABLE 16**

**Mean, Standard deviation**

**and Critical Ratio obtained for test of**

**significance of difference between mean scores of**

**Scientific Attitude for subsample based on Level of education of father**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on Level of education of father | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| High  Vs  Average | High Vs Low | Average  Vs  Low |
| High | 81 | 171.54 | 20.84 | 1.57 | \*2.53 | 1.92 |
| Average | 554 | 167.69 | 18.47 |
| Low | 230 | 164.92 | 18.75 |

\* Indicates significance at 0.05 level

Table 16 shows that the values of mean and standard deviation of Scientific Attitude scores of High father's education group is 171.54 and 20.84 and of Average father's education group are 167.69 and 18.75 and that of Low father's education group are 164.92 and 18.75 respectively.

Standard error of means for High, Average and Low father's education groups provided in the table 7 are 2.32, 0.78 and 1.25 respectively, which shows that the means are highly significant.

The 't' value obtained for High and Average father's education groups is 1.57 and that of Average and Low father's education groups is 1.92 which are less than 1.96, the tabled value required for significance at 0.05 level. This means that there exists no significant difference in Scientific Attitude between High and Average, Average and Low father's education groups.

The 't' value obtained for High and Low father's education groups is 2.53 which is greater than 1.96, the tabled value required for significance at 0.05 level. This means that there exists significant difference in Scientific Attitude between High and Low father's education groups.

An examination of mean scores shows that High father's education group have high mean Scientific Attitude score than that of Average and Low father's education groups.

**4.3.10** **Comparison of mean scores of Scientific Attitude among Higher Secondary School students based on Level of education of mother**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Level of education of mother are given in table 17.

**TABLE 17**

**Mean, Standard deviation**

**and Critical Ratio obtained for test of**

**significance of difference between mean scores of scientific**

**attitude for subsample based on Level of education of mother**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subsamples based on  level of education of mother | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples | | |
| High  Vs  Average | High Vs Low | Average  Vs  Low |
| High | 67 | 173.49 | 19.27 | \*2.08 | \*\*3.67 | \*\*3.16 |
| Average | 539 | 168.31 | 18.31 |
| Low | 250 | 163.69 | 19.19 |

\* Indicates significance at 0.05 level

\*\* Indicates significance at 0.01 level

Table 17 shows that the values of mean and standard deviation of Scientific Attitude scores High mother's education group are 173.49 and 19.27 and of Average mother's education group are 168.31 and 18.31 and that of Low mother's education group are 163.69 and 19.19 respectively.

Standard error of means for High, Average and Low mother's education groups provided in the table 7 are 2.36, 0.79 and 1.19 respectively, which shows that the means are highly significant.

The 't' value obtained for High and Average mother's education groups is 2.08, which is greater than 1.96, the tabled value required for significance at 0.05 level. This means that there exists significant difference in Scientific Attitude between High and Average mother's education groups.

The 't' value obtained for High and Low mother's education groups is 3.67 and that of Average and Low mother's education groups is 3.16, which are greater than 2.58 the tabled value required for significance at 0.01 level. This means that there exists significant difference in Scientific Attitude between High and Low mother's education groups and Average and Low mother's education groups.

An examination of mean scores shows that High mother's education group have high mean Scientific Attitude score than that of Average and Low mother's education groups.

**4.3.11** **Comparison of mean scores of Scientific Attitude among Higher Secondary School students based on Family income**

The values of mean, standard deviation and Critical Ratio obtained for test of significance of difference between mean scores of Scientific Attitude obtained for subsample based on Family income are given in table18.

**TABLE 18**

**Mean, Standard deviation and Critical  
 Ratio obtained for test of significance of difference between  
 mean scores of Scientific Attitude for subsample based on Family income**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subsamples based on family income | Number | Mean | Standard deviation | Critical Ratio obtained for paired comparison of subsamples |
| High | 463 | 169.01 | 19.49 | \*2.56 |
| Low | 412 | 165.76 | 17.95 |

**\*** Indicates significance at 0.05 level

Table 18 shows that the values of mean and standard deviation of Scientific Attitude scores of High and Low Family income groups are 169.01 and 19.49 and that of Low family income group are 165.76 and 17.95 respectively.

Standard error of means for High and Low family income groups provided in the table 7 are 0.88 and 0.91 respectively, which shows that the means are highly significant.

The 't' value obtained for High and Low family income groups is 2.56, which is greater than 1.96, the tabled value required for significance at 0.05 level. This means that there exists significant difference in Scientific Attitude between High and Low family income groups.

An examination of mean scores shows that High Family income group have high mean Scientific Attitude score than the Low Family income group.

**Norms of Scientific Attitude for science, Humanities and Commerce students**

Distinct norms were established for science and commerce students since it was found that there is significant difference between these two groups in the mean scores on Scientific Attitude scale.

The percentile norms for science, humanities and commerce students are given.

**Percentile norms of Scientific Attitude for Science, Humanities and Commerce Students**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | Science | Humanities | Commerce |
|  |  |  |  |
| P10 | 146.00 | 146.00 | 144.00 |
| P20 | 154.00 | 151.00 | 151.00 |
| p25 | 156.00 | 155.00 | 153.00 |
| p30 | 160.00 | 157.00 | 156.00 |
| p40 | 165.00 | 163.00 | 160.00 |
| p50 | 170.00 | 167.00 | 165.00 |
| p60 | 175.00 | 170.00 | 169.00 |
| p70 | 180.00 | 175.00 | 174.00 |
| p75 | 183.00 | 177.00 | 176.00 |
| p80 | 186.00 | 178.00 | 178.00 |
| p90 | 194.00 | 187.00 | 186.00 |

This can be made evident from the ogives drawn in figure 3 for the distribution of scores of Science, Humanities and Commerce students.

Ogive of the science students lies right to the ogive of the commerce students showing that science students are superior than commerce students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines AC and GI respectively. From the graph it is very clear that science and commerce students differ more significantly at third quartile and some what equal throughout first and second quartiles.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for Aided, Government and Unaided Students**

Distinct norms were established for Aided Vs Government and Aided Vs Unaided students since it was found that there is significant difference between these groups in the mean scores on Scientific Attitude scale.

The percentile norms for Aided Vs Government and Aided Vs Unaided students are given.

**Percentile norms of Scientific Attitude for Government, Aided and Unaided students**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | Government | Aided | Unaided |
|  |  |  |  |
| P10 | 145.10 | 148.00 | 141.70 |
| P20 | 152.00 | 153.00 | 149.60 |
| p25 | 155.00 | 156.00 | 152.75 |
| p30 | 158.00 | 159.00 | 155.10 |
| p40 | 164.00 | 164.00 | 158.80 |
| p50 | 167.00 | 171.00 | 162.00 |
| p60 | 171.00 | 176.00 | 169.40 |
| p70 | 176.00 | 180.00 | 176.00 |
| p75 | 178.00 | 184.50 | 177.25 |
| p80 | 180.80 | 189.00 | 179.00 |
| p90 | 189.00 | 194.00 | 185.50 |

This can be made evident from the ogives drawn in figure 4 for the distribution of scores of Government, Aided and Unaided students.

Ogive of the Aided students lies right to the ogive of the Unaided students showing that Aided students are superior than Unaided students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines AC and GI respectively. From the graph it is very clear that aided and unaided students differ significantly at first quartile and differ more significantly throughout second and third quartile.

Ogive of the Aided students lies right to the ogive of the Government students showing that Aided students are superior than Government students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DE and difference between Q1 and Q3 are represented by lines AB and GH respectively. From the graph it is very clear that Aided and Government students differ more significantly at third quartile and some what equal throughout first and second quartiles.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for Christian, Hindu and Muslim students**

Distinct norms were established for Christian Vs Muslim students since it was found that there is significance of difference between these two groups in the mean scores on Scientific Attitude scale.

The percentile norms for Christian Vs Muslim students are given.

**Percentile norms of Scientific Attitude for Christian, Hindu and Muslims Students**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | Government | Aided | Unaided |
| P10 | 147.00 | 146.00 | 141.00 |
| P20 | 155.00 | 152.00 | 150.20 |
| p25 | 156.00 | 155.00 | 154.00 |
| p30 | 159.00 | 158.00 | 157.00 |
| p40 | 164.00 | 163.00 | 162.00 |
| p50 | 169.00 | 168.00 | 167.00 |
| p60 | 174.00 | 172.00 | 169.60 |
| p70 | 179.00 | 177.00 | 175.00 |
| p75 | 182.00 | 178.50 | 177.00 |
| p80 | 186.20 | 181.40 | 179.80 |
| p90 | 193.10 | 190.00 | 188.00 |

This can be made evident from the ogives drawn in figure 5 for the distribution of scores of Christian, Hindu and Muslim students.

Ogive of the Christian students lies right to the ogive of the Muslim students showing that Christian students are superior than Muslim students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines AC and GI respectively. From the graph it is very clear that Christian and Muslim students differ significantly at third quartile and somewhat equal throughout first and second quartiles.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for General, OBC, SC and ST students**

Distinct norms were established for General Vs OBC, OBC Vs ST and General Vs ST and SC Vs ST students since it was found that there is significance of difference between these two groups in the mean scores on Scientific Attitude scale.

The percentile norms for General Vs OBC, General Vs ST, OBC Vs ST, SC Vs ST are given.

**Percentile norms of Scientific Attitude for General, OBC, SC and ST students**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Percentiles | General | OBC | SC | ST |
| P10 | 148.00 | 142.00 | 144.10 | 143.70 |
| P20 | 156.00 | 151.00 | 153.00 | 149.40 |
| p25 | 158.00 | 154.00 | 155.00 | 151.00 |
| p30 | 161.00 | 157.00 | 157.40 | 152.00 |
| p40 | 166.00 | 162.00 | 168.80 | 156.00 |
| p50 | 171.00 | 166.00 | 171.00 | 158.00 |
| p60 | 176.00 | 170.00 | 176.20 | 165.20 |
| p70 | 180.00 | 175.00 | 179.80 | 169.00 |
| p75 | 182.50 | 177.00 | 183.00 | 171.25 |
| p80 | 187.00 | 179.00 | 185.60 | 174.00 |
| p90 | 193.00 | 188.00 | 201.00 | 178.30 |

This can be made evident from the ogives drawn in figure 6 for the distribution of scores of General, OBC, SC and ST students.

Ogive of the General students lies right to the ogive of the OBC students showing that General students are superior than OBC students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance FG and difference between Q1 and Q3 are represented by lines AC and JK respectively. From the graph it is very clear General and OBC students differ significantly at first, second and third quartile

Ogive of the General students lies right to the ogive of the ST students showing that General students are superior than ST students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance FH and difference between Q1 and Q3 are represented by lines AD and JL respectively. From the graph it is very clear that General and ST students differ significantly throughout first, second and third quartile.

Ogive of the SC students lies right to the ogive of the OBC students showing that General students are superior than OBC students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance EG and difference between Q1 and Q3 are represented by lines BC and IK respectively. From the graph it is very clear that SC and OBC students differ significantly throughout second and third quartiles and very slightly differ at first quartile.

Ogive of the OBC students lies right to the ogive of the ST students showing that OBC students are superior than ST students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance GH and difference between Q1 and Q3 are represented by lines CD and KL respectively. From the graph it is very clear that OBC and ST students differ more significantly throughout second and third quartile and some what equal at first quartile.

Ogive of the SC students lies right to the ogive of the ST students showing that General students are superior than OBC students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance EH and difference between Q1 and Q3 are represented by lines BD and IL respectively. From the graph it is very clear that SC and ST students differ significantly at first quartile and differ more significantly throughout second and third quartile.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for English medium Vs Malayalam medium students**

Distinct norms were established for English medium Vs Malayalam medium students at secondary level since it was found that there is significance of difference between these two groups in the mean scores on Scientific Attitude scale. The percentile norms for English medium Vs Malayalam medium students.

**Percentile norms of Scientific Attitude for English Medium and Malayalam Medium students**

|  |  |  |
| --- | --- | --- |
| Percentiles | English  Medium | Malayalam Medium |
| P10 | 152.00 | 145.00 |
| P20 | 157.20 | 152.00 |
| p25 | 159.00 | 155.00 |
| p30 | 161.00 | 157.30 |
| p40 | 164.40 | 163.00 |
| p50 | 171.00 | 167.00 |
| p60 | 174.00 | 171.00 |
| p70 | 179.00 | 177.00 |
| p75 | 181.00 | 179.00 |
| p80 | 184.00 | 182.00 |
| p90 | 195.80 | 190.00 |

This can be made evident from the ogives drawn in figure 7 for the distribution of scores of English Medium and Malayalam Medium students.

Ogive of the English medium students lies right to the ogive of the Malayalam medium students showing that English medium students are superior than Malayalam medium students in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance CD and difference between Q1 and Q3 are represented by lines AB and EF respectively. From the graph it is very clear that English medium and Malayalam medium students differ significantly at first quartile and some what equal throughout second and third quartile.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for High, Average and Low achievers**

Distinct norms were established for High Vs Average, High Vs Low, Average Vs low achievers, since it was found that there is significant difference between these groups in the mean scores on Scientific Attitude scale. The percentile norms for High Vs Average, High Vs Low, Average Vs Low achievers are given.

**Percentile norms of Scientific Attitude for High, Average and Low achievers**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | High | Average | Low |
| P10 | 153.00 | 147.00 | 139.00 |
| P20 | 161.00 | 155.00 | 144.00 |
| p25 | 165.00 | 156.00 | 147.00 |
| p30 | 166.50 | 159.00 | 149.00 |
| p40 | 172.00 | 164.00 | 152.00 |
| p50 | 176.00 | 168.00 | 157.00 |
| p60 | 181.00 | 171.00 | 161.20 |
| p70 | 187.00 | 176.00 | 167.00 |
| p75 | 189.75 | 178.00 | 171.00 |
| p80 | 192.00 | 180.00 | 173.60 |
| p90 | 199.50 | 188.00 | 180.30 |

This can be made evident from the ogives drawn in figure 8 for the distribution of scores of High, Average and Low achievers.

Ogive of the High achievers lies right to the ogive of the Average achievers showing that High achievers are superior than Average achievers in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DE and difference between Q1 and Q3 are represented by lines AB and GH respectively. From the graph it is very clear that High and Average achievers differ significantly throughout first, second and third quartile.

Ogive of the High achievers lies right to the ogive of the Low achievers showing that High achievers are superior than Low achievers in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines ACand GI respectively. From the graph it is very clear that High and Low achievers differ significantly throughout first, second and third quartile.

Ogive of the Average achievers lies right to the ogive of the Low achievers showing that Average achievers are superior than Low achievers in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance EF and difference between Q1 and Q3 are represented by lines BC and HI respectively. From the graph it is very clear that Average and Low achievers differ significantly throughout first, second and third quartile.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for High, Average and Low achievers in science.**

Distinct norms were established for High Vs Average, High Vs Low, Average Vs Low achievers in science, since it was found that there is significant difference between these groups in the mean scores on Scientific Attitude scale.

The percentile norms for High Vs Average, High Vs Low, Average Vs Low achievers in science.

**Percentile norms of Scientific Attitude for High, Average and Low achievers in science**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | High | Average | Low |
| P10 | 156.00 | 146.00 | 141.00 |
| P20 | 162.00 | 153.60 | 146.00 |
| p25 | 165.00 | 156.00 | 149.00 |
| p30 | 167.00 | 158.40 | 150.00 |
| p40 | 172.00 | 163.20 | 153.00 |
| p50 | 178.00 | 168.00 | 157.00 |
| p60 | 183.00 | 172.00 | 163.80 |
| p70 | 189.00 | 176.00 | 167.00 |
| p75 | 190.00 | 178.00 | 170.00 |
| p80 | 193.00 | 180.00 | 172.00 |
| p90 | 199.85 | 188.00 | 179.20 |

This can be made evident from the ogives drawn in figure 9 for the distribution of scores of High, Average and Low achievers in science.

Ogive of the High achievers in science lies right to the ogive of the Average achievers in science showing that High achievers in science are superior than Average achievers in science in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DE and difference between Q1 and Q3 are represented by lines AB and GH respectively. From the graph it is very clear that High and Average achievers in science differ significantly throughout first, second and third quartile.

Ogive of the High achievers in science lies right to the ogive of the Low achievers in science showing that High achievers in science are superior than Low achievers in science in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines AC and GI respectively. From the graph it is very clear that High and Low achievers in science differ significantly throughout first, second and third quartile.

Ogive of the Average achievers in science lies right to the ogive of the Low achievers in science showing that Average achievers in science are superior than Low achievers in science in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance EF and difference between Q1 and Q3 are represented by lines BC and HI respectively. From the graph it is very clear that Average and Low achievers in science differ significantly throughout first, second and third quartile.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for High, Average and Low father's education groups**

Distinct norms were established for High Vs Low father's education groups, since it was found that there is significant difference between these two groups in the mean scores on Scientific Attitude scale.

The percentile norms for High Vs Low father's education groups are given.

**Percentile norms of Scientific Attitude for High, Average and Low father's education groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | High | Average | Low |
| P10 | 149.20 | 147.00 | 141.10 |
| P20 | 156.40 | 152.00 | 150.00 |
| p25 | 159.50 | 156.00 | 154.20 |
| p30 | 162.00 | 159.00 | 156.00 |
| p40 | 168.00 | 163.00 | 161.00 |
| p50 | 171.00 | 168.00 | 165.00 |
| p60 | 176.00 | 172.00 | 170.60 |
| p70 | 183.20 | 177.00 | 176.00 |
| p75 | 189.50 | 180.00 | 177.00 |
| p80 | 191.60 | 182.00 | 179.00 |
| p90 | 201.00 | 191.00 | 187.90 |

This can be made evident from the ogives drawn in figure 10 for the distribution of scores of High, Average and Low father's education groups.

Ogive of the High father's education group lies right to the ogive of the Low father's education group showing that High achievers in science are superior than Low achievers in science in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines AC and GI respectively. From the graph it is very clear that High and Low father's education groups differ more significantly at third quartile and some what equal throughout first and second quartile.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for High, Average and Low mother's education groups**

Distinct norms were established for High Vs Average, High Vs Low and Average Vs Low mother's education groups, since it was found that there is significant difference between these groups in the mean scores on Scientific Attitude scale. The percentile norms for High Vs Average, High Vs Low and Average Vs Low mother's education groups are given.

**Percentile norms of Scientific Attitude for High, Average and Low mother's education groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Percentiles | High | Average | Low |
| P10 | 149.80 | 148.00 | 141.00 |
| P20 | 157.20 | 154.00 | 148.00 |
| p25 | 162.00 | 157.00 | 151.00 |
| p30 | 163.20 | 160.00 | 154.00 |
| p40 | 169.20 | 165.00 | 158.00 |
| p50 | 172.00 | 168.00 | 165.00 |
| p60 | 178.00 | 173.00 | 169.00 |
| p70 | 184.00 | 177.00 | 175.00 |
| p75 | 190.00 | 180.00 | 176.50 |
| p80 | 192.00 | 182.00 | 179.00 |
| p90 | 199.40 | 191.00 | 186.00 |

This can be made evident from the ogives drawn in figure 11 for the distribution of scores of High, Average and Low mother's education groups.

Ogive of the High mother's education group lies right to the ogive of the Average mother's education group showing that High mother's education group is superior than Average mother's education group in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DE and difference between Q1 and Q3 are represented by lines AB and GH respectively. From the graph it is very clear that High and Average mother's education groups differ significantly throughout first, second and third quartiles.

Ogive of the High mother's education group lies right to the ogive of the Low mother's education group showing that High mother's education group is superior than Low mother's education group in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance DF and difference between Q1 and Q3 are represented by lines AC and GI respectively. From the graph it is very clear that High and Low mother's education groups differ significantly at first, second and third quartiles.

Ogive of the Average mother's education group lies right to the ogive of the Low mother's education group showing that Average mother's education group is superior than Low mother's education group in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance EF and difference between Q1 and Q3 are represented by lines BC and HI respectively. From the graph it is very clear that Average and Low mother's education groups differ significantly throughout first, second and third quartiles.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**Norms of Scientific Attitude for High and Low family income groups**

Distinct norms were established for High Vs Low students since it was found that there is significant difference between these two groups in the mean scores on Scientific Attitude scale. The percentile norms for High Vs Low family income groups are given.

**Percentile norms of Scientific Attitude for High and Low family income groups**

|  |  |  |
| --- | --- | --- |
| Percentiles | High | Low |
| P10 | 146.30 | 144.00 |
| P20 | 156.00 | 151.00 |
| p25 | 158.00 | 153.00 |
| p30 | 161.00 | 156.00 |
| p40 | 166.00 | 160.00 |
| p50 | 170.00 | 165.00 |
| p60 | 173.00 | 170.00 |
| p70 | 178.00 | 175.80 |
| p75 | 180.00 | 178.00 |
| p80 | 183.00 | 181.00 |
| p90 | 191.00 | 190.60 |

This can be made evident from the ogives drawn in figure 12 for the distribution of High and Low family income groups.

Ogive of the High family income group lies right to the ogive of the Low family income group showing that High family income group is superior than Low family income group in their scientific attitude. Difference between these groups were shown by the distance separating the curves at various levels. The difference between the two medians is given by the distance CD and difference between Q1 and Q3 are represented by lines AB and EF respectively. From the graph it is very clear that High and Low family income groups differ significantly throughout first, second and third quartiles.

Percentiles corresponding to any cumulative percentage can be readily determined from the ogive.

**SUMMARY, CONCLUSIONS AND SUGGESTIONS**

This chapter provides an overview of the significant aspects of the various stages of study. This includes the summary of procedure, major findings, tenability of hypothesis, educational implications and suggestions for further research.

**5.1 RESTATEMENT OF THE PROBLEM**

The study was entitled as SCIENTIFIC ATTITUDE AMONG HIGHER SECONDARY SCHOOL STUDENTS OF KERALA.

**5.2 OBJECTIVES**

The objectives of the present study were the following:

1. To construct a standardised tool to measure the scientific attitude among Higher Secondary School Students.

2. To find out the extent of scientific attitude among Higher Secondary School students in the total sample and subsamples based on:

i. Gender,

ii. Subject of specialisation at Higher Secondary level,

iii. Type of Management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

3. To find out whether there exists significant difference in mean scores of scientific attitude between the relevant subsamples based on

i. Gender,

ii. Subject of specialisation at Higher Secondary level,

iii. Type of Management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

**5.3 HYPOTHESES**

The hypotheses set for the study was, there exists significant difference between the mean score of scientific attitude among Higher secondary school students of the relevant sub samples based on:

i. Gender,

ii. Subject of specialisation at Higher Secondary level,

iii. Type of Management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

**5.4 METHODOLOGY**

**5.4.1 Sample**

The sample is 875 students studying in standard XI of 13 Higher secondary schools in the Wayanad revenue district of Kerala. The sample for the study was selected using stratified sampling technique. The strata considering in sampling are based on Gender, Subject of specialisation at Higher Secondary level and Type of Management of school.

**5.4.2 Tool**

The tool used for the study was scientific attitude scale constructed by the investigator with the help of supervising teacher.

**5.4.3 Statistical techniques used**

The statistical analysis involves:

i. Calculation of mean,

ii. Percentiles and

iii. Test of significance of difference between means for large independent samples.

**5.5 MAJOR FINDINGS**

The extent of scientific attitude among Higher secondary school students in terms of mean score in total sample and subsamples are given in Table 19.

**TABLE 19**

**The extent of scientific attitude   
among Higher secondary school students in terms   
of mean score in total sample and relevant subsamples**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Samples | | Mean score | | |
| Total Sample | | 167.29 | | |
| Subject of specialisation at Higher Secondary Level | | Science  Humanities  Commerce | 169.02  166.21  164.90 | |
| Type of Management of School | | Government  Aided  Unaided | 166.46  170.45  163.59 | |
| Religion of Student | | Christian  Hindu  Muslim | 169.33  166.91  165.55 | |
| Community Category | | General  OBC  SC  ST | 170.53  165.86  169.41  159.69 | |
| Medium of Instruction at secondary level | | English  Malayalam | 171.00  166.89 | |
| Academic Achievement at Secondary level | | High  Average  Low | 175.62  167.23  158.73 | |
| Academic Achievement in Science at Secondary level | | High  Average  Low | 176.81  166.93  158.71 | |
| Level of Education of Father | | High  Average  Low | 171.54  167.69  165.04 | |
| Level of Education of Mother | | High  Average  Low | 173.49  168.31  163.80 | |
| Family Income | | High  Low | 169.01  165.76 | |

**Percentiles**

The percentile norms obtained for scores on scientific Attitude for the total sample and relevant subsamples are given in table.

**TABLE 20**

**Percentile scores obtained on scores of Scientific Attitude among Higher Secondary school students for Total sample and subsamples**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Percentiles | Total | Subject of specialization | | | Type of Management of School | | | Religion | | | Community Category | | | |
| Science | Humanities | Commerce | Govt. | Aided | Unaided | Christian | Hindu | Muslim | General | OBC | SC | ST |
| P10 | 146.00 | 146.00 | 146.00 | 144.00 | 145.10 | 148.00 | 141.70 | 147.00 | 146.00 | 141.00 | 148.00 | 142.00 | 144.10 | 143.70 |
| P20 | 152.00 | 154.00 | 151.00 | 151.00 | 152.00 | 153.00 | 149.60 | 155.00 | 152.00 | 150.20 | 156.00 | 151.00 | 153.00 | 149.40 |
| P25 | 155.00 | 156.00 | 155.00 | 153.00 | 155.00 | 156.00 | 152.75 | 156.00 | 155.00 | 154.00 | 158.00 | 154.00 | 155.00 | 151.00 |
| P30 | 158.00 | 160.00 | 157.00 | 156.00 | 158.00 | 159.00 | 155.10 | 159.00 | 158.00 | 157.00 | 161.00 | 157.00 | 157.40 | 152.00 |
| P40 | 163.00 | 165.00 | 163.00 | 160.00 | 164.00 | 164.00 | 158.80 | 164.00 | 163.00 | 162.00 | 166.00 | 162.00 | 168.80 | 156.00 |
| P50 | 167.00 | 170.00 | 167.00 | 165.00 | 167.00 | 171.00 | 162.00 | 169.00 | 168.00 | 167.00 | 171.00 | 166.00 | 171.00 | 158.00 |
| P60 | 172.00 | 175.00 | 170.00 | 169.00 | 171.00 | 176.00 | 169.40 | 174.00 | 172.00 | 169.60 | 176.00 | 170.00 | 176.20 | 165.20 |
| P70 | 177.00 | 180.00 | 175.00 | 174.00 | 176.00 | 180.00 | 176.00 | 179.00 | 177.00 | 175.00 | 180.00 | 175.00 | 179.80 | 169.00 |
| P75 | 179.00 | 183.00 | 177.00 | 176.00 | 178.00 | 184.50 | 177.25 | 182.00 | 178.50 | 177.00 | 182.50 | 177.00 | 183.00 | 171.25 |
| P80 | 182.00 | 186.00 | 178.00 | 178.00 | 180.80 | 189.00 | 179.00 | 186.20 | 181.40 | 179.80 | 187.00 | 179.00 | 185.60 | 174.00 |
| P90 | 191.00 | 194.00 | 187.00 | 186.00 | 189.00 | 194.00 | 185.50 | 193.10 | 190.00 | 188.00 | 193.00 | 188.00 | 201.00 | 178.30 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Medium of Instruction at Secondary level | | Academic Achievement at Secondary level | | | Achievement in Science at Secondary level | | | Level of Education of Father | | | Level of Education of Mother | | | Family Income | |
| English | Malayalam | High | Average | Low | High | Average | Low | High | Average | Low | High | Average | Low | High | Low |
| 152.00 | 145.00 | 153.00 | 147.00 | 139.00 | 156.00 | 146.00 | 141.00 | 149.20 | 147.00 | 141.10 | 149.80 | 148.00 | 141.00 | 146.30 | 144.00 |
| 157.20 | 152.00 | 161.00 | 155.00 | 144.00 | 162.00 | 153.60 | 146.00 | 156.40 | 152.00 | 150.00 | 157.20 | 154.00 | 148.00 | 156.00 | 151.00 |
| 159.00 | 155.00 | 165.00 | 156.00 | 147.00 | 165.00 | 156.00 | 149.00 | 159.50 | 156.00 | 154.20 | 162.00 | 157.00 | 151.00 | 158.00 | 153.00 |
| 161.00 | 157.30 | 166.50 | 159.00 | 149.00 | 167.00 | 158.40 | 150.00 | 162.00 | 159.00 | 156.00 | 163.20 | 160.00 | 154.00 | 161.00 | 156.00 |
| 164.40 | 163.00 | 172.00 | 164.00 | 152.00 | 172.00 | 163.20 | 153.00 | 168.00 | 163.00 | 161.00 | 169.20 | 165.00 | 158.00 | 166.00 | 160.00 |
| 171.00 | 167.00 | 176.00 | 168.00 | 157.00 | 178.00 | 168.00 | 157.00 | 171.00 | 168.00 | 165.00 | 172.00 | 168.00 | 165.00 | 170.00 | 165.00 |
| 174.00 | 171.00 | 181.00 | 171.00 | 161.20 | 183.00 | 172.00 | 163.80 | 176.00 | 172.00 | 170.60 | 178.00 | 173.00 | 169.00 | 173.00 | 170.00 |
| 179.00 | 177.00 | 187.00 | 176.00 | 167.00 | 189.00 | 176.00 | 167.00 | 183.20 | 177.00 | 176.00 | 184.00 | 177.00 | 175.00 | 178.00 | 175.80 |
| 181.00 | 179.00 | 189.75 | 178.00 | 171.00 | 190.00 | 178.00 | 170.00 | 189.50 | 180.00 | 177.00 | 190.00 | 180.00 | 176.50 | 180.00 | 178.00 |
| 184.00 | 182.00 | 192.00 | 180.00 | 173.60 | 193.00 | 180.00 | 172.00 | 191.60 | 182.00 | 179.00 | 192.00 | 182.00 | 179.00 | 183.00 | 181.00 |
| 195.80 | 190.00 | 199.50 | 188.00 | 180.30 | 199.80 | 188.00 | 179.20 | 201.00 | 191.00 | 187.90 | 199.40 | 191.00 | 186.00 | 191.00 | 190.60 |

IThere exists significant difference between the mean scores of scientific attitude of the following pair of subsamples

i. Science and Commerce students (CR = 2.81, P<0.01)

ii. Aided and Govt. School students (CR = 2.70, P<0.01)

iii.Aided and Unaided School students (CR = 2.63, P<0.01)

iv. Christian and Muslim students (CR = 2.31, P<0.05)

v. General and OBC students (CR = 3.84, P<0.01)

vi.General and ST students (CR = 4.23, P<0.01)

vii.OBC and ST students (CR = 2.25, P<0.05)

viii.SC and ST students (CR = 2.13, P<0.05)

ix. English Medium and Malaylam Medium (CR = 1.99, P<0.05) students

x. High and Average achievers (CR = 4.98, P<0.01)

xi. High and Low achievers (CR = 8.11, P<0.01)

xii. Average and Low achievers (CR = 5.21, P<0.01)

xiii.High and Average achievers in science (CR = 6.01, P<0.01)

xiv. High and Low achievers in science (CR = 8.90, P<0.01)

xv. Average and Low achievers in science (CR = 5.11, P<0.01)

xvi.High and Low father's education groups (CR = 2.47, P<0.05)

xvii.High and Average mother's (CR = 2.08, P<0.05) education groups

xviii.High and Low mother's education (CR = 3.67, P<0.01) groups

xix.Average and Low mother's education (CR = 3.16, P<0.01) groups

xx.High and Low Family Income groups (CR = 2.56, P<0.05)

II There exists no significant difference between the mean scores of scientific attitude of the following pair of subsamples

i. Male and Female students (CR=1.50, P>0.05)

ii. Science and Humanities students (CR=1.84, P> 0.05)

iii. Humanities and Commerce students (CR=0.18, P> 0.05)

iv. Govt and Unaided students (CR=1.19, P> 0.05)

v. Christian and Hindu students (CR=1.62, P> 0.05)

vi. Hindu and Muslim students (CR=0.86, P>0.05)

vii. General and SC students (CR=0.27, P>0.05)

viii. SC and OBC students (CR=1.00, P>0.05)

ix. High and Average father's education (CR=1.57, P>0.05) groups

x. Average and Low father's education (CR=1.80, P>0.05) groups

**5.6 CONCLUSION**

The present study reveals that the objectives of science teaching in developing scientific attitude is satisfied, ie, the students who have successfully completed their Secondary education and those are pursuing in Higher Secondary School have a high Scientific attitude.

Scientific attitude is found to be increasing as academic achievement and science achievement increases. Parental Education in general, especially mother's level of education have a hold on scientific attitude. As father's level of education and mother's level of education increases, level of scientific attitude also increases.

When we compare commerce with humanities and boys with girls, it can be seen that though commerce and girls students have high achievement than humanities and boys groups, the Scientific Attitude score are higher for humanities and boys groups. Though, difference in Scientific Attitude is not significant.

School backgrounds such as Type of management of schools and medium of instruction and social backgrounds such as Religion of student, Community category and Family income influences the level of scientific attitude. But an examination of science achievement of the categories based on above variables given in appendix V shows that the groups which have high scientific attitude has high science achievement as well. So it can be concluded that the difference is related to their science achievement than to the category to which they belong.

The above results also agrees with trends shown by review of related studies. i.e, those who are studying science (Saxena, 1972; Shrivasthava, 1980; Dani, 1984) and those who have high science achievement (Shrivasthava, 1980; Shinde, 1982; Koushik, 1988; Marice, 2004) have high science attitude. The social backgrounds of the students also have an influence on the level of Scientific attitude (Shinde, 1982; Shrivasthava, 1983; Ghosh, 1989; Kumar, 1991; Sinha, 1991; Rao, 1996; Jayasree, 1998; Vidyapati & Rao, 2003; Marice, 2004). No influence of Gender was found on the level of Scientific attitude by Martin, 1972; Shinde, 1982; Dani, 1984; Ghosh, 1989; Rao, 1996; Jayasree, 1998; Rani & Rao, 2000 and Marice, 2004. Hence the result of the present study is confirming the findings by previous researchers in other populations.

**5.7 TENABILITY OF HYPOTHESES**

The tenability of hypotheses can be examined using the above findings. The hypotheses set for the study states that there exists significant difference between the mean score of scientific attitude among Higher secondary school students of the relevant sub samples based on

i. Gender,

ii. Subject of specialisation at Higher Secondary level,

iii. Type of Management of school,

iv. Religion of student,

v. Community category,

vi. Medium of instruction at secondary level,

vii. Academic achievement at secondary level,

viii. Achievement in science at secondary level,

ix. Level of education of father,

x. Level of education of mother and

xi. Family income.

(i) In view of the major finding II(i) Hypothesis (i) is accepted.

(ii) In view of the major findings I(i), II(ii) and II(iii) Hypothesis (ii) is only partially accepted.

(iii) In view of the major findings I(ii), I(iii) and II(iv) Hypothesis (iii) is only partially accepted.

(iv) In view of the major findings I(iv), II(v) and II(vi) Hypothesis (iv) is only partially accepted.

(v) In view of the major findings I(v), I(vi), I(vii), I(viii), II(vii) and II(viii) Hypothesis (v) is only partially accepted.

(vi) In view of the major finding I(ix) Hypothesis (vi) is accepted.

(vii) In view of the major findings I(x), I­(xi) and I(xii) Hypothesis (vii) is accepted.

(viii) In view of the major findings I(xiii), I(xiv) and I(xv) Hypothesis (viii) is accepted.

(ix) In view of the major findings I(xvi), II(ix) and II(x) Hypothesis (ix) is only partially accepted.

(x) In view of the major findings I­(xvii), I(xviii) and I(ix) Hypothesis (x) is accepted.

(xi) In view of the major finding I(xx), Hypothesis (xi) is accepted.

**5.8 EDUCATIONAL IMPLICATIONS**

Science educators have long recognized that scientific attitude is among the most important outcomes which should result from science teaching. Although some educators have considered scientific attitude as a by products or concomitant forms of learning there has been persistent growing tendency to view these attitudes as equal to or superior to the knowledge objective of science instruction. Science teachers are becoming aware that if scientific attitudes are to develop from the study of science, they must be taught for directly and systematically in the same manner as we try to develop a mastery of principles of science.

The findings of the present study reveals that scientific attitude increases as science achievement increases. Another thing to be noted is that Aided school students have more scientific attitude than Government and Unaided students. Perhaps it is due to the better educational facilities compared to the Government schools. The relatively low scientific attitude in the Unaided schools may be due to better experienced and qualified teachers in Aided schools or due to the composition of Aided schools with the high achievers. Hence effort should be made to nurture scientific attitude by providing suitable opportunities to Government and Unaided students also.

Christian students have high scientific attitude and high achievement when compared to other religions. So, teachers should adopt process oriented teaching-learning methods to increase their achievement through which scientific attitude can be improved.

Non-ST students are superior than ST students in their scientific attitude. Hence proper measures should be adopted to avoid misconceptions, superstitions etc. It is necessary that a massive effort is made to spread science education in a formal and non-formal manner among tribal students.

Another finding of the study is, English medium students are superior than Malayalam medium students in their scientific attitude. This may be due to their high achievement in science and high SES of their family. So, special attention should be given to Malayalam medium students to improve their achievement in science because majority of students of Kerala are studying in Malayalam medium.

Students having high Academic achievement in terms of percentage of total mark in S.S.L.C and percentage of mark in science at secondary level are superior than the students having average and low achievement at secondary level, in their Scientific Attitude so, proper care should be taken for improving methodologies of teaching and learning.

Students of parents having high level of education and family income have high Scientific Attitude than the students of parents having Average or low level of education and family income. Hence Teachers should identify the family background of each of his/her student and must give proper attention to them and should take special efforts to the growth of the disadvantaged sections.

**5.9 SUGGESTIONS FOR FURTHER RESEARCH**

The present study enabled the investigator to suggest some areas of research. These are as follows.

1. Studies can be taken up to identify the factors influencing scientific attitude.

2. Studies can be conducted to find out why community differences exists in the development of scientific attitude.

3. Studies can be conducted to find out why school difference exists in the development of scientific attitude.

4. Studies can be conducted to find out the influence of different subjects on development of scientific attitude.

5. Studies can be conducted to know the extent of scientific attitude among students who were not able to complete their secondary education successfully.

6. Comparison of scientific attitude of culturally advantaged and culturally disadvantaged school pupils.

7. Studies may be conducted on the use of audio-visual teaching aids, laboratory and library facilities in the schools as these have greater influence on the development of scientific attitude.

8. Studies may be conducted on individual components of scientific Attitude at various levels of education.

9. Studies can be conducted to compare the extent of scientific attitude of students at various districts, states and countries.

10. Studies may be conducted on the relationship of variables such as scientific attitude, scientific temper, scientific interest, scientific aptitude, attitude towards science and problem solving skill at various levels of education.

11. Influence of teacher-pupil relationship on development of scientific attitude at various levels of education.

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**SCIENTIFIC ATTITUDE SCALE**

**APPENDIX I**

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Please read the following instructions carefully.

This scientific attitude scale contains two parts - Part I and Part II. Part I consists of certain statements. Each statement has five responses . SA, A, N, D and SD. After reading all statements carefully put a cross mark against your response

i) SA - If you strongly agree

ii) A - If you agree

iii) N - If you cannot decide

iv) D - If you disagree

v) SD - If you strongly disagree

Example: "Hell is an imagination ". If you strongly disagree with the statement you should put X as shows below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

If you want to change a response, darken it and put another cross mark X against the new response.

Example: "Hell is an imagination".

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

**\nÀt±-i-§Ä {i²m-]qÀÆw hmbn-¡p-I.**

X¶n-cn-¡p¶ Scientific Attitude Scale þÂ c­v `mK-§-fp-­v. `mKw. 1 Dw `mKw. 2 Dw.

`mKw 1þÂ Nne {]kvXm-h-\-IÄ sImSp-¯n-cn-¡p-¶p. Hmtcm {]kvXm-h-\bv¡pw   
5 {]Xn-I-c-W-§Ä hoXw D­v þ ià-ambn tbmPn-¡p¶p (SA), tbmPn-¡p-¶p (A),   
Xocpam-\n-¡m³ Ign-bp-¶nÃ (N), hntbm-Pn-¡p¶p (D), ià-ambn hntbm-Pn-¡p¶p (SD). Hmtcm {]kvXm-h-\bpw {i²m-]qÀÆw hmbn-¨-tijw \n§-fpsS {]Xn-I-c-W-¯n-\p-t\sc t{Imkv   
AS-bmfw X tcJ-s¸-Sp-¯pI

DZm-l-c-Ww: ""\cIw Hcp k¦-ev]-amWv''.

Cu {]kvXm-h-\-tbmSv \n§Ä ià-ambn hntbmPn-bv¡p-¶p-sh-¦nÂ \n§-fpsS   
{]Xn-I-c-W-¯n-\p-t\sc Xmsg ImWn-¨n-cn-bv¡p¶ {]Imcw X AS-bmfw tcJ-s¸-Sp-¯p-I.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

{]Xn-I-cWw amä-W-sa¶v \n§Ä¡v tXm¶n-bmÂ BZy-s¯ {]Xn-I-cWw Idp-¸n-¡p-Ibpw ]pXnb {]Xn-I-c-W-¯n\p t\sc X AS-bmfw tcJ-s¸-Sp-¯p-Ibpw sN¿p-I.

DZm-l-c-Ww: ""\cIw Hcp k¦-ev]-amWv''

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

1. Keeping scare crow do not avoid damage that may occur to buildings

sI«n-S-§Ä¡v tISp-]-äm-Xn-cn-¡m³ t\m¡p-Ip-¯n-IÄsh-bv¡p-¶Xv {]tbm-P-\-I-c-aÃ.

2. Tourist centres should be established inside the dense forests to earn foreign currency

hntZ-i-\mWyw t\Sp-¶-Xn-\p-th­n DÄh-\-§-fnÂ Sqdnkväv tI{µ-§Ä   
Øm]n-bvt¡-­-Xm-Wv.

3. You see one of your best friends stealing money from another student's bag. It is to be reported to the class teacher.

\n§-fpsS Gähpw ASp¯ kqlr¯v ¢mÊnse asämcp Ip«n-bpsS \_mKnÂ\n¶v ]Ww tamjvSn-¡p-¶Xv \n§Ä ImWm-\n-S-bm-Ip-¶p. A§-s\-bm-sW-¦nÂ Cu kw`hw   
\n§-fpsS A[ym-]-I-t\mSv ]d-tb-­-Xm-Wv.

4. Filling a cross word in science is an enjoyable hobby.

imkv{X-]-Z-{]iv\w ]qcn-¸n-¡p-¶Xv Bkzm-Zy-I-c-amb Hcp hnt\m-Z-am-Wv.

5. Organ transplantation should be prohibitted

Ah-bh-amäw \ntcm-[n-¡-Ww.

6. ' Kathakali' is the best art form

"IY-I-fn'sb shÃm³ asämcp Iem-cq-]-an-Ã.

7. "After the tsunami disaster in 2004, people in some area, decided to stop the use of sea food temporarily ".This decision is reasonable

"2004 þse kp\m-an-sb-¯p-SÀ¶v ISÂ aÕy-¯nsâ D]-tbmKw XXvImew th­ F¶p Nne {]tZ-i-§-fnse P\-§Ä Xocp-am-\n-¨p.'' Cu Xocp-am\w bpàn-k-l-am-Wv.

8. It is enjoyable to complete the observation of life cycle of organisms

Pohn-I-fpsS Poh-N{I \nco-£Ww IrXy-ambn ]qÀ¯oI-cn¡pI F¶Xv ck-I-c-amb A\p-`-h-am-Wv.

9. In this universe, life exists only on earth

{]]-©-¯nÂ `qan-bnÂ am{Xta Poh-\p-Åq.

10. Guests will come if crow crows

Im¡-hn-cp-¶p-hn-fn-¨mÂ hncp-¶p-ImÀ h¶n-cn-bv¡pw.

11. Tribal areas are to be urbanised to improve standard of life of tribes.

BZn-hm-kn-I-fpsS Pohn-X-\n-e-hmcw sa¨-s¸-Sp-¯m³ A¯cw {]tZ-i-§Ä   
\K-c-h-ev¡-cn-t¡-­-Xm-Wv.

12. There is nothing wrong in copying for passing examinations.

]co£ Pbn-¡m³th­n tIm¸n-b-Sn-¡p-¶-XnÂ sXän-Ã.

13. All questions can be solved by adopting scientific method.

imkv{Xob coXn Ah-ew-\_n¨v F´n\pw D¯cw Is­-¯mw.

14. It is interesting to repeat experiments in science till you get a satisfying answer.

Xr]vXn-I-c-amb D¯cw In«p-¶-Xp-hsc imkv{X ]co-£-W-§Ä BhÀ¯n¨v   
sNbvXp-t\m-¡p-¶Xv \n§Ä¡v Hcp lc-am-Wv.

15. Kitchen work should done by men as well

ASp-¡-f-tPmen ]pcp-j-·mcpw sNt¿-­-Xm-Wv.

16. Religious heads should not be questioned because they are protectors of our religion.

aXm-[n-Im-cn-IÄ \½psS aX¯nsâ kwc-£-IÀ Bb-Xn\mÂ Ahsc   
tNmZyw- sN-t¿-­-Xn-Ã.

17. At times lying can be accepted to establish that science is true

imkv{Xw icn-bm-sW¶v Øm]n-¡m³ Nne-t¸m-sgms¡ IÅhpw ]dbmw

18. It is boring to ponder on the Mysteries behind natural phenomena.

{]Ir-Xn-{]-Xn-`m-k-§-fpsS ]n¶nse cl-ky-§-f-dn-bm³ {ian-¡p-¶Xv apjn-¸-³   
A\p-`-h-am-Wv.

19. There exists no planets in the solar system which is not discovered by man.

kuc-bqY¯nÂ a\p-jy³ Is­-¯n-bn-«n-Ãm¯ {Kl-§Ä H¶pw Xs¶-bn-Ã.

20. Predicting future by making parrots pick cards is meaningless.

Xs¯-b-s¡m­v io«v FSp-¸n¨v `mhn-{]-h-N\w \S¯n AXnÂ hniz-kn-¡p-¶-XnÂ   
Ig-¼n-Ã.

21. Mental diseases can be cured through black magic also.

am\-kn-I-tcm-K-§Ä amdm³ a{´-hm-Zhpw Bh-iy-am-Wv.

22. For sustainable agriculture, chemical fertilizers are unavoidable.

kpØn-c-amb Irjn¡v cmk-h-kvXp-¡Ä A\p-t]-£-Wo-b-am-Wv.

23. You get 35 marks out of 100 in one subject. But when you counted the marks in your answer paper, you had only 34 marks. It is not necessary to report to the teacher because getting 34 will make you fail.

\n§Ä¡v Hcp hnj-b-¯nsâ D¯-c-¡-S-emkv In«nb-t¸mÄ 100Â 35 amÀ¡v F¶mÂ Hmtcm D¯-c-¯n-sâbpw amÀ¡v \n§Ä Iq«n-t\m-¡n-b-t¸mÄ 34 amÀt¡-bp-Åq. 35Â Ip-dªmÂ tXmev¡p-sa-¶-Xn-\mÂ A[ym-]-I-t\mSv ]d-tb-­-Xn-Ã.

24. It is impossible to invent a new device more efficient than the computer.

I¼yq-«-dn-t\-¡mÄ Imcy-£-a-amb asämcp D]-I-cWw \nÀ½n-¡pI Akm-[y-am-Wv.

25. It is useless to seek answers for questions that cannot be answered easily.

DS-\Sn D¯cw In«m¯ tNmZy-§Ä¡p ]n¶mse At\z-jn-¨p-t]m-Ip-¶Xv   
\ncÀ°-I-am-Wv.

26. AIDS affected children should be admitted to schools.

AIDS tcmK-\_m-[n-X-cmb Ip«n-IÄ¡v kv¡qfnÂ {]th-i\w \evI-Ww.

27. There is no need for further evidence on matters we feel to be true.

icn-sb¶v \ap-¡p-tXm-¶p¶ Imcy-§Ä¡v asämcp sXfn-hnsâ Bh-iy-anÃ

28. "You happen to see an advertisement of a medicine in the TV which claims that it can boost intelligence". You will try to verify claims before buying it.

""\_p²n-iàn hÀ²nbv¡pw F¶hIm-i-s¸-Sp¶ Hcp acp-¶nsâ ]c-kyw \n§Ä   
T.V. bnÂ ImWm-\n-S-bm-Ip-¶p.'' AXnsâ hnizm-ky-X-sb-¸än At\z-jn¨tijta   
B acp¶v hm§m³ \n§Ä {ian-bv¡p-I-bp-Åq.

29. One day you happen to hear a strange sound of a bird. You will try to know more about it.

Hcp ]£n-bpsS hnNn-{X-amb i\_vZw \n§Ä tIÄ¡m-\n-S-bm-Ip-¶p. B ]£nsb I­p-]n-Sn-bv¡m\pw IqSp-X-e-dn-bm\pw \n§Ä {ian-bv¡pw.

30. Astrology is a superstition

tPymXnjw AÔ-hn-izm-k-am-Wv.

31. Plastic is inevitable in the present world.

C¶s¯ temI¯v ¹mÌnIv A\p-t]-£-Wo-b-am-Wv.

32. You got a pen from the school playground. You showed it to many students. But it was not theirs. In this situation you will hand over it to the teacher.

kv¡qfnsâ Ifn-Ø-e-¯p-In-S¶v Hcp t]\ \n§Ä¡v In«p-¶p. ]e-tcmSpw   
tNmZn-¨p-sh-¦nepw AXv Ah-cp-tS-sXm-¶p-a-Ã. C¯-c-sam-c-h-Ø-bnÂ AXv \n§Ä ssIh-i-am-¡msX A[ym-]-Is\ Gev]n-¡pw.

33. Gandhian life style is not suitable for the new age.

KmÔn-b³ Pohn-X-coXn ]pXnbbpK-¯n\v A\p-tbm-Py-a-Ã.

34. There are no limits to human abilities.

a\p-jysâ Ign-hp-IÄ¡v ]cn-anXn-I-fn-Ã.

35. Sex education is to be experimented in school level.

ssewKnI hnZym-`ymkw kv¡qÄ Xe-¯nÂ ]co-£n-bv¡--s¸-tS-­-Xm-Wv.

36. Though you have many friends studying other subjects, you will show more intimacy to those study same subject as yours.

aäv hnj-b-§Ä ]Tn-bv¡p¶ kplr-¯p-¡Ä \n§Ä¡p-s­-¦nepw \n§-fpsS   
AtX hnjbw ]Tn-bv¡p¶ Hcm-tfmSv \n§Ä IqSp-XÂ kulrZw ImWn-bv¡pw.

37. It is curious to observe the stars.

\£-{X-\n-co-£Ww IuXp-I-c-am-Wv.

38. A report about extra terrestrial lives spreads in your locality. You will try to seek evidence about it.

\n§-fpsS \m«nÂ A\y{K-l-Po-hn-I-sf-¡p-dn-¨pÅ hmÀ¯ ]c-¡p-¶p.   
A§-s\-bm-sW-¦nÂ \n§Ä C¡m-cy-¯nsâ kXym-hØ Adn-bm³ {ian-bv¡p-w.

39. Success depends upon luck

hnPbw `mKys¯ B{i-bn-¨n-cn-bv¡p¶p.

40. Water scarcity in drought striken areas can be overcome by extensive digging of borewells.

hcÄ¨ A\p-`-h-s¸-Sp¶ Øe-§-fnÂ IpgÂ¡n-W-dp-IÄ hym]-I-ambn   
Ipgn¡p-¶-Xn-eqsS Pe-£maw ]cn-l-cn-bv¡m-hp-¶-Xm-Wv.

41. Your teacher decided to conduct a class test. You didn't go to school on that day because you were not prepared. So when you go to school on the next day, you will say to the teacher that you were on leave because you didn't study.

\n§-fpsS A[ym-]-I³ Hcp ¢mkv sSÌv \S-¯m³ Xocp-am-\n-bv¡p-¶p. ]Tn--¨nÃ F¶ Imc-W-¯mÂ At¶-Zn-hkw \n§Ä ¢mÊnÂ t]mIp-¶n-Ã. A§-s\-bm-sW-¦nÂ  
]ntä-Zn-hkw \n§Ä ¢mÊnÂ sNÃp-t¼mÄ "]Tn-bv¡m-¯-Xp-sIm-­mWv Xte-Zn-hkw hcm-Xn-cp-¶Xv' F¶v A[ym-]-I-t\mSv ]d-bpw.

42. Scientific truths are provisional

imkv{Xob kXy-§-fnÂ amäw hcm-hp-¶-Xm-Wv.

43. Marriage functions must be made simple.

hnhm-lm-tLm-j-§Ä eLq-I-cn-bvt¡-­-XmWv

44. Objective sensory experiences are true.

hkvXp-\n-jvT-amb C{µn-bm-\p-`-h-§Ä kXy-am-Wv.

45. You find a question in the question paper which is out of syllabus. Later you will try to find its answer.

"kne-\_-kn-en-Ãm¯ Hcp tNmZyw \n§-fpsS tNmZy-t]-¸-dnÂ ImWp-¶p.' ]n¶oSv \n§Ä AXnsâ D¯cw Is­-¯m³ {ian-bv¡pw.

46. To believe in omen, though unscientific, proves to be true.

iIp-\-§-fnÂ hniz-kn-bv¡p-¶Xv Aim-kv{Xo-b-am-sW-¦nepw kXy-am-sW¶v   
sXfn-ªn-«p-­v.

47. Indiscriminate nuclear testings should be discouraged.

hnth-N-\-c-ln-X-amb AWp-]-co-£-W-§Ä t{]mÕm-ln-¸n-bv¡-cp-Xv.

48. There is nothing wrong in copying in examinations if the supervisor is not strict.

kq¸ÀsshkÀ A{i-²-Im-Wn-¨mÂ tIm¸nb-Sn-bv¡p-¶-XnÂ sXän-Ã.

49. Life style of ancient man was in tune with the nature.

{]mIrX a\p-jysâ kwkvImcw {]I-rXnbv¡v A\p-tbm-Py-am-Wv.

50. Mobile phones should be prohibitted suddenly due to the health hazards behind it.

Btcm-Ky-]-c-amb Imc-W-§-fmÂ samss\_Â t^mWp-IÄ DS-\Sn   
\ntcm-[n-bvt¡-­-Xm-Wv.

51. Participation in the festivals and ceremonies of other religions should be encouraged.

aäv aX-§-fpsS BNm-c-§-fnepw BtLm-j-§-fnepw ]s¦-Sp-¡pI F¶Xv   
t{]mÕm-ln-¸n-¡-s¸-tS-­-Xm-Wv.

52. "You happen to hear about the 'disappearance' of a well in your locality". You will visit that place to know about it.

""\n§-fpsS hoSn-\-Sp-¯pÅ Hcp {]tZ-i¯v InWÀ "A{]-Xy-£-ambn' F¶v   
tIÄ¡m-\n-S-bm-Ip-¶p.'' CtX-¡p-dn-¨-dn-bm³ \n§Ä B Øew kµÀin-bv¡pw.

53. Death news will be heard if dogs howl at night.

\mb Hmcn-bn-«mÂ ac-W-hmÀ¯ tIÄ¡p-sa¶v ]d-bp-¶Xv icn-bm-Wv.

54. It is better to put on cotton than silk.

knÂ¡p hkv{X-§Ä [cn-bv¡p-¶-Xn-t\-¡mÄ \ÃXv tIm«¬ hkv{X-§Ä   
[cn-bv¡p-¶-Xm-Wv.

55. Science is the panacea for all problems.

imkv{Xw FÃm {]iv\-§Ä¡pw adp acp-¶m-Wv.

56. You see a water tap being open in the public road. Then you will close it.

s]mXp hgn-bnÂ ss]¸v Xpd¶v shÅw ]mgmbn t]mIp-¶Xv \n§Ä ImWp-¶p.   
A§-s\-sb-¦nÂ \n§-fXv ]q«pw.

57. Two of your best friends quarrel in the class. You will not stay even in the side of the friend who is correct because indulging in it may adversely affect you.

¢mÊnÂ \n§-fpsS c­v ASp¯ kqlr-¯p-¡Ä X½nÂ hg¡p IqSp-¶p. CXnse   
CS-s]-SÂ \n§sf {]Xn-Iq-e-ambn \_m[n-¡p-sa-¶-Xn-\mÂ icn-bpÅ kplr-¯nsâ `mK¯pw \n§Ä \nev¡n-Ã.

**Part II**

This part consists of certain statements. Read it carefully and put a cross mark against the letter which one you select.

Cu `mK¯v Nne {]kvXm-h-\-IÄ sImSp-¯n-cn-¡p-¶p. Ah {i²m]qÀÆw hmbn¨tijw \n§Ä Xnc-sª-Sp-¡p¶ A£-c-¯n-\p-t\sc X ASbmfw   
tcJ-s¸-Sp-¯p-I.

58. To study the concept of 'Photosynthesis' which one of the following will you select.

{]Imi kwtÇ-jWw F¶ Bibw ]Tn-bv¡m³ Xmsg¸-dªncnbv¡p-¶-h-bnÂ \n§Ä kzoI-cn-¡p-¶Xv GXv?

A. The process by which plants prepare food using water and carbon dioxide.

(F) Pehpw ImÀ\_¬ssU-Hm-IvsskUpw D]tbm-Kn¨v kky-§Ä Blmcw   
\nÀ½n-¡p¶ {]{Inb

B. The process by which plants prepare carbohydrates and oxygen using carbon dioxide, water and sunlight in the presence of chlorophyll.

(\_n) ImÀ\_¬ssU HmIvsskUpw Pehpw D]-tbm-Kn¨v kqcy-{]-Im-i-¯n-sâbpw lcn-X-I-¯n-sâbpw km¶n-[y-¯nÂ kky-§Ä [m\y-Ihpw HmIvkn-P\pw \nÀ½n-¡p¶ {]{Inb

C. It is the process by which plants prepare carbohydrates and oxygen by absorbing carbon dioxide from the atmosphere, water and minerals from the soil in the presence of sunlight and chlorophyll present in leaves.

(kn) A´-co-£-¯nÂ \n¶pw ImÀ\_¬ ssUHm-IvsskUpw a®nÂ\n¶v Pehpw [mXp-e-h-W-§fpw kzoI-cn¨v kqcy-{]Imi¯nâbpw Ce-bn-e-S-§n-bn-cn-¡p¶ lcn-X-I-¯n-sâbpw km¶n-[y-¯nÂ kky-§Ä [m\yIhpw HmIvkn-P\pw   
\nÀ½n-¡p¶ {]{Inb

light energy

D. Water + Carbon dioxide carbohydrate + oxygen

chlorophyll

{]Im-timÀÖw

(Un) Pew + ImÀ\_¬ssUHm-IvsskUv [m\yIw+HmIvkn-P³

lcn-XIw

Light energy

E) 6H2O + 6CO2 C6H12O6 + 6O2

chlorophyll

{]Im-timÀÖw

(C) 6H2O + 6CO2  C6H12O6 + 6O2

lcn-XIw

59. Suppose, your family member is bitten by a dog you would;

\n§-fpsS Hcp IpSpw-\_mw-Ks¯ ]«n ISn-bv¡p-¶p-sh¶v Icp-Xp-I. F¦nÂ \n§Ä

A) Wash the wound with water and take the person to the hospital

(F) apdnhv shÅw D]-tbm-Kn¨v Igp-Ip-Ibpw Abmsf Bip-]-{Xn-bnÂ   
{]th-in-¸n-bv¡p-Ibpw sN¿pw.

B) Not take any actions

(\_n) H¶pw sN¿p-I-bn-Ã.

C) Wash the wound with water and then with antiseptic lotion and apply bandage and take the person to the hospital.

(kn) apdnhv BZyw shÅw D]-tbm-Kn¨pw ]n¶oSv AWp-\m-in\n D]tbm-Kn¨pw   
Igp-Inb tijw h¨p-sI«pIbpw Bip-]-{Xn-bnÂ {]th-in-¸n-¡p-Ibpw sN¿pw.

D) Wash the wound with water and apply bandage and take the person to the hospital.

(Un) apdnhv shÅw D]-tbm-Kn¨v Igp-In-b-tijw h¨p-sI-«pIbpw Abmsf   
Bip-]-{Xn-bnÂ {]th-in-¸n-¡p-Ibpw sN¿pw.

E) Console the bitten person, wash the wound with plenty of water and then with antiseptic lotion, apply bandage, watch the dog for 10 days. If it dies take the patient to the hospital for antirabies injection

(C) Abmsf Biz-kn-¸n-¡p-Ibpw apdnhv BZyw [mcmfw shÅw D]-tbm-Kn¨pw ]n¶oSv AWp-\m-in\n sIm­pw Igp-In-b-tijw h¨p-sI-«p-Ibpw ISn¨ ]«nsb ]¯p Znhkw \nco-£n-¡p-Ibpw ]«n Nmhp-I-bm-sW-¦nÂ tcmKnsb   
t]]«n hnj\_m-[-bvs¡-Xn-cmb Ip¯n-h-bv]n-\mbn Bip-]-{Xn-bnÂ   
sIm­p-t]m-hp-Ibpw sN¿pw.

60. Which one of the following will you select to study the structure of stomata.

-Xmsg ]d-ªn-cn-¡p-¶-h-bnÂ Bky-c-{Ô-¯nsâ LS\ ]Tnbv-¡m³ \n§Ä   
sXc-sª-Sp-¡p-¶Xv GXv?

**SCIENTIFIC ATTITUDE SCALE**

**APPENDIX II**

**Dr. K. Abdul Gafoor Ryni. K.K.**

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Please read the following instructions carefully.

This scientific attitude scale contains two parts - Part I and Part II. Part I consists of certain statements. Each statement has five responses . SA, A, N, D and SD. After reading all statements carefully put a cross mark against your response

i) SA - If you strongly agree

ii) A - If you agree

iii) N - If you cannot decide

iv) D - If you disagree

v) SD - If you strongly disagree

Example: "Hell is an imagination ". If you strongly disagree with the statement you should put X as shows below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

If you want to change a response, darken it and put another cross mark X against the new response.

Example: "Hell is an imagination".

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

**\nÀt±-i-§Ä {i²m-]qÀÆw hmbn-¡p-I.**

X¶n-cn-¡p¶ Scientific Attitude Scale þÂ c­v `mK-§-fp-­v. `mKw. 1 Dw `mKw. 2 Dw.

`mKw 1þÂ Nne {]kvXm-h-\-IÄ sImSp-¯n-cn-¡p-¶p. Hmtcm {]kvXm-h-\bv¡pw   
5 {]Xn-I-c-W-§Ä hoXw D­v þ ià-ambn tbmPn-¡p¶p (SA), tbmPn-¡p-¶p (A),   
Xocpam-\n-¡m³ Ign-bp-¶nÃ (N), hntbm-Pn-¡p¶p (D), ià-ambn hntbm-Pn-¡p¶p (SD). Hmtcm {]kvXm-h-\bpw {i²m-]qÀÆw hmbn-¨-tijw \n§-fpsS {]Xn-I-c-W-¯n-\p-t\sc t{Imkv   
AS-bmfw X tcJ-s¸-Sp-¯pI

DZm-l-c-Ww: ""\cIw Hcp k¦-ev]-amWv''.

Cu {]kvXm-h-\-tbmSv \n§Ä ià-ambn hntbmPn-bv¡p-¶p-sh-¦nÂ \n§-fpsS   
{]Xn-I-c-W-¯n-\p-t\sc Xmsg ImWn-¨n-cn-bv¡p¶ {]Imcw X AS-bmfw tcJ-s¸-Sp-¯p-I.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

{]Xn-I-cWw amä-W-sa¶v \n§Ä¡v tXm¶n-bmÂ BZy-s¯ {]Xn-I-cWw Idp-¸n-¡p-Ibpw ]pXnb {]Xn-I-c-W-¯n\p t\sc X AS-bmfw tcJ-s¸-Sp-¯p-Ibpw sN¿p-I.

DZm-l-c-Ww: ""\cIw Hcp k¦-ev]-amWv''

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SA | A | N | D | SD |

1. Keeping scare crow do not avoid damage that may occur to buildings

sI«n-S-§Ä¡v tISp-]-äm-Xn-cn-¡m³ t\m¡p-Ip-¯n-IÄsh-bv¡p-¶Xv {]tbm-P-\-I-c-aÃ.

2. Tourist centres should be established inside the dense forests to earn foreign currency

hntZ-i-\mWyw t\Sp-¶-Xn-\p-th­n DÄh-\-§-fnÂ Sqdnkväv tI{µ-§Ä   
Øm]n-bvt¡-­-Xm-Wv.

3. Filling a cross word in science is an enjoyable hobby.

imkv{X-]-Z-{]iv\w ]qcn-¸n-¡p-¶Xv Bkzm-Zy-I-c-amb Hcp hnt\m-Z-am-Wv.

4. Organ transplantation should be prohibitted

Ah-bh-amäw \ntcm-[n-¡-Ww.

5. ' Kathakali' is the best art form

"IY-I-fn'sb shÃm³ asämcp Iem-cq-]-an-Ã.

6. "After the tsunami disaster in 2004, people in some area, decided to stop the use of sea food temporarily ".This decision is reasonable

"2004 þse kp\m-an-sb-¯p-SÀ¶v ISÂ aÕy-¯nsâ D]-tbmKw XXvImew th­ F¶p Nne {]tZ-i-§-fnse P\-§Ä Xocp-am-\n-¨p.'' Cu Xocp-am\w bpàn-k-l-am-Wv.

7. It is enjoyable to complete the observation of life cycle of organisms

Pohn-I-fpsS Poh-N{I \nco-£Ww IrXy-ambn ]qÀ¯oI-cn¡pI F¶Xv ck-I-c-amb A\p-`-h-am-Wv.

8. Guests will come if crow crows

Im¡-hn-cp-¶p-hn-fn-¨mÂ hncp-¶p-ImÀ h¶n-cn-bv¡pw.

9. Tribal areas are to be urbanised to improve standard of life of tribes.

BZn-hm-kn-I-fpsS Pohn-X-\n-e-hmcw sa¨-s¸-Sp-¯m³ A¯cw {]tZ-i-§Ä   
\K-c-h-ev¡-cn-t¡-­-Xm-Wv.

10. There is nothing wrong in copying for passing examinations.

]co£ Pbn-¡m³th­n tIm¸n-b-Sn-¡p-¶-XnÂ sXän-Ã.

11. All questions can be solved by adopting scientific method.

imkv{Xob coXn Ah-ew-\_n¨v F´n\pw D¯cw Is­-¯mw.

12. Religious heads should not be questioned because they are protectors of our religion.

aXm-[n-Im-cn-IÄ \½psS aX¯nsâ kwc-£-IÀ Bb-Xn\mÂ Ahsc   
tNmZyw- sN-t¿-­-Xn-Ã.

13. At times lying can be accepted to establish that science is true

imkv{Xw icn-bm-sW¶v Øm]n-¡m³ Nne-t¸m-sgms¡ IÅhpw ]dbmw

14. It is boring to ponder on the Mysteries behind natural phenomena.

{]Ir-Xn-{]-Xn-`m-k-§-fpsS ]n¶nse cl-ky-§-f-dn-bm³ {ian-¡p-¶Xv apjn-¸-³   
A\p-`-h-am-Wv.

15. There exists no planets in the solar system which is not discovered by man.

kuc-bqY¯nÂ a\p-jy³ Is­-¯n-bn-«n-Ãm¯ {Kl-§Ä H¶pw Xs¶-bn-Ã.

16. Predicting future by making parrots pick cards is meaningless.

Xs¯-b-s¡m­v io«v FSp-¸n¨v `mhn-{]-h-N\w \S¯n AXnÂ hniz-kn-¡p-¶-XnÂ   
Ig-¼n-Ã.

17. Mental diseases can be cured through black magic also.

am\-kn-I-tcm-K-§Ä amdm³ a{´-hm-Zhpw Bh-iy-am-Wv.

18. You get 35 marks out of 100 in one subject. But when you counted the marks in your answer paper, you had only 34 marks. It is not necessary to report to the teacher because getting 34 will make you fail.

\n§Ä¡v Hcp hnj-b-¯nsâ D¯-c-¡-S-emkv In«nb-t¸mÄ 100Â 35 amÀ¡v F¶mÂ Hmtcm D¯-c-¯n-sâbpw amÀ¡v \n§Ä Iq«n-t\m-¡n-b-t¸mÄ 34 amÀt¡-bp-Åq. 35Â Ip-dªmÂ tXmev¡p-sa-¶-Xn-\mÂ A[ym-]-I-t\mSv ]d-tb-­-Xn-Ã.

19. It is impossible to invent a new device more efficient than the computer.

I¼yq-«-dn-t\-¡mÄ Imcy-£-a-amb asämcp D]-I-cWw \nÀ½n-¡pI Akm-[y-am-Wv.

20. It is useless to seek answers for questions that cannot be answered easily.

DS-\Sn D¯cw In«m¯ tNmZy-§Ä¡p ]n¶mse At\z-jn-¨p-t]m-Ip-¶Xv   
\ncÀ°-I-am-Wv.

21. AIDS affected children should be admitted to schools.

AIDS tcmK-\_m-[n-X-cmb Ip«n-IÄ¡v kv¡qfnÂ {]th-i\w \evI-Ww.

22. There is no need for further evidence on matters we feel to be true.

icn-sb¶v \ap-¡p-tXm-¶p¶ Imcy-§Ä¡v asämcp sXfn-hnsâ Bh-iy-anÃ

23. "You happen to see an advertisement of a medicine in the TV which claims that it can boost intelligence". You will try to verify claims before buying it.

""\_p²n-iàn hÀ²nbv¡pw F¶hIm-i-s¸-Sp¶ Hcp acp-¶nsâ ]c-kyw \n§Ä   
T.V. bnÂ ImWm-\n-S-bm-Ip-¶p.'' AXnsâ hnizm-ky-X-sb-¸än At\z-jn¨tijta   
B acp¶v hm§m³ \n§Ä {ian-bv¡p-I-bp-Åq.

24. You got a pen from the school playground. You showed it to many students. But it was not theirs. In this situation you will hand over it to the teacher.

kv¡qfnsâ Ifn-Ø-e-¯p-In-S¶v Hcp t]\ \n§Ä¡v In«p-¶p. ]e-tcmSpw   
tNmZn-¨p-sh-¦nepw AXv Ah-cp-tS-sXm-¶p-a-Ã. C¯-c-sam-c-h-Ø-bnÂ AXv \n§Ä ssIh-i-am-¡msX A[ym-]-Is\ Gev]n-¡pw.

25. Gandhian life style is not suitable for the new age.

KmÔn-b³ Pohn-X-coXn ]pXnbbpK-¯n\v A\p-tbm-Py-a-Ã.

26. There are no limits to human abilities.

a\p-jysâ Ign-hp-IÄ¡v ]cn-anXn-I-fn-Ã.

27. Though you have many friends studying other subjects, you will show more intimacy to those study same subject as yours.

aäv hnj-b-§Ä ]Tn-bv¡p¶ kplr-¯p-¡Ä \n§Ä¡p-s­-¦nepw \n§-fpsS   
AtX hnjbw ]Tn-bv¡p¶ Hcm-tfmSv \n§Ä IqSp-XÂ kulrZw ImWn-bv¡pw.

28. It is curious to observe the stars.

\£-{X-\n-co-£Ww IuXp-I-c-am-Wv.

29. A report about extra terrestrial lives spreads in your locality. You will try to seek evidence about it.

\n§-fpsS \m«nÂ A\y{K-l-Po-hn-I-sf-¡p-dn-¨pÅ hmÀ¯ ]c-¡p-¶p.   
A§-s\-bm-sW-¦nÂ \n§Ä C¡m-cy-¯nsâ kXym-hØ Adn-bm³ {ian-bv¡p-w.

30. Success depends upon luck

hnPbw `mKys¯ B{i-bn-¨n-cn-bv¡p¶p.

31. Water scarcity in drought striken areas can be overcome by extensive digging of borewells.

hcÄ¨ A\p-`-h-s¸-Sp¶ Øe-§-fnÂ IpgÂ¡n-W-dp-IÄ hym]-I-ambn   
Ipgn¡p-¶-Xn-eqsS Pe-£maw ]cn-l-cn-bv¡m-hp-¶-Xm-Wv.

32. Your teacher decided to conduct a class test. You didn't go to school on that day because you were not prepared. So when you go to school on the next day, you will say to the teacher that you were on leave because you didn't study.

\n§-fpsS A[ym-]-I³ Hcp ¢mkv sSÌv \S-¯m³ Xocp-am-\n-bv¡p-¶p. ]Tn--¨nÃ F¶ Imc-W-¯mÂ At¶-Zn-hkw \n§Ä ¢mÊnÂ t]mIp-¶n-Ã. A§-s\-bm-sW-¦nÂ  
]ntä-Zn-hkw \n§Ä ¢mÊnÂ sNÃp-t¼mÄ "]Tn-bv¡m-¯-Xp-sIm-­mWv Xte-Zn-hkw hcm-Xn-cp-¶Xv' F¶v A[ym-]-I-t\mSv ]d-bpw.

33. Scientific truths are provisional

imkv{Xob kXy-§-fnÂ amäw hcm-hp-¶-Xm-Wv.

34. Marriage functions must be made simple.

hnhm-lm-tLm-j-§Ä eLq-I-cn-bvt¡-­-XmWv

35. Objective sensory experiences are true.

hkvXp-\n-jvT-amb C{µn-bm-\p-`-h-§Ä kXy-am-Wv.

36. You find a question in the question paper which is out of syllabus. Later you will try to find its answer.

"kne-\_-kn-en-Ãm¯ Hcp tNmZyw \n§-fpsS tNmZy-t]-¸-dnÂ ImWp-¶p.' ]n¶oSv \n§Ä AXnsâ D¯cw Is­-¯m³ {ian-bv¡pw.

37. To believe in omen, though unscientific, proves to be true.

iIp-\-§-fnÂ hniz-kn-bv¡p-¶Xv Aim-kv{Xo-b-am-sW-¦nepw kXy-am-sW¶v   
sXfn-ªn-«p-­v.

38. Indiscriminate nuclear testings should be discouraged.

hnth-N-\-c-ln-X-amb AWp-]-co-£-W-§Ä t{]mÕm-ln-¸n-bv¡-cp-Xv.

39. There is nothing wrong in copying in examinations if the supervisor is not strict.

kq¸ÀsshkÀ A{i-²-Im-Wn-¨mÂ tIm¸nb-Sn-bv¡p-¶-XnÂ sXän-Ã.

40. Life style of ancient man was in tune with the nature.

{]mIrX a\p-jysâ kwkvImcw {]I-rXnbv¡v A\p-tbm-Py-am-Wv.

41. Mobile phones should be prohibitted suddenly due to the health hazards behind it.

Btcm-Ky-]-c-amb Imc-W-§-fmÂ samss\_Â t^mWp-IÄ DS-\Sn   
\ntcm-[n-bvt¡-­-Xm-Wv.

42. Participation in the festivals and ceremonies of other religions should be encouraged.

aäv aX-§-fpsS BNm-c-§-fnepw BtLm-j-§-fnepw ]s¦-Sp-¡pI F¶Xv   
t{]mÕm-ln-¸n-¡-s¸-tS-­-Xm-Wv.

43. "You happen to hear about the 'disappearance' of a well in your locality". You will visit that place to know about it.

""\n§-fpsS hoSn-\-Sp-¯pÅ Hcp {]tZ-i¯v InWÀ "A{]-Xy-£-ambn' F¶v   
tIÄ¡m-\n-S-bm-Ip-¶p.'' CtX-¡p-dn-¨-dn-bm³ \n§Ä B Øew kµÀin-bv¡pw.

44. Death news will be heard if dogs howl at night.

\mb Hmcn-bn-«mÂ ac-W-hmÀ¯ tIÄ¡p-sa¶v ]d-bp-¶Xv icn-bm-Wv.

45. Science is the panacea for all problems.

imkv{Xw FÃm {]iv\-§Ä¡pw adp acp-¶m-Wv.

46. You see a water tap being open in the public road. Then you will close it.

s]mXp hgn-bnÂ ss]¸v Xpd¶v shÅw ]mgmbn t]mIp-¶Xv \n§Ä ImWp-¶p.   
A§-s\-sb-¦nÂ \n§-fXv ]q«pw.

47. Two of your best friends quarrel in the class. You will not stay even in the side of the friend who is correct because indulging in it may adversely affect you.

¢mÊnÂ \n§-fpsS c­v ASp¯ kqlr-¯p-¡Ä X½nÂ hg¡p IqSp-¶p. CXnse   
CS-s]-SÂ \n§sf {]Xn-Iq-e-ambn \_m[n-¡p-sa-¶-Xn-\mÂ icn-bpÅ kplr-¯nsâ `mK¯pw \n§Ä \nev¡n-Ã.

**Part II**

This part consists of certain statements. Read it carefully and put a cross mark against the letter which one you select.

Cu `mK¯v Nne {]kvXm-h-\-IÄ sImSp-¯n-cn-¡p-¶p. Ah {i²m]qÀÆw hmbn¨tijw \n§Ä Xnc-sª-Sp-¡p¶ A£-c-¯n-\p-t\sc X ASbmfw   
tcJ-s¸-Sp-¯p-I.

48. Suppose, your family member is bitten by a dog you would;

\n§-fpsS Hcp IpSpw-\_mw-Ks¯ ]«n ISn-bv¡p-¶p-sh¶v Icp-Xp-I. F¦nÂ \n§Ä

A) Wash the wound with water and take the person to the hospital

(F) apdnhv shÅw D]-tbm-Kn¨v Igp-Ip-Ibpw Abmsf Bip-]-{Xn-bnÂ   
{]th-in-¸n-bv¡p-Ibpw sN¿pw.

B) Not take any actions

(\_n) H¶pw sN¿p-I-bn-Ã.

C) Wash the wound with water and then with antiseptic lotion and apply bandage and take the person to the hospital.

(kn) apdnhv BZyw shÅw D]-tbm-Kn¨pw ]n¶oSv AWp-\m-in\n D]tbm-Kn¨pw   
Igp-Inb tijw h¨p-sI«pIbpw Bip-]-{Xn-bnÂ {]th-in-¸n-¡p-Ibpw sN¿pw.

D) Wash the wound with water and apply bandage and take the person to the hospital.

(Un) apdnhv shÅw D]-tbm-Kn¨v Igp-In-b-tijw h¨p-sI-«pIbpw Abmsf   
Bip-]-{Xn-bnÂ {]th-in-¸n-¡p-Ibpw sN¿pw.

E) Console the bitten person, wash the wound with plenty of water and then with antiseptic lotion, apply bandage, watch the dog for 10 days. If it dies take the patient to the hospital for antirabies injection

(C) Abmsf Biz-kn-¸n-¡p-Ibpw apdnhv BZyw [mcmfw shÅw D]-tbm-Kn¨pw ]n¶oSv AWp-\m-in\n sIm­pw Igp-In-b-tijw h¨p-sI-«p-Ibpw ISn¨ ]«nsb ]¯p Znhkw \nco-£n-¡p-Ibpw ]«n Nmhp-I-bm-sW-¦nÂ tcmKnsb   
t]]«n hnj\_m-[-bvs¡-Xn-cmb Ip¯n-h-bv]n-\mbn Bip-]-{Xn-bnÂ   
sIm­p-t]m-hp-Ibpw sN¿pw.

**APPENDIX V**

**Mean Scores of Academic achievement and   
Achievement in Science at Secondary Level in Total Sample and Subsampels**

|  |  |  |  |
| --- | --- | --- | --- |
| Samples | | Mean score of Academic Achievement at Secondary level | Mean score of Achievement in Science at Secondary level |
| Total sample |  | 59.41 | 62.06 |
| Subject of specialisation at Higher Secondary Level | Science  Humanities  Commerce | 64.78  52.96  55.04 | 67.23  54.75  58.93 |
| Type of Management of School | Government  Aided  Unaided | 57.36  64.36  60.30 | 60.21  67.00  61.17 |
| Religion of Student | Christian  Hindu  Muslim | 61.85  59.88  55.80 | 64.27  62.62  58.55 |
| Community Category | General  OBC  SC  ST | 62.73  57.91  58.19  50.71 | 65.22  60.70  60.64  53.42 |
| Medium of Instruction at secondary level | English  Malayalam | 68.18  58.47 | 69.45  61.26 |
| Level of Education of Father | High  Average  Low | 66.65  60.27  54.98 | 69.86  63.10  57.01 |
| Level of Education of Mother | High  Average  Low | 70.96  60.52  54.31 | 73.57  63.32  56.66 |
| Family Income | High  Low | 61.29  57.74 | 64.36  60.00 |

APPENDIX III

**SCIENTIFIC ATTITUDE SCALE RESPONSE SHEET**

Name : ....................................................................................................................................... Gender: M / F

Name of School : ........................................................................

Subject of specialization .........................................................

Type of School : Govt. / Aided / Unaided Religion: ...........................................................................

Community : SC / ST / OBC / Others

Medium of Instruction at Secondary Level: .........................................................................................

Percentage of total mark obtained in S.S.L.C. : .................. Percentage of mark in Science: .................

Education of Parents: Father : .................................................. Mother : ......................................................

Family Income of Parents : ...............................................................................................................................

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | SA | A | N | D | SD |  | 31 | SA | A | N | D | SD |
| 2 | SA | A | N | D | SD |  | 32 | SA | A | N | D | SD |
| 3 | SA | A | N | D | SD |  | 33 | SA | A | N | D | SD |
| 4 | SA | A | N | D | SD |  | 34 | SA | A | N | D | SD |
| 5 | SA | A | N | D | SD |  | 35 | SA | A | N | D | SD |
| 6 | SA | A | N | D | SD |  | 36 | SA | A | N | D | SD |
| 7 | SA | A | N | D | SD |  | 37 | SA | A | N | D | SD |
| 8 | SA | A | N | D | SD |  | 38 | SA | A | N | D | SD |
| 9 | SA | A | N | D | SD |  | 39 | SA | A | N | D | SD |
| 10 | SA | A | N | D | SD |  | 40 | SA | A | N | D | SD |
| 11 | SA | A | N | D | SD |  | 41 | SA | A | N | D | SD |
| 12 | SA | A | N | D | SD |  | 42 | SA | A | N | D | SD |
| 13 | SA | A | N | D | SD |  | 43 | SA | A | N | D | SD |
| 14 | SA | A | N | D | SD |  | 44 | SA | A | N | D | SD |
| 15 | SA | A | N | D | SD |  | 45 | SA | A | N | D | SD |
| 16 | SA | A | N | D | SD |  | 46 | SA | A | N | D | SD |
| 17 | SA | A | N | D | SD |  | 47 | SA | A | N | D | SD |
| 18 | SA | A | N | D | SD |  | 48 | SA | A | N | D | SD |
| 19 | SA | A | N | D | SD |  | 49 | SA | A | N | D | SD |
| 20 | SA | A | N | D | SD |  | 50 | SA | A | N | D | SD |
| 21 | SA | A | N | D | SD |  | 51 | SA | A | N | D | SD |
| 22 | SA | A | N | D | SD |  | 52 | SA | A | N | D | SD |
| 23 | SA | A | N | D | SD |  | 53 | SA | A | N | D | SD |
| 24 | SA | A | N | D | SD |  | 54 | SA | A | N | D | SD |
| 25 | SA | A | N | D | SD |  | 55 | SA | A | N | D | SD |
| 26 | SA | A | N | D | SD |  | 56 | SA | A | N | D | SD |
| 27 | SA | A | N | D | SD |  | 57 | SA | A | N | D | SD |
| 28 | SA | A | N | D | SD |  | 58 | A | B | C | D | E |
| 29 | SA | A | N | D | SD |  | 59 | A | B | C | D | E |
| 30 | SA | A | N | D | SD |  | 60 | A | B | C | D | E |

**APPENDIX IV**

**SCIENTIFIC ATTITUDE SCALE RESPONSE SHEET**

Name : ....................................................................................................................................... Gender: M / F

Name of School : ........................................................................

Subject of specialization .........................................................

Type of School : Govt. / Aided / Unaided Religion: ...........................................................................

Community : SC / ST / OBC / Others

Medium of Instruction at Secondary Level: .........................................................................................

Percentage of total mark obtained in S.S.L.C. : .................. Percentage of mark in Science: .................

Education of Parents: Father : .................................................. Mother : ......................................................

Family Income of Parents : ...............................................................................................................................

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | SA | A | N | D | SD |  | 25 | SA | A | N | D | SD |
| 2 | SA | A | N | D | SD |  | 26 | SA | A | N | D | SD |
| 3 | SA | A | N | D | SD |  | 27 | SA | A | N | D | SD |
| 4 | SA | A | N | D | SD |  | 28 | SA | A | N | D | SD |
| 5 | SA | A | N | D | SD |  | 29 | SA | A | N | D | SD |
| 6 | SA | A | N | D | SD |  | 30 | SA | A | N | D | SD |
| 7 | SA | A | N | D | SD |  | 31 | SA | A | N | D | SD |
| 8 | SA | A | N | D | SD |  | 32 | SA | A | N | D | SD |
| 9 | SA | A | N | D | SD |  | 33 | SA | A | N | D | SD |
| 10 | SA | A | N | D | SD |  | 34 | SA | A | N | D | SD |
| 11 | SA | A | N | D | SD |  | 35 | SA | A | N | D | SD |
| 12 | SA | A | N | D | SD |  | 36 | SA | A | N | D | SD |
| 13 | SA | A | N | D | SD |  | 37 | SA | A | N | D | SD |
| 14 | SA | A | N | D | SD |  | 38 | SA | A | N | D | SD |
| 15 | SA | A | N | D | SD |  | 39 | SA | A | N | D | SD |
| 16 | SA | A | N | D | SD |  | 40 | SA | A | N | D | SD |
| 17 | SA | A | N | D | SD |  | 41 | SA | A | N | D | SD |
| 18 | SA | A | N | D | SD |  | 42 | SA | A | N | D | SD |
| 19 | SA | A | N | D | SD |  | 43 | SA | A | N | D | SD |
| 20 | SA | A | N | D | SD |  | 44 | SA | A | N | D | SD |
| 21 | SA | A | N | D | SD |  | 45 | SA | A | N | D | SD |
| 22 | SA | A | N | D | SD |  | 46 | SA | A | N | D | SD |
| 23 | SA | A | N | D | SD |  | 47 | SA | A | N | D | SD |
| 24 | SA | A | N | D | SD |  | 48 | SA | A | N | D | SD |