A STUDY OF SCIENTIFIC ATTITUDE AND PROCESS SKILLS IN SCIENCE OF HIGH SCHOOL STUDENTS

Dissertation submitted to Tamil Nadu Teachers Education University in partial fulfilment of the requirements for the degree of MASTER OF EDUCATION

By

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DECLARATION

I declare that the disseration entitled “A STUDY OF SCIENTIFIC ATTITUDE AND PROCESS SKILLS IN SCIENCE OF HIGH SCHOOL STUDENTS” submitted to the Tamil Nadu Teacher Education University, Chennai for the fulfilment of the degree of master of Education is the record of original research work carried out by me under the guidence of Mr. Bright.C. Assistant Professor in Education, N.V.K.S.D. College of Education, Attoor and it has not been submitted by me for the award of any degree, diploma, litle or recognition before.

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Certified that Uma Maheswari. R, student of Master of Education has done research on the topic “A STUDY OF SCIENTIFIC ATTITUDE AND PROCESS SKILLS IN SCIENCE OF HIGH SCHOOL STUDENTS” for the award of degree of Master of Education, submitted to N.V.K.S.D. College of Education, Attoor, affiliated to Tamil Nadu Teachers Education University. It is a record of bonafide research work done by her under my guidence and supervision. It is further certified that the work is an original one, free from any duplication.

Place : Attoor Mr. Bright. C

Date : Guide

AKNOWLEDGEMENT

First and foremost I thank the Almighty God who inspired and guided me all the way.

I have immense pleasure in expressing my deep sense of gratitude and my heartiest thanks to my beloved guide Mr. Bright.C, M.A., M.Ed., M.Phil., Ph.D., Assistant Professor in Education, N.V.K.S.D College of Education, Attoor for his immense patience, effective guidance, cordial support and constant advocacy bestowed throughout the work.

My profound gratitude to Dr. B.C. Shoba, Principal, N.V.K.S.D College of Education, Attoor, for given me the opportunity to undertake this dissertation work and for the encouragement given to accomplish the same.

I express my sincere thanks to Mrs. P. Sheela, Librarian and Mr. Jeya Mohan, Library Assistant, N.V.K.S.D College of Education, Attoor, for their valuable assistance given to me.

I also express my gratitude to all the teaching and non – teaching staff of the N.V.K.S.D College of Education, Attoor for the encouragement given to me in completing this research work.

I express my sincere thanks to the administratiors, staffs and students of various schools for their kind co-operation.

My whole hearted thanks and gratitude to my family members for their advice, encouragement and moral support.

Finally thanks are extended to one and all for those who extended their co-operation to finish the dissertation work.

Place : Attoor Uma Maheswari, R.

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CHAPTER I

INTRODUTION

Education is the process of instruction aimed at the all round development of individuals, by providing the necessary skills and knowledge to understand and participated in day to day activities of today's world. It dispels ignorance and boosts moral values of the individuals, it is the only wealth which cannot be robbed. It builds character, provides strength of mind and increase knowledge. Education sustains the human values which contribute to individual as a socially accepted well - being. It forms the basis for lifelong learning and inspires confidence to face the challenges. It provides the skills to individual to become self-reliant and aware of opportunities and rights.

Education as a powerful tool in the socio-economic transformation of a society, community and nation. It sharpens the eye of knowledge, develops awareness and make mind logical. It is also the key to build-up the skills and capacities and all dimension necessary for techno-economic development.

In the present world the knowledge of science is essential for everyone, because it has an immense value in everyday life. All our educational endeavours eventually are concerned with the inculcation of abilities, which include logical thinking and develop skills desirable to make scientific observation among the young learners. Science education provides opportunity for creative thinking and constructive imagination.

The 20th century in the age of science and its last decade in charge practically as a result of technology and advances made in scientific research.

Right from the cradle to the grave all our activities are controlled and fashioned by science. Science has changed not only mans mode of life but his modes of thoughts also. According to Nehru, “The application of science are inevitable and unavoidable for all countries and people today,"

Science in one of those human activities that man has created to gratify human needs and desires. Education commission (1964 - 1966) started that “science is universal and so can be benefits”. Its material benefits are immense and for reaching industrialization of agriculture and release of nuclear energy, to mention two examples but even more profound is its contribution to culture.

The science is applied in the development of scientific attitude for the students, that should one of the goals of the school program. It develops the students leads to willingness to work together. Science process skills is evaluating in applying such information is also closely allied to attitude, process skills of attitude.

NEED AND SIGNIFICANCE OF THE STUDY

Science has occupied almost all spheres of human. Today we are living in an age of science and all over activities are controlled and governed by science .The knowledge of science is indeed for every individual only adapting suitable method. Teaching of science at the school stage helps the development of school literacy,

This is the age of science of logic. Every effects has cause a reason. Nothing happens that cannot be explained in scientific thinking can bring down

a nation and impede its progress. So let us cast away unfound thoughts, beliefs, practices and follow the clear light of go forward on the path of progress and prosperity of one nation .

Science is an intellectual endeavour consisting of two parts progress and product .The product of science consist of facts, concepts, theories, principles which are derived out from experiments and observations. But the process of science is slowly interpreted as hypothesising, designing, experimenting, recording, analysing and inferring. However the process of science consists of an awareness of values understanding science.

Various factors like intelligence, creativity, scientific aptitude, etc. influence science process skills of students. Several studies have been conducted on the relationship between science process skills and variables like intelligence, creativity, scientific aptitude, etc. But there are only few studies on the relationship between scientific attitude and process skills in science. The present study is an attempt to study the relationship between scientific attitude and process skills in science of high school students.

STATEMENT OF THE PROBLEM

The problem selected for the present study is entitled as "A study of Scientific Attitude and Process Skills in Science of High School Students".

OPERATIONAL DEFINITION

SCIENTIFIC ATTITUDE

Scientific attitude is the way of thinking reasonably, logically, and clearly without any prejudice or preconceived nation. It is necessary because unscientific thinking can create problem of the world.

In this study scientific attitude refers to the scores obtained by the high school students in scientific attitude scale administered by the investigator.

PROCESS SKILLS IN SCINCE

The term "Process skills in science" refers to a cluster of intellectual skills which account for covering a significance stage of scientific investigation defined as forming a part of behaviour change to be attained by students as consequence of learning science.

In this study process skills in science of high school students refers to the scores obtained by the process skill test.

OBJECTIVES

1. **To construct and validate Scientific Attitude scale.**
2. To study the scientific attitude of high school students.
3. To study the process skills in science of high school students.
4. To compare the mean scores of scientific attitude of high school students based on: -
    a) Gender
    b) Locality
    c) Type of school
    d) Parental Educational Qualification
    e) Monthly Income of the Family

5. To compare the mean scores of process skills in science of high school students based on
    a) Gender
    b) Locality
    c) Type of school
    d) Parental Educational Qualification
    e) Monthly Income of the Family.
6. To study the correlation between scientific attitude and process skills in science of high school students.

HYPOTHESES

1. There is no significant difference in the mean scores of scientific attitude of boys and girls.
2. There is no significant difference in the mean scores of scientific attitude of urban and rural high school students.
3. There is no significant difference in the mean scores of scientific attitude of government and aided high school students.
4. There is no significant difference in the mean scores of scientific attitude of high school students based on their fathers' educational qualification.
5. There is no significant difference in the mean scores of scientific attitude of high school students based on their mothers' educational qualification.

6. There is no significant difference in the mean scores of scientific attitude of high school students based on their parents' monthly income.
7. There is no significant difference in the mean scores of process skills in science of boys and girls.
8. There is no significant difference in the mean scores of process skills in science of urban and rural high school students.
9. There is no significant difference in the mean scores of process skills in science of government and aided high school students.
10. There is no significant difference in the mean scores of process skills in science of high school students based on their fathers' educational qualification.
11. There is no significant difference in the mean scores of process skills in science of high school students based on their mothers' educational qualification.
12. There is no significant difference in the mean scores of process skills in science of high school students based on their parents' monthly income.
13. There is no correction between scientific attitude and process skills in science of high school students.

METHODOLOGY

The investigator used normative survey method for the present study.

SAMPLE OF THE STUDY

The present study was conducted on a sample of 400 students from various high schools in Kanyakumari District.

TOOLS USED

i. General data sheet.

ii. Science Process skills test (prepared by Usha Kumari. C and Dr. Minikumari .V.S, 1995)

iii. Scientific attitude scale (constructed by Uma Maheswari. R. and Bright .C.)

STATISTICAL TECHNIQUES USED

For the analysis of data following statistical techniques were adopted.

i. Arithmetic Mean

ii. Standard Deviation

iii. 't' test

iv. ANOVA

v. Person's Product Moment Correlation Coefficient.

DELIMITATIONS OF THE STUDY

i. The investigator has selected samples from high schools only.

ii. The sample is limited to 400 students only.

ORGANIZATION OF THE REPORT

The investigator conducted the study and collected data from various sources. It has been analyzed, conclusions are drawn and proposals are recommended for further research in the field.

The chapter I deals with the details of the introduction which includes need and significance of study, important terms, objectives of study, major hypotheses and delimitations of the study.

The chapter II contains the research related to the present investigation and theoretical overview.

The Chapter III contains methodology, Normative Survey method, the sample used for the study, the tool used for the study, data collection procedure and statistical procedure.

The chapter IV contains details of analysis of data, their results and also the interpretation for the same.

The chapter V contains the summary, findings, conclusion, recommendation and suggestions.

CHAPTER - II

REVIEW OF RELATED LITERATURE

Theoretical overview

Studies related in scientific attitude

Studies related in process skills in science

CHAPTER II

REVIEW OF RELATED LITERATURE

Research takes advantages of the knowledge which has accumulated in the past as a result of human endeavour. It never be undertaken in isolation of the work that has already been done on the problems which are directly or indirectly related to a study proposed by researcher. A careful review of the research journals books dissertations, these in and other sources of information on the problem to be investigated in one of the important steps in the planning of any research study.

The phase "Review of literature" consists of two words, review and literatur. The term review means to organize the knowledge of the specific area of research to evolve an edifice of knowledge to show that the proposed study would be an addition to this field, The task of review of literature is highly creative and seditious because the research has to synthesis the available knowledge of the world in a unique way to provide the rationale of his study.

PURPOSE OF THE REVEIW

1. The review of related literature enables the researcher to define the limits his field. It helps the researcher to delimit and define.
2. By review the related literature the researcher can avoid unfruitful and useless problem areas. Researchers can select those areas in which positive findings are very likely to result and his endeavours would be likely to add to the knowledge in a meaningful way.

3. Through the review of literature gives the researcher can avoid unintentional duplication of well established findings.
4. The review of literature gives the researcher an understand of the research methodology which refers to the way the study in to be conducted. It helps the researcher to know about the tools and instruments which proved to be useful and promising in the previous studies.
5. The final and important specific reasons for reviewing the related literature is to know about the recommendation of previous researchers listed in their studies for further research.

The studies reviewed are classified as follows

i. Studies related to scientific attitude.

ii. Studies related to process skills in science.

THEORETICAL OVER VIEW

SCIENTIFIC ATTITUDE

The main aim of teaching science is to inculcate scientific attitude in the studies, the scientific attitude, by its name, tends to be associated solely with the area of science and scientific methods.

DEFINITIONS OF SCIENTIFIC ATTITUDE

Richard .W. Moore (1970) has rightly defined scientific attitude, "as the opinion or position taken with respect to a psychological object in the field of science".

Henry (1964) defines the scientific attitude as "an attitude which reflect scientific thinking and to be scientific means that one has such attitudes as curiosity, rationality, suspended, judgement, open mindedness, objectively and humanity".

According to Gauld etal (1982) scientific attitude refers to approaches utilized for problem solving, decision making and scientific thinking by acting primarily an evidence.

In defining scientific attitude Paul. B. Diederich has put forward the following components (Bhandula, Chanada and Sharma 1986).

i. Scepticism, not taking things for granted.
ii. Asking for prior questions.
iii. Desire for experimental verification.
iv. Precision.
v. A liking for new things.
vi. Willingness to challenge opinion.
vii. Humility.
viii. Loyalty to truth.
ix. An objective attitude.
x. A version to superstition.
xi. Liking for scientific explanation.
xii. Suspended judgment.
xiii. Distinction between hypothesis and solution.
xiv. Awareness of assumptions.

xv. Judgment of what in fundamental and general significances.

xvi. Faith in the possibility of solving problems.

xvii. Respect for qualification.

xviii. Acceptance of probabilities.

xix. Acceptance of warranted generalizations.

xx. Desire for completeness of knowledge.

CHARACTERISTICS OF SCIENTIFIC ATTITUDE

According to the national society of the study of education (1960) the following characteristics are found in a person possessing scientific attitude.

i. He in open minded.

ii. He has a burning desire for the acquisition of current knowledge and search for truth.

iii. He has confidence and his abilities to seek knowledge with his own efforts.

iv. He possess and adequate ability of problem solving and believes that the problems can be solved through proper efforts involving scientific observation and experimentation.

If we take a still broader view, the person possessing the following qualities may be safely described as man of scientific attitude.

i. Has spirit of curiosity.

ii. Believes in cause and effect relationship.

iii. Believes in the theory of evidence.

iv. Is open minded.

v. Has love for truth.

vi. Adapts scientific method in his thinking and working.

A pupil who has developed scientific attitude (Yadar 1992)

i. Is clear and precise in his activities and makes clear and precise statement.

ii. Always bases his judgement on verified facts and not on opinions.

iii. Prefers to suspend his judgement if sufficient data is not available.

iv. Is objective in his approach and behaviour.

v. Is free from superstitions.

vi. It's honest and truthful in recoding and collecting scientific data.

vii. After finishing his work takes care to arrange the apparatus, equipment at their proper places.

viii. Shows a favourable reaction towards efforts of using science for human welfare.

TECHNIQUES OF DEVELOPING SCIENTIFIC ATTITUDE AMONG THE STUDENTS

The development of scientific attitude among the learners must be a prime objective of teaching science at any stage of school curriculum. Some measures should be done by the teachers and institutions for the inculcation and development of scientific attitude among the children,

They are

i. Satisfaction of curiosity.

ii. Get rid of the superstitions.

iii. Proper way of teaching.

iv. Utilizing co-curricular activities.

v. Proper environment of classroom.

vi. Inspiring for the study of scientific literature.

vii. Self - example by the teacher.

Apart from the above, the following components or points are also worth trying for the teachers to develop scientific attitudes.

1**. Use of wide reading**

The students should be encouraged to read library books and supplementary books in science. It should be possible only if the school has separate science library.

2. Study of superstitions

When the science teacher so many science lessons practically it will more effective if the science teacher encourages his pupils to practically investigate some common superstitions and come to their own conclusions by actual survey and study.

3. Use of planned exerciser

Some magazines devoted to science provided exercise for developing certain attitudes. Cutting from news papers can also be used for the purpose. Certain pictures and cutting may be displayed on the bullet in board and used again for direct teaching. Good text books certain exercise at the end of each chapter, which fulfill the aim of developing scientific attitude.

4. Proper use of laboratory period

The laboratory period can offer many opportunities for learning certain elements of scientific attitudes. It is the function of the teacher to see that such opportunities are properly utilized.

5. Co - Curricular activities in science

The activities likes science club, hobbies club, scientific society, chemistry society, photographic club, scientific excursions, making of scientific models, organizing science apparatus, maintaining aquarium, vivarium, terrarium, etc. Should be given effectively organized and pupils be given sufficient freedom to plan their activities.

6. The atmosphere of the class

If the internal setting of the class in properly arranged and the room is decorated in a manner which contributes to the development of the pupils can be diverse towards the inculcation of certain attitudes. Secondly, the role of the teacher is also very important to develop a desirable atmosphere in the class. The teacher should encourage the spirit of friendly criticism of procedures, data collections, hypothesis and results.

7. The personal example of the teacher

The children have the great tendency to copy the teachers. So teachers must be free from bias and prejudices. He must be open-minded , critical in thought and action in his day to day dealings, must be free from superstitions and unfolded beliefs, must be objectives and impartial and his approach to everyday problems must be truthful and having faith and effective relationship.

Although many of the characteristics that we associate with scientific attitudes may develop naturally with maturity, the open-minded, cautious, objective approach to situations that require decisions based on reliable evidence should be encouraged and emphasized by each teacher. With proper attention to its development, the scientific attitude can be fostered as a characteristic valuate to each student as he faces problems in school and in adult life.

DEFINITIONS OF SCIENTIFIC PROCESS

Welch defines scientific process as a 'series' of activities or operations performed by the scientist in his attempt to understand nature (Nay, et. al: 1991)

Thannenbaum (1971) listed the following eight process most appropriate for the seventh, eighth and ninth grade U.S. Schools which included as basic elements for various approaches of defining science process. They are:-

i. Observing
ii. Comparing
iii. Classifying
iv. Quantifying
v. Measuring
vi. Experimenting
vii. Inferring
viii. Predicting

Easter (1973) describe the process of science as that which scientist and children must be a good observer, be must be able to infer about objects and ideas. The investigator must be able to measure, to communicate his data to others and to predict from his data. He must name the variables that are control variables in the experiment other more sophisticated skills of this category are formulating hypothesis and interpreting data.

Doran and others (1974) defines the process of science as observation, measurement, classification, experiment communication, prediction and formulation of hypotheses theories, laws and models.

According to Kyle and William (1980) "Scientific inquiry stands for systematic and investigative performance ability which incorporate unrestrained inductive thinking capabilities after a person has acquired a broad and critical knowledge of a particular subject through formal learning process"

CHARCTERISTICS OF PROCESS SKILLS SCIENCE

Main characteristics of process skills science as advocated by National Science Teachers Association, Washington are as follows:-

i. Science proceeds on the assumption based on centuries of experience that the universe is not capricious.
ii. Science knowledge is based on observation of samples matter than are accessible to public investigations in contrast purely private investigations.

iii. Science proceeds in a piece meal manner even though it also aims at achieving a systematic and comprehensive understanding of various sectors and aspects of nature.

iv. Science is not and probably never will be finished enterprise and there remains very more to be discovered about new things in the universe and how they are interrelated.

v. Measurement is an important feature of most branches of modern science because the formations as well as the establishment of the laws are facilitated through the development of qualitative distinctions.

VARIOUS PROCESSES OF SCIENCE

According to Brown (1968) the processes of science includes

A : Application of generalization to new situation

a) Ability to deductively apply principles to specific experiences.

b) Ability to extrapolate beyond given data.

B : Collection of data

a) Ability to identify a problem.

b) Ability to delimit the problem.

c) Skill in reading and understanding data in various forms.

d) Ability to choose a course of action by determining what is necessary for the solution of a problem.

e) Ability to choose the best authority.

C : Analysis of data

a) Skill in formulating hypothesis.

b) Ability to organize list of hypothesis.

c) Understanding cause and effect relationships.

d) Skill in testing hypothesis.

D : Synthesis of data

a) Ability to synthesis data into generalizations.

b) Willingness to with hold judgment until sufficient information in available.

E : Evaluation of data

a) Ability to evaluate evidence.

b) Skill in evaluating arguments.

c) Ability to distinguish among assumptions, hypotheses, theories, and established principles.

According to K. Andesson science process / content and development stages are:-

1. Observing (Sensory motor)

The main route to knowledge in through observing, using all the senses. This process is a distinct one by which people comes to know about the characteristics of objects and their implications.

a) Seeking / Hearing / Feeling / Tasting / Smelling.

2. Communicating (Per conceptual)

Objects are named and events are described by people so that they can tell others about them. Communicating in a fundamental human process that enables one to learn more about a greater range of information that could be learned without the process.

a) Silent / Oral / Written / Pictorial comparing (intuitive)

3. Comparing

Comparing is a distinct process by which people systematically examine objects and events in terms of similarities and differences. By comparing the known to something unknown. All measurements are forms of comparing.

a) Sensory comparison/Relative positive comparison/Linear comparison.
b) Weight comparisons /Capacity comparisons / Quantity comparisons.

4. Organizing (Concrete operational)

Knowledge of principles and law is gained only through the systematic compiling classifying and ordering of observed and compared data. Bodies of knowledge are drawn from long term organizing processes.

a) Data gathering / Sequencing / Grouping / Classifying.

5. Relating (Concrete operational)

Relating is a process by which concrete and abstract ideas are woven together to test or explain phenomena. Hypothetical, Deductive reasoning, Co-ordinate graphing, the managing of variables and the comparison of effects of the major concepts of science.

a) Using space - time relationship / Formulating experimental hypotheses.

b) Controlling and manipulating variables / Experimenting.

6. Inferring (Formal operational)

The process of realizing ideas that are directly observable in the process of inferring. The process leads to predictive explanations for simple and complex phenomena.

a) Synthesizing / Analyzing / Generalizing. Recording and predicting patterns.

b) Starting laws / Formulating explanatory ideas and the organizing.

7. Applying (Formal operational)

Use of knowledge in the applying of knowledge, Inventing, Creating, Problem solving and determining probabilities are ways of using information that tead to getting further information.

a) Using knowledge to solve problems / Inventing (technology)

Burn and Brookes (1970) have listed fourteen processes of science. They are:-

I. Abstracting
II. Analysing
III. Classifying
IV. Conceptualizing
V. Equating
VI. Evaluating
VII. Generalizing
VIII. Inferring
IX. Ordering
X. Sequencing
XI. Stimulating
XII. Synthesizing
XIII. Theorizing
XIV. Translating

The American Association for the Advancement of Science (AAAS, 1968) has given thirteen skills with brief definitions. They are

Basic Process

1. Observing

Using five sense to obtain information.

2. Using spaces - time relationship

Describing spatial relationships and their change with time.

3. Classifying

Imposing order on collection of objects or events.

4. Using numbers

Identifying quantitative relationship in nature.

5. Measuring

Expressing length, area, volume, weight, temperature, force and speed.

6. Communicating

Expressing ideas with oral and written words, diagram, maps, graphs, mathematical equations and various kinds of visual demonstrations.

7. Predicting

Making specific forecasts of what a future observations.

8. Inferring

An explanation of an observation.

Integrated process

9. Controlling variables

Studying the influence of changing variables and the factors which influence one another.

10. Interpreting data

Using data to make inference, predictions and hypothesis.

11. Formulating hypothesis

Making general statements of explanation.

12. Defining operationally

Defining terms in the context of experiences.

13. Experimenting

Larger process of using basic and integrated process.

These basic process skills are essential and appropriate for elementary children for science teaching. The integrated process skills are much more complicated and more suitable for higher classes.

According to Pachaury (1996) science process involve the following:-

a) Observation

Observation is a mother process of scientific inquiry. However, children need training in this skill, because even adults are at times insensitive to what they ought to observe and even hear around them. Observation should be honestly made, recorded and reliably reported.

b) Measurement

Quantification of data is an important step in processing scientific evidence regarding a phenomenon. It helps in arriving at precision and hence follows one of the major characteristics of science that is the law of parsimony. Quantification has other benefits too, like that of comparison and utilizing the quantified data for predicting and hypothesizing new preposition between among the variables. Hence quantification of the data refines conceptualization by making better models of reality.

c) Inference

Consequences of observation and quantifications lead to drawing of an inference regarding a scientific event. Inference, in fact link between the cause and the effect relationships arrived through the process of 'if - then - therefore'

logic. A hypothesis is nothing but an anticipated inference regarding a relationship between a set of variables.

d) Predicting

Predictions help in creating new knowledge in science because they arise new questions of relationship between/among variables. Hence predictions are a continual source of nourishment to the imagination and extrapolation are required. Hence children should be encouraged to make and test their predictions experimentally.

e) Hypothesis

According to psychologist, Carl Rogers, the generation of a hypothesis is an art of true creativity. In generation of a hypothesis caution should be exercised to tag it to the observable and measurable events.

f) Interpretation

Interpretation is drawing of an inference upon an inference interpretation is an important link for theory building. A theory is neither fully accepted nor fully falsified by the empirical and anticipated inference or by a predicted hypothesis.

g) Mental modeling

Scientists make mental models of reality models have the limitation of reality. Models have the limitation of reflecting partial truth only.

PROCESS APPROACH

Science - A process approach gives emphasis to theory that science skills or process such as observing, hypothesizing etc taught the use of

meaningful classroom investigation of facts or concepts. The process approach focuses on the learning of inquiry skills more than specific content.

PROCESS APPROACH - EDUCATIONAL IMPLICATIONS

The value of process approach in science teaching is widely accepted. By stressing on the scientific skills in teaching the student is made to perform the role of an original investigator. Since educators believe that the acquisitions of the acquisition of process skills in science will help a student to face life problems better and look at problems critically and take objective decisions over and above all these, process approach to science teaching will help students to learn science with meaning and with full understanding of the processes that form the body of science.

Billeh and Malik (1977) lightly point out that in order to understand science one should know the process through which scientific knowledge is acquired and developed.

While all types of cognitive skills are expressed right from the beginning of science teaching at the earlier stages it can be informal. But this approach needs to be formalized and stabilized as one goes higher in the educational ladder. Students who are about to enter the university need to be given formal and systematic training in processes of science if they are optimally benefit by the science courses that they take up in universities.

Any teacher of science in higher education knows the fact that scientific processes are not properly stressed in higher education. Temple Man (1965) in

critical of what is happening in higher education when he says that the responsibility of the institution is not to crush the spirit of free inquiry by indolence or indifference.

Carter (1980) stresses that in higher education the needs of the individual will met only if the higher level cognitive skills are developed properly through the process of instruction.

Lewis (1972) quotes UNESCO committee's view regarding the importance of scientific processes in science curriculum. According to the committee science education is a continuing process from pre-school age to post-university training it should focus on pre - university education during which in the committee's view, the spirit of inquiry and logical thought is ripe for development.

STUDIES RELATED TO SCIENTIFIC ATTITUDE

INDIAN STUDIES

Anusupria (2012) conducted a study on "Scientific Aptitude and Scientific Attitude of Higher secondary school students"

The present study was probed to scientific aptitude and scientific attitude. The data were collected using self made scientific attitude scale. The investigator used normative survey method. The objectives of the study was to find out the scientific attitude of higher secondary students based on gender, locality, type of school, educational qualification and monthly income. The findings revealed that there exists significant difference between the male and female students in their scientific aptitude. Locality had no influenced on scientific attitude. Monthly income influenced on scientific aptitude and scientific attitude.

Antony Gracious & Anna Raja (2011) conducted a study on "Scientific Attitude and Teaching Competency of Prospective Teachers"

The present study was probed to find the relationship between scientific attitude and teaching competency of prospective Teachers. Data for the study were collected using self made scientific attitude scale and teaching competency scale. The findings showed that was no significant relationship between scientific attitude and teaching competency of prospective teachers.

Aruna and Sumi (2011) conducted a study on "Effectiveness of Process Approach Science on Attitude towards Science and Process Skills in Science".

The present study was to compare the mean pretest scores of attitude towards science of the experimental and control groups. The compare the mean posttest scores of attitude towards science of the experimental and control group. In the comparison of the two groups was almost equal in their attitude towards science.

Elakiya and Mary Lily Puspham (2010) conducted a study on "A study on the Scientific Attitude of IX standard students in Coimbator District".

Scientific attitude is a very significant aspect in the process of science education. This study aims to measure the level of scientific attitude. A sample of 244 students studying in IX standard were selected. The investigator adopted survey method for the present study were collected using a self constructed tool. The result of the present study reveal that the level of the present study reveal that the level of scientific attitude of IX standard students in coimbatore District was high. Gender and nature of school influenced the scientific attitude of the students.

Lakshmi Narayana and Anjuli Suhane (2010) conducted a study on "Contribution of Scientific Aptitude and Scientific Attitude to Develop Environmentally Sensitive Practices".

The major purpose of this paper was to explore the contribution of Scientific aptitude and scientific attitude among students of secondary schools, Neither scientific aptitude not its components significantly influenced environmental practices of secondary school students. Influenced of scientific attitude of components of environmental practices, scientific attitude and significant influenced on limiting use of poly products.

Saroji Sobtt and Balijit Singh (2010) conducted a study on "Scientific Attitude of High School Teachers in Relation to Value Patterns"

The present study explores the relationship between scientific attitude and value patterns of school teachers. The objectives of the study was to study the relationship between scientific attitude value patterns. Survey method was adopted for this study. 100 high school teachers of Ambala District of Haryana were selected as sample of the study. For the purpose of data collection, following tools were used (i) Scientific attitude study scale by D.N. Dani (ii) Value inventory for teachers by Dr. H.L. Singh and Dr. S.P. Anluwalia. For alaysis of the data mean, mode, standard deviation, 't' test and Pearson product moment correlation were used by the investigator. The results indicated that scientific attitude of high and low value achieve group do not differ significantly.

Sara Kuamr, Minnel Kodi and Ponamblathiy agarayan (2007) conducted "A study on Achievement in Science related to Scientific Aptitude and Scientific Attitude".

The information given in this study was relevant to make some important discussion for the education to inculcate the scientific aptitude and attitude towards the students' community, as it was needed for the developing scientific and Technological world. From this point, it conduced that this study was very useful to all of us we education think to improve the scientific environment among the students of the future.

Sukhwant Bajwa and Monika Mahajan (2009) conducted a study on "Scientific Attitude in Relation to Family Environment and Gender".

Every citizen should develop a scientific attitude to make intelligent decisions and for solving personal as well as environmental problems. Major objectives was to study the relationship between scientific attitude and family environment. To test whether there is any significance difference between boys and girls on variable of scientific attitude. The findings revealed that there exists no significant difference between boys and girls on the variable of scientific attitude.

Yadav and Bharathi (2007) conducted a study on "The Relationship between Environmental Awareness and Scientific Attitude among Higher secondary students".

The major objectives of the study were the study of the nature and extent of environmental awareness among higher secondary students and factors affecting it and the relationship between environmental awareness and scientific attitude. The study revealed that age, sex, place of residence, family

status, parents education affect environmental awareness of higher secondary students. The environmental awareness was related with scientific attitude.

Sivakumar et.al (2007) conducted a study on "Achievement in Science as related to Scientific Aptitude and Scientific Attitude of IX standard students".

The present study explores the relationship between scientific aptitude and scientific attitude. The objectives was to explore the relationship among variables namely achievement in science. Scientific aptitude and scientific attitude. To investigate the association and variations between achievement in science. Scientific aptitude and scientific attitude. The findings showed the negative correlation between achievement in science and scientific attitude. Students from rural and urban area had similar scientific aptitude. Students from matriculation and state board schools had some type of achievement score in science but they differ in their scientific aptitude and scientific attitude favoured students from matriculation schools.

Anice James and Marice (2004) conducted a study on "Achievement in Science as related to Scientific Aptitude and Scientific Attitude among IX standard students in Tamil Nadu"

To explore the relationship among the variables namely achievement in science, scientific aptitude and scientific attitude. The findings revealed that positive correlation among achievement in science and scientific aptitude. No

significant relation between scientific attitude and achievement in science was observed.

Turpin and Jordan (2000) conducted a study on "Effects on Science Content Achievement, Science Process Skills and Attitude towards Science".

To investigated activity based science curriculum on science content achievement, science process skills and attitude towards science. The experimental group have higher posttest mean scores on the process skills than the control groups. When specific science skills were examined that experimental groups adjusted posttest means of the experimental group and control group was not significant.

FOREIGN SUDIES

Grazia Buccheri, Nadji Abt Gurber, Christian Bruhwiler (2011) conducted a study on "The Impact of Gender on Interest In Science Topics and the Choice of Scientific and Technical Vocations".

Many countries belonging to the Organization for economic Co-operation and Development (OECD) not a shortage of highly qualified scientific technical personal, whereas demand for such employees in growing. Therefore, how to motivate (female) high performers in science or mathematics to pursue scientific careers is of special interest. The sample for this study in taken from the programme for International student Assessment (PISA) 2006. It comprises 7819 high performers either in science or mathematics from representative countries of four different education systems which generally

performed, well or around the OECS average in PISA 2006. Switzerland, Inland, Australia, and Korea. The results give evidence that gender specificity and gender inequality in science education are a cross-national problem. Interests in specific science disciplines only partly supports vocation choices in scientific technical fields. Instead, gender and gender stereo types play a significant role. Enhancing the utility of a scientific vocational choice in expected to soften the gender impact.

Doherty and Michael Hugh Ed.D (2010) conducted a study on "The Effect of Daily Graded Reflective Journaling on Gains in Conceptual Understanding and the Scientific Attitude towards Conceptual Understanding for High school students studying Newtonian Mechanics".

Literature in presented that establishes student misconceptions are an obstacle to the development of conceptual understanding Newtonian with the Hake gain analysis, in the accept metric within the Physics Educational Research Community for measuring gain in conceptual understanding of Newtonian Mechanics and the effectiveness of instructional methodology. The force concept Inventory coupled with the Hake gain calculation revealed that for the physics students and the honors physical science students that engaged in reflective journaling focused on the concepts being studied and how those concepts compared to their existing understandings achieve significant gains in conceptual understanding of Newtonian Mechanics.

The change in the scientific attitude towards conceptual understanding that took place over the duration of the study was also investigated. No significant change was found to have occurred regarding thin variable for the major sub-groups of this study, although females seemed to derive greater benefits than males through engaging in daily, graded, reflective Journaling.

Impact on students of either gender and from two learning streams, both cognitively and affectively.

Munro Jessica, Stansbury Jeffrey Tsai (2010) conducted a study on "A Causal Role for Negative Affect: Misattribution in Biased Evaluations of Scientific Information".

The role of negative effect as a potential causal mechanism under lying the tendency for prior attitudes to bias evaluations of scientific information was investigated using a misattribution of affect manipulation. Participant read scientific studies that disconfirmed prior beliefs. Half the participants were given the opportunity to misattribute any negative affect to poor room conditions (study 1) or caffeinated water (study 2). All participants than evaluated the methodological quality of the scientific information. Those in the misattribution condition evaluated the information more positively than those in the control condition. In study 2. No differences were found for participants reading confirming information. The role of affect in attitude resistance in discussed.

Renata Clerici (2008) conducted a study on "Knowledge and Attitudes of Future school teachers in the Scientific Mathematical Sphere: Some Evidences for Italy".

Analysis of the university careers of students who are training to become primary school teachers has shown that a certain number have real difficulty in passing examinations in the scientific and methodological fields. This paper uses both objective and subjective data to analyze the level of competence in this cultural field, and the propensity towards certain disciplines. Competence in scientific subjects among these students varies considerably, but the greatest concern is a widespread negative attitude towards the quantitative sciences. To transform this approach the way in which these are taught to future teachers required considerably improvement, by means of projects and programs which take into consideration awareness of this background, that in the attitude of "fighting shy" from both cognitive and affective view points.

Imelda Caleon, Subramaniam, (2005) conducted a study on "The Impact of A Cryogenics-Based Enrichment Programme on Attitude towards Science and the Learning of Science Concepts".

This study explores the impact of a cryogenics based enrichment programme, which involves demonstrations that use liquid nitrogen, on attitudes towards science and the learning of science concepts; the findings presented in this paper are based on a sample of 214 fifty grade students from two schools in Singapore who had their enrichment lesson in a subzero

temperature science centre as more enjoyable and acquired more interest in wanting to pursue science careers after experiencing the Cryogenics based enrichment programme, but no remarkable and conclusive change was detected in their perceptions of the social implications of science. Significant knowledge gains were also detected among the participants. The programme did not have any differential impact on students of either gender and from two learning streams, both cognitively and affectively.

Michacl, Reiss January (2004) conducted a study on "Student Attitudes towards Science: A long – Term perspective".

In this study the attitudes of 4 students, 2 boys and 2 girls, towards science were followed over the course of 6 years. Data were obtained in two ways: first and principally, the students were interviewed annually in their homes from the ages of 11 to 16 years and again at the age of 17, one year after the ending of their compulsory schooling; and secondly, the students were observed during their science lessons in an English state (non-free-paying) school, from 1994 to 1999. Each student attitudes towards science and her/his experience of her/his school science education are described by means of quotations and episodic biographical vignettes. These allow us to track the ways in which the student's attitudes about science developed over the course of the study. The findings help to shed light on the reasons why many students lost interest in science during the course of their secondary science education.

STUDIES RELATED TO PROCESS SKILLS IN SCIENCE

Jasmin Agnal (2012) conducted a study on "Relationship Between Creativity and Science Process Skills of Secondary school students".

The present study explores the relationship between creativity and science process skills of secondary school students. A sample of 400 students studying IX and X standard were selected from this study. The major objective of the study were, to find out any difference between creativity and science process skills bases on sex, locality, type of school and level of creativity. The findings showed the secondary school students have average attainment of various process skills. Creativity and process skills are positively correlated.

Anu Supriya (2012) conducted a study on "Scientific Aptitude and Scientific Attitude of Higher Secondary School students".

To find out the scientific aptitude and attitude of higher secondary students based on gender, locality, type of school, Educational qualification and monthly income. The findings revealed that gender and locality influenced on scientific aptitude and not in scientific attitude. Monthly income influenced on scientific attitude and scientific aptitude.

Aruna and Sumi conducted a study on "Effectiveness of Process Approach in Science on Attitude towards Science and Process Skills in Science".

The objectives are mean scores of attitude towards science and process skills in science of pretest and post test scores. From the findings it is evident that the process approach in science is superior to the constructivist model of teaching for increasing attitude towards science and process in science. The new approaches help the teacher to increase his/her knowledge about outcome of teaching. In ordinary classroom teaching model, there may not been much emphasis on the development of process skills.

Manoj and Devanathan (2011) conducted a study on "Science Process Skills in Relation with Scientific Attitude".

The present study was probed to find the relationship between science process skills and scientific attitude. The investigator used random sampling method. The findings showed the problem. Based learning strategies significantly enhance process skills in Biological science. Process skills in Biological science and scientific attitude are positively correlated. Problem based learning has bearing on improving scientific attitude of students at secondary level.

Puspha (2011) conducted a study on "Scientific Aptitude and Process Outcomes in Biology of Eleventh standard students".

The present study dada was collected using a self constructed tool. The result of the present study revealed that the eleventh standard students had average level of scientific aptitude and various process skills. Sex, locality and community has influenced on this study. Scientific aptitude and process

outcomes in Biology of eleventh standard students are positively and significantly correlated with each other.

Ramnath and Sivakumar (2011) conducted "A study on Constructivism Based Learning Strategy in Enhancing the Science Process Skills of the students of Secondary schooling".

The major objectives are to find out the difference between boys and girls in the mean scores of science process skills. To find out the relationship between science process skills and achievement in science of secondary school students. The findings showed that constructivism based learning strategy enhances the science process skills. Gender has no influence in enhancing science process skills through constructivism based learning strategy. Science process skills and achievement in science of the students have significant relationship between each other. Hence, it was concluded that enhancement in science process skills in equally proportionate to achievement in the science subject.

Sumi and Aruna (2011) conducted a study of "Effectiveness of Process Approach in Science on Attitude towards Science and Process Skills in Science".

To compare the mean pretest scores of attitude towards science of the experimental and control groups. To compare the mean posttest scores of attitude and process skills in science towards science of the experimental and control groups. The feelings are process approach in science is superior to the

constructivist model of teaching for increased attitude towards science process skills in science. Process approach helps the teachers to increased his/her knowledge about the outcome of teaching. The development of science process skills helped students to nature a new world in their learning.

Manoj and Devanathan (2011) conducted a study on "Effectiveness of Problem Based Learning Strategies on Science Process Skills in Relation with Scientific Attitude".

The objectives are, develop suitable learning materials based on problem based strategy. To develop suitable teaching materials to measure the process skills in Biological science. To compare the process skills in Biological Science of pupils taught through problem-based learning strategy with that of pupils taught through conventional method. To find out the correlation between process skills in Biological Science and Science interest in students taught through problem-based learning strategy and to study the effects of the strategy on scientific attitude. The findings revealed that the problem-based learning strategies significantly enhance process skills in Biological Science. Process skills in Biological Science and scientific attitude are positively correlated. Problem-based learning has bearing on improving scientific attitude of students at secondary level.

Saranya (2010) conducted a study on "Relationship between Scientific Aptitude and Process Outcomes in Physics of Higher Secondary students".

To construct and validate a test of process outcomes in Physics. To study the level of scientific aptitude of higher secondary students. To study the understanding of science process skills of higher secondary students. To find out if there is any difference in higher secondary students, scientific aptitude based on sex, locality and type of school. To find out if there in any difference in higher secondary students process outcomes in physics based sex, locality, type of school and level of scientific aptitude. To find out the relationship between the scientific aptitude and process outcomes in physics of higher secondary students. The findings are the higher secondary students have low scientific aptitude. The higher secondary students have average understandings of various process skills. Sex, locality and type of management of the school have influence on the scientific aptitude of higher secondary students. Sex, locality, type of management and scientific aptitude have influence on the process outcomes in physics of higher secondary students. Scientific aptitude and process outcomes in physics of higher secondary students are positively and significantly correlated with each other.

Kun-Yuan Yang and Jia-sheng Heh (2007) conducted a study on "The Impact of Internet Virtual Physics Laboratory Instruction on the Achievement in Physics, Science Process Skills and Computer Attitudes of 10^{th}- Grade students".

The objective was to investigate and compare the impact of Internet Virtual Physics Laboratory (IVPL) instruction with traditional laboratory instruction in physics academic achievement, performance of science process

skills and computer attitudes of tenth grade students. The pre-test results indicated that the students entry-level physics academic achievement, science process skills, and computer attitude were equal for both group. On the post-test, the experimental group achieved significantly higher mean scores in physics academic achievement and science process skills.

Paul J. German (2006) conducted "A study on Directed Inquiry Approach to Learning Science Process Skills: Treatment Effects and Aptitude – Treatment Interactions".

The study was to help high-school students gain the critical thinking skills required to solve problems in the biology lab. The experimental group received the DIAL (SPS)2 treatment while the comparison group received a more traditional approach. The DIAL (SPS)2 curriculum had no significant effect on the learning of science process skills or on cognitive development. Aptitude-treatment interaction analysis revealed an interaction of DIAL (SPS)2 treatment and cognitive development.

Aruna (2006) made "A study on Process Outcomes in Science and Intelligence".

To find out the difference in mean scores of process outcomes in science for the sample of Boys and Girls, Private and Government. To find out the difference in mean scores of intelligence in science for the sample of Boys and girls, Private and Government. To find out the relationship between the process outcomes in science and intelligence. The findings revealed that sex

has some significant effect on the process out comes in science of secondary school pupils. Management has no contribution in the development of process outcomes in science of secondary school pupils. The relationship between the process outcomes in science and intelligence in positive.

Aruna (2004) made "A study on Process Outcomes in Science and Classroom Climate".

The objectives are, to find out the relationship between the process outcomes in science and classroom climate for the total sample and relevant sub samples based on sex, locality and management. To compare the mean values of process outcomes in science of secondary school pupils in the sub samples classified on the basis of sex, locality and management. The results shows that there exists positive relationship between the process outcomes in science and classroom climate. Process outcomes in science of girls were found to be superior to boys. Locality has no contribution in the development of process outcomes in science. Government school pupils score higher in process outcomes in physics than private school pupils.

Ambuli (2004) made a study on "Relationship between Intelligence and Process Outcomes in Physics of Secondary school students".

To construct and standardize a test of process outcomes in Physics. To study the understanding of science process skills of secondary school students. To find out if there is any significant difference in secondary school students process outcomes in Physics based on sex, locality, type of school and level of

intelligence. To find out the relationship between intelligence and process outcomes in Physics of secondary school students. The secondary school students have average understanding of various process skills. Sex, locality, type of management and intelligence have influence on process outcomes in Physics of secondary school students. Intelligence and process outcomes in Physics of secondary school students are positively and significantly correlated with each other.

Ruffin and Aisha (2003) conducted "A study on the Acquisition of Inquiry Skills and Computer Skills by VIII grade Urban Middle schools in a Technology Supported Environment".

To examine the acquisition of computer skills and inquiry skills by urban eighth grade students in a technology supported environment. To study specifically focuses on students ability, to identify, understand and work through the process of scientific inquiry, while also developing computer technology tool skills. After the treatment students acquired more inquiry skills and computer skills. Broadened there basic conceptual understanding and perceptive about science. Engaged actively in a relevant learning process. Created tangible evidence of their inquiry skills and computer skills. Recalled and retained more details about the inquiry process and the computer technology tools.

Meade and Karen (2002) made a study on "The Effect of Inquiry Instruction on student Learning in Technology based Undergraduate Chemistry Laboratories".

The major purpose of the study was to identify conceptual and attitude effect of inquiry learning in Technology based undergraduate chemistry laboratories. Pretest and post test conceptual gains were significant for both treatment groups. Low inquiry students performed significantly better on exploration questions than high inquiry students. Process skills developed at higher levels for high inquiry students than low inquiry students. Positives attitudes decreased significantly for all students from pretest to post test.

Celene Joseph (2001) conducted a study on "Process Outcomes in Physics in relation to select Affective Correlates of Secondary school students".

To test whether the select affective variables could discriminate significantly among the three levels of achievement (HAP) High Process Achievers, (APA) Average Process Achievers and (LPA) Low Process Achievers through paired comparisons of the mean scores of there groups. To find out the extent of relationships of process outcomes in physics with the selected affective variables.

Key styniak (2001) conducted a study on "The Effect of Participation in an Extended Inquiry Project on General Chemistry Student Laboratory Interactions, Confidence and Process Skills".

To study the effect of participation by second semester chemistry students in an extended open inquiry laboratory investigation on their use of science process skills and confidence in performing several aspects of laboratory investigation. To investigate the verbal interaction of a student lab term among team members and with their instructor over three open inquiry laboratory sessions and two non inquiry sessions. The participation in open inquiry laboratory increases student confidence and for some students, the ability to use science process skills. Evidence documents differences in student laboratory interactions and behavior that are attributes to the type of laboratory experience.

Maidon and Carolyn (2001) conducted a study on "Comparison of the Fifth Grade Elementary School Science Research Based Curriculum and Activity Centered Traditional Curriculum-Effect of Conceptual Knowledge, Process Skills and Attitude.

The major objectives of the study was to examine the student outcomes of process skills, conceptual knowledge and attitudes of a research based, model curriculum (SLL) as defined by the National Center for improving science education (NSISE) and science Curricula (ACTS). The students taught with SLL curriculum scored significantly higher on the fifth grade science End of Grade (EOG), the BAPS (Basic Process Skills than those taught with ACTS program. The outcomes provided on evidence that the research based curriculum promoted a higher level of conceptual development and

process skill attainment and developed more positive attitudes than the students in the activity centered traditional science program.

Ida Nancy (2001) made a study on "The Relationship of Different Dimensions of Study Habit with Process Outcomes in Biology of IX standard students".

To find out the relationship between different dimensions of study habits and process outcomes in Biology for the whole sample and the relevant subsamples bases on sex, locality, management category of the school. To find out the ability of the independent variable (study habit) to discriminate between the three levels of process outcomes namely "high", "average", and "Low" through paired comparisons of the mean scores of three groups using t-tests for the whole sample. To develop a multiple regression equation for predicting process outcomes in Biology in terms of independent variables which correlate high with process outcome (by ANOVA approach). A positive correlation was found to exit between the study habit and process outcome in Biology for the whole sample and the relevant subsamples based on the sex of the students, locality of the school and management category of the school. Various dimensions of study habit investigated also showed significant positive correlation with the process outcomes in the case of whole sample and most of the subsamples. But the correlation obtained were not significant in the case of home environment, planning of the work and planning of subjects in the subsamples namely government and urban school students respectively.

Dana Lisa Ann (2001) conducted a study on "The Effects of the Level of Inquiry of Secondary Science Laboratory Activities on Students Understanding of Concepts and Nature of Science, Ability to use Process Skills and Attitude towards Problem Solving".

The major purpose of the study was to create the situated laboratory instrument (SLAI) that clearly defines various levels of inquiry based upon scientific category of teacher student behaviors. The SLAI was utilized in a preliminary study in a public high school of the effects of various levels of inquiry teaching on students understanding of concepts and the nature of ability to use process skills and attitude towards problem solving.

Turpin and Jordan (200) conducted a study of "Effects of an Integrated Activity Based Curriculum on student Achievement of Science Process skills and Science Attitudes".

To investigated activity based science curriculum on science content achievement, science process skills and attitude towards science. The experimental group have higher post test mean score on the process skills than the control group. When specific science skills were examined that experimental group's adjusted post test mean score was significantly higher than that of the control group on the science process skills of identifying variables, designing investigations and interpreting data. The experimental group and the control group showed on significant differences in adjusted post test means on the science process skills of formulating hypothesis and graphing

data. The adjusted post test means of the experimental group and control group were not significantly different.

Kasinath (2000) conducted a study on "Effectiveness of Inquiry Method of Teaching Science in Fostering Science Process Skills.\, Creating and Curiosity".

To study the effectiveness of ITM (Inquiry Training Method) interns of its instructional and nurturing effects. Experimental and controlled groups were alike with regard to dependent variables i.e, science process skills, creativity, fluency, flexibility, originality and curiosity. The significant interaction between the treatment and levels of intelligence in fostering science process skills suggested that differentiating variance was contributed by both, there by sub doing the exclusive effect of each of them separately. ITM method of teaching was more effective than conventional method in fostering 'fluency', similarly, levels of intelligence contributed differentially to its development. ITM was more effective in fostering originality than CM. However levels of intelligence did not contributed differentially to its fostering. ITM was more effective in fostering curiosity than CM. However levels of intelligence did not contributed differentially to its fostering. The gains occurred in the dependent variables. Science process skills, creativity and curiosity (except flexibility) though ITM were sustained by the students.

CHAPTER - III

METHODOLOGY

Method adopted for the present study

Normative survey method

Purpose and uses of survey method

Characteristics of normative survey method

Population of the study

Sample of the study

Tools used

Personal data sheet

Description of process skills in science test

Scientific attitude scale

CHAPTER III

METHODOLOGY

Research is a systematized effort to gain new knowledge. Research simply seeks the answer to certain questions which has not been answered so far and the answer depend upon human efforts. According to George J. Mouly "Research in a systematic and scholarly application of the scientific method". It involves more systematic structure of investigation usually resulting in some sort of formal record of procedures and a report of results and conclusions.

Research is oriented towards the discovery of relationship that exists among phenomena of the world in which we live. Research in the most important process of advancing knowledge for promoting progress and to enable man to relate more effectively to his environment to accomplish his purpose and to resolve his conflicts. So research in not only a way but it in one of the most effective ways of solving scientific problems.

Research methods may be understood as all those methods techniques that are used for condition of Research. Research methods or techniques, thus refers to the methods the researcher use in perform research operations. In other words, all those methods which are used by the researcher during the course of studying has research problems are termed as research problems are termed as research methods.

George J. Mouly has classified research methods into 3 basic types.

i) Historical Method

ii) Survey Method

iii) Experimental Method

METHOD ADOPTED FOR THE PRESENT STUDY

The present study attempts to explore the study of scientific Attitude and Process skills in science of high school students. Since the problem selected in concerned with survey type the investigator has selected the normative survey method for conducting the present study.

NORMATIVE SURVEY METHOD

The word 'survey' has been derived from the words 'sur' or 'sor' and 'veeir' or 'veior' which means over and see respectively. Normative Survey deals with "What in?". Its scope in very vast. It describes and interprets what exists at present. In a normative survey we are concerned with conditions or relationships that exist practices that prevail, beliefs, points of view or attitudes that are held-, process that are going on, influences that are being felt and trends that are developing. This type of research in described by various terms such as "Normative", "Descriptive", "Survey" or trend.

CHARACTERISTICS OF NORMATIVE SURVEY METHOD

i. It is essentially cross sectional.

ii. It gathers data from a relatively large number of cases at a particular time.

iii. It deals with clearly defined problems and has definite objectives.

iv. It provides information useful to the solution of local problems.

v. Surveys may be qualitative or quantitative.

POPULATION OF THE STUDY

The population of the study consists of all the students studying IX and X standard in the high school students of Kanyakumari District.

SAMPLE OF THE STUDY

A sample in a small propotion of a population selected for the observation and analysis. The sample for the present study consisted of 400 high school students studying in different schools of Kanyakumari District. The investigator has adopted stratified random sampling method. The details of the sample selected for the present study are given in the following table.

Table : 3.1 Details of the Sample Selected For The Present Study

SI. No.	**Name of the School**	**Rural/ Urban**	**Govt/ Aided**	**Boys**	**Girls**	Total
1.	Govt Girls H.S.S, Marthandam	Urban	Govt	-	25	25
2.	Govt H.S.S, Thuckalay	Urban	Govt	17	20	37
3.	Govt H.S.S, Kattathurai	Urban	Govt	15	23	38
4.	Govt H.S.S, Kollemcode	Rural	Govt	17	29	46
5.	Govt H.S.S, Thengaipattnam	Rural	Govt	24	32	56
6.	C.S.I. VV H.S.S, Irenipuram	Rural	Aided	23	25	48
7.	St, Joseph's H.S.S, Mulagumoodu	Rural	Aided	20	21	41
8.	LMS Boys H.S.S, Marthandam	Urban	Aided	20	-	20
9.	St, Mary's H.S.S, Colachel	Urban	Aided	18	22	40
10.	St, Aloysius Higher Secondary School, Marthandam Thurai	Rural	Aided	24	25	49
	Total			**178**	**222**	**400**

Percentage wise distribution of Sample

Table: 3.2 Gender wise Distribution

Gender	**Count**	**Percentage**
Male	178	44.5%
Female	222	55.5%
Total	400	100%

Table 3.3 Locality wise Distribution

Locality	Count	Percentage
Urban	160	43.25%
Rural	240	56.75%
Total	400	100%

Table 3.4 Type of school wise distribution

Type of School	Count	Percentage
Government	202	50.5%
Aided	198	49.5%
Total	400	100%

Table 3.5 Fathers' Educational Qualification wise distribution

Fathers' Educational Qualification	Count	Percentage
Below SSLC	160	40%
SSLC-HSC	105	26.25%
UG	60	15%
PG	40	10%
Professional	35	8.75%
Total	400	100%

Table 3.6 Mothers' Educational Qualification wise distribution

Mothers' Educational Qualification	**Count**	**Percentage**
Below SSLC	155	38.75%
SSLC-HSC	100	25%
UG	65	16.25%
PG	45	11.25%
Professional	35	8.75%
Total	400	100%

Table 3.7 Parents' Monthly income wise distribution

Monthly Income	**Count**	**Percentage**
below 5000	160	40%
5000- 10000	150	37.5%
Above 10000	90	22.5%

TOOLS USED

For each and every type of research, we used certain instruments to gather new facts and explore new fields. Such instruments are called tools. In order to measure the scientific attitude and process skills in science of high school students, the investigator used the following tools.

1. Personal data sheet
2. 'Scientific Attitude scale' (prepared by Uma Maheswari .R and Bright .C 2013).

3. ‘Test of Process skills in science’ (prepared and validated by Mrs. Jasmine Agnal .A and Dr. Minikumari, V.S, 2012).

PERSONAL DATA SHEET

The personal data sheet is used to collect personal information. Such as their name, sex, standard, name of the school, community, type of school, parental qualification and monthly income of the family. A copy of personal data sheet in given in Appendix. A.

SCENTIFIC ATTITUDE SCALE

To measure the scientific attitude of IX standard students, the investigator used Likert’s type attitude scale for developing the attitude scale. The investigator used the method of Likerts item analysis for validation of the scale. The development and validation of attitude scale includes the following steps.

i) Collecting of statements
ii) Screening of the statements
iii) The draft scale and its administrations
iv) Instruction of scoring
v) Item analysis
vi) Selecting the final test of statement
vii) Establishing reliability and validity

a) Collection of statements

The first step in the construction of the tool in the collection of statements regarding the problem under study. The investigator collected ideas from journals, magazines, new papers, educational reports and books. By making use of there, 50 statements were prepared in the draft of scientific Attitude scale. The scale consists of positive and negative statements.

b) Screening of the statements

The draft scale was submitted to the guide and experts in the field of education and psychology to judge the suitability of items. According to the suggestion given by the guide a few statements which seemed to overlap with one another were rejected. The vague items were revised and 40 statements were selected for the scientific attitude scale. The trail from contains both selected were arranged in a random order. The draft from of scientific attitude scale was then selected as the final one.

c) The draft scale and its administrations

The draft inventory consisting of 40 items was administered to a sample of 400 students who were randomly selected from the population statements related to attitude towards science were given in the scale each statements has five choices viz, “Strongly agree”, “Agree”, “undecided”, “Disagree” and “Strongly Disagree”. Students were instructed to read each of the questions carefully and answer them by think as appropriate for themselves.

d) Instruction for Scoring

The scoring was done as follows a score of 5,4,3,2,1 was given to the category for a positive statements. The score in reversed for negative statements. The score of attitude scale in the total of the score obtained for all the items.

e) Item Analysis

The procedure of Likert's analysis as follows:

i) The two response sheet of the subject were arranges according to the order of the magnitude of the total scores, the highest score being at the top, than the next lower and soon. This enabled the investigator to retest the top and bottom 200 subjects. Who represented the high and low group of subjects.

ii) Those subjects with the top 50 percentage of all total scores may be considered to have most favorable attitude and those with the lowest 50 percentage of all the total score may be considered to have the least favorable attitude.

iii) The mean score for each statement in calculated separately in two groups.

The following Table: 3.2 illustrate this method calculation of mean for one statement for the 2 group with the most favorable and the least unfavorable attitude towards science.

TABLE : 3.8 Calculation of mean for one statement for the 2 group with the most favorable and the least unfavorable attitude towards science.

Response category	Scale Value x	High Group		Low Group	
		F	fX	f	fX
Strongly agree	5	50	250	20	100
Agree	4	31	124	22	88
Undecided	3	11	33	8	24
Disagree	2	5	10	17	34
Strongly Disagree	1	3	3	23	23
Total	**15**	**100**	**420**	**100**	**269**

$\bar{x}$ H = $^{420}/_{100}$ = 4.20

$\bar{x}$ L = 269/100 = 2.69

$\bar{x}$ = $\bar{x}$ H - $\bar{x}$ L = 4.20 – 2.69 = 1.51

Finally all the statements are ranked according to their differences in mean scores. Those will mean difference near zero are consider to poor and therefore eliminates.

f) Selecting the final list of statements

Using Likert's item analysis method, 50 items were selected. Items with mean differences near to zero are considered poor and eliminated and item with mean differences one or more than one are selected for final scientific attitude scale. Thus the final attitude scale consists of 40 items. These item selected were shown with*.

TABLE: 3.9 DETAILS OF SELECTED ITEM FOR SCIENTIFIC ATTITUDE SCALE

SI.No.	STATEMENTS	VALUE	ITEM SELECTED
1.	Scientific facts can be changed	0.17	
2.	Working in a science laboratory in very interesting.	1.51	*
3.	Search of scientific knowledge in waste of time.	1.25	*
4.	Scientists are very intelligent people.	1.02	*
5.	Scientific inventions help for better living.	0.85	*
6.	Scientific discoveries are harmful to human life.	0.83	*
7.	Scientific laws are verified under natural setting.	0.15	
8.	Science in my favorite subject.	0.73	*
9.	All the Phenomena cannot be verified.	0.73	*
10.	Learning science develops critical thinking.	0.77	*
11.	Science lessons are interesting.	0.79	*
12.	Scientists cannot answer all the questions in the universe.	0.88	*
13.	I like to work with scientists.	0.85	*
14.	It would prefer to perform experiments rather than reading books.	0.81	*
15.	Most of the people cannot accept the scientific truths.	0.85	*
16.	I am very curious to know about the universe.	1.10	*
17.	Scientists need scientific aptitude.	0.97	*
18.	Working in a science laboratory in very hazardous human health.	0.93	*
19.	Al happenings in the universe are based on science.	0.26	

20.	Scientists report the facts through experiments.	1.11	*
21.	Scientists cannot have a peace of minor.	0.73	*
22.	Scientific study needs creativity.	1.20	*
23.	All the electronic inventions are valuable products of science.	0.91	*
24.	I get bored when watching science programs on TV.	0.85	*
25.	Sometimes science fails to explain how things happen.	0.11	
26.	Scientific knowledge destroys human values.	0.13	
27.	Scientific works are highly expensive.	0.46	
28.	Diseases can be cured by prayer than by medicines.	0.78	*
29.	Scientific thinking is necessary for the solution of problem of life.	0.41	
30.	Scientists are naturally less friendly.	0.87	*
31.	There are no such things as absolute facts.	0.22	
32.	All the verified facts cannot be applicable to human life.	0.41	
33.	Astronomical Phenomena are beyond human control.	1.13	*
34.	Life of man cannot be improved by the knowledge of science.	0.90	*
35.	Progress of a nation depends on its scientific progress.	0.09	
36.	For common people knowledge of science in not very essential.	0.83	*
37.	It is better to read some journals than participating in science fairs.	0.84	*
38.	Science by its nature in hostile to women.	0.78	*
39.	Hunting animals and birds leads to the ecological imbalance.	0.85	*
40.	Learning of science destroys students' cultural and moral values.	0.70	*
41.	Scientific facts are used in everyday life.	0.54	*

42.	Expert astrologists cold find out the truths that scientists could not.	0.65	*
43.	Learning science leads to scientific inquiry.	0.86	*
44.	Earth quake in caused by the Goddess of anger.	0.97	*
45.	Only scientific knowledge prevents environmental hazards.	0.63	*
46.	Scientific principles are verified by experimentations.	0.90	*
47.	Doing Experiments in not as good as finding out information from teachers.	0.92	*
48.	Learning science develops good health habits.	1.37	*
49.	Scientific methods are not useful to the public.	0.80	*
50.	Scientific knowledge in essential for healthy living.	0.76	*

Vii) Establishing Validity And Reliability of the Scale Validity

To establish content validity, the draft tool was submitted to the guide and experts in N.V.K.S.D. College of Education, Attoor. In accordance with their suggestions and opinions, the investigator deleted some items and modifies a few. Thus the contents validity of the tool was established along with if face validity of the tool was established by the exports opinion.

Reliability

Reliability in the accuracy or precision of measuring instrument. It is the degree to which measures are free from error and therefore yield consistent results. In this present investigation the reliability was found out by split half method. It measures the degree of homogeneity of the item in a test. For

calculating the split half reliability, the scores obtained by a sample of 100 high school students. The scores of odd items and even items were taken separately and correlations were calculated. Using Pearson's product co-efficient formula the reliability of the whole test was found out to be 0.71.

DESCRIPTION OF PROCESS SKILLS IN SCIENCE TEST

The variable of process skills in science was measured by using a standardized process skills in science test prepared by Jasmine Agnal.A and Dr. Minikumari V.S. and (2012). It consists of 47 questions. The questions are multiple choice type. Four alternatives were given to each question. Based on various science process skills. The process skills in science enunciated by Thannenboum (1971).

The process were

1. Observing
2. Comparing
3. Classifying
4. Quantifying
5. Measuring
6. Experimenting
7. Inferring
8. Predicting

The above mentioned process were selected by the investigator because there are fundamental and basic to all other process skills. The questions

selected by difficulty index and discriminating power. The scoring will be numerical carried out by each question have one mark. Reliability of the tool is found to be 0.72. Also the tool possessed adequate face and content validity.

ADMINISTRATION OF THE TOOL

For administration of test, the investigator visited 10 schools as per the schedule fixed. The permission for administering the tool was obtained from the headmaster of all schools. Before administering the test, the investigator explained, the purpose of her study. The respondents were given a copy of "Scientific Attitude Scale", "Process Skills in Science Test" and Personal data sheet. The investigator explained the directions clearly. The response sheets were collected from the respondents after marketing the responses. Depending of the facts supplied by the analysis has be made.

STATISTICAL TECHNIQUES USED

For the analysis of data collected, following statistical techniques Arithmetic mean, standard deviation, t-test, ANOVA and Product moment method of correlation Co-efficient were adopted.

1. Arithmetic Mean

Arithmetic Mean $\bar{x} = A + \frac{\sum fd}{N} \times C$

Where,

$\bar{x}$ = Arithmetic Mean

A = assumed mean of the scores obtained

f = frequency of each class interval

d = deviation of scores from the assumed mean

N = total frequency

C = class interval

2. Standard deviation

Standard deviation (σ) = $C\sqrt{\frac{\sum df^2}{N} - \left(\frac{\sum fd}{N}\right)^2}$

Where,

d = deviation of the scores from the assumed mean

c = class interval

f = frequency of each class interval

N = total frequency

3. t-test

The test of the significance of the difference between two mean in known as 't' test.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}$$

Where,

$\bar{X}_1$ = Arithmetic mean of the first group

$\bar{X}_2$ = Arithmetic mean of the second group

σ_1 = Standard deviation of the first group

σ_2 = Standard deviation of the second group

N_1 = Total number in the first group

N_2 = Total number in the second group

4. ANOVA

$$F = \frac{MSb}{MSw}$$

Where,

MSb = Mean Square Varian's between groups.

MSw = Mean Square Varian's within groups.

5. Co-efficient of correlation

Pearson's product Moment correlation

$$r = \frac{N . \sum XY - \sum X . \sum Y}{\sqrt{\left[N \sum X^2 - (\sum X)^2\right] x \left[N \sum Y^2 - (\sum Y)^2\right]}}$$

Where,

r = the Pearson's product moment correlation co-efficient

N = total number of pairs of x and y

X = row scores of the x - variable

Y = row scores of the y - variable

CHAPTER - IV

ANALYSIS AND INTERPRETATION OF DATA

Scientific attitude of high school students based on background variables

Process skills in science of high school students based on back ground variables

Tenability of hypotheses

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

The analysis and interpretation of data is one of the important steps in research process. It is the application of deductive and inductive logic to examine critically the results obtained in the light of the previous studies. Analysis of data means studying the tabulated data in order to determine the inherent facts or meanings. It involves breaking down existing complex factors into simpler parts and putting the parts together in new arrangements for the purpose of interpretation.

In the present study the data collected were analyzed using the following statistical techniques.

1. Arithmetic mean
2. Standard devotion
3. 't' test
4. ANOVA
5. Pearson's Product Moment Correlation

Descriptive Statistics for Scientific Attitude

Table : 4.1 Descriptive statistics for scientific attitude

Mean	133
SD	16.24
Count	400

From the table 4.1, it is clear that the total number of sample selected for the present study was 400. The arithmetic mean scores obtained for the total sample was 133 and standard deviation was 16.24.

Percentage wise distribution of scientific attitude of high school students

Percentage wise distribution of scientific attitude of high school students

Table : 4.2 Percentage wise distribution of scientific attitude of high school students

Scientific attitude	**Count**	**Percentage**
Low	82	20.5
Medium	219	54.75
High	99	24.75
Total	**400**	**100.00**

From the table 4.2, it is clear that 20.5% of high school students possess low scientific attitude. 54.75% possess medium scientific attitude and 24.75% possess high scientific attitude. This indicates that most of the high school students have medium level of scientific attitude.

COMPARISON OF MEAN SCORES OF SCIENTIFIC ATTITUDE OF HIGH SCHOOL STUDENTS BASED ON BACKGROUND VARIABLES

Comparison of mean scores of scientific attitude of high school students based on gender

H_o1: Null hypothesis

There is no significant difference in the mean scores of scientific attitude of boys and girls.

Table : 4.3 Comparison of mean scores of scientific attitude based on gender

Gender	Mean	SD	N	t	Remark
Male	132.19	16.94	178	0.88	Not significant
Female	133.65	15.62	222		

From the above table 4.3 it can be seen that the t value is 0.88, which is not significant at 0.05 level with df 398. It means that there is no significant difference in the mean scores of scientific attitude of boys and girls. Therefore the null hypothesis that there is no significant difference in the mean scores of scientific attitude of boys and girls is accepted. Further from the mean scores of scientific attitude, it can be said that male and female high school students possess same level of scientific attitude.

Comparison of mean scores of scientific attitude based on locality

H_o2 : Null hypothesis

There is no significant difference in the mean scores of scientific attitude of rural and urban high school students.

Table : 4.4 Comparison of mean scores of scientific attitude based on Locality

Locality	Mean	S D	N	T	Remark
Rural	132.33	16.93	240	0.79	Not significant
Urban	133.63	15.42	160		

From the above table 4.4 it can be seen that the 't' value is 0.79, which is not significant at 0.05 level with df 398. It means that there is no significant difference in the mean scores of scientific attitude of rural and urban high school students. Therefore, the null hypothesis that there is no significant difference in the mean scores of scientific attitude of rural and urban high school students is accepted. Further from the mean scores of scientific attitude, it can be said that rural and urban students possess same level of scientific attitude.

Comparison of mean scores of scientific attitude based on type of school

H_o3 : Null hypothesis

There is no significant difference in the mean scores of scientific attitude of government and aided high school students.

Table : 4.5 Comparison of mean scores scientific attitude based on type of management

Type of School	Mean	SD	N	t	Remark
Government	132.58	15.47	202	0.33	Not Significant
Aided	133.13	17.45	198		

From the above table 4.5, it can be seen that the 't'- value is 0.33 which is not significant at any level with df 398. It means that there is no significant difference in the mean scores of scientific attitude of government and aided high school students. Therefore, the null hypothesis that there is no significant difference in the mean scores of scientific attitude of government and aided high school students is accepted. Further from the mean scores of scientific attitude, it can be said that the government and aided high school students possess same level of scientific attitude.

Comparison of mean scores of scientific attitude of high school students based on their fathers' educational qualification.

H_o4 : Null hypothesis

There is no significant difference in the mean scores of scientific attitude of high school students based on their fathers' educational qualification.

Table : 4.6 Comparison of mean scores of scientific attitude of high school students based on their fathers educational qualification

Educational Qualification of father	Mean	SD	Source	Sum of squares	df	Mean squares	F	Remark
Below SSLC	124.88	12.28	Between groups	4474.78	4	1118.70	98.91	Significant at 0.01 level
SSLC-HSC	134.12	14.81						
UG	144.5	16.85	Within groups	4468.17	395	11.31		
PG	138.5	17.20						
Professional	139.64	16.78	Total	8942.95	399			

From the above table 4.6, it can be seen that the 'F'- value is 98.91, which is significant at o.01 level with df 399. It means that there is a significant difference in mean scores of scientific attitude of high school students based on their fathers' educational qualification. Therefore, the null hypothesis that there is no significant difference in the mean scores of scientific attitude of high school students based on their fathers' educational qualification is rejected. Further from the mean scores of scientific attitude of students having educational qualification UG is 144.5 which is significantly higher than that students of educational qualification below SSLC, SSLC-HSC, PG and

Professional level. It may therefore, be said that the students whose fathers' were UG qualified have significantly more scientific attitude than those students whose fathers' who are below SSLC, SSLC-HSC, PG and Professionally qualified. .

The result does not help to identify exactly the pairs of groups which differ statistically. Hence pair wise comparison is used for further analysis.

Table : 4.7 Pair wise comparison of for scientific attitude based on fathers' educational qualification

Qualification of Father	Mean	SD	N	Pair	t-test	Remark
Below SSLC	124.88	12.28	160	AVsB	5.307	Significant At 0.05 level
SSLC-HSC	134.12	14.81	105	BVsC	3.934	Significant at 0.05 level
UG	144.5	16.85	60	CVsD	1.723	No Significant
PG	138.5	17.20	40	DVsE	0.290	Not Sig
Professional	139.64	16.78	35	EVs A	4.923	Sig. at 0.05 level

The result shows that there is significant different among the high school students whose fathers' are below SSLC, SSLC-HSC, and Professional level in their scientific attitude. The other pair whose fathers' having educational qualification UG and PG level do not differ in their scientific attitude. The mean scores of scientific attitude of high school students 144.5 whose fathers' educational qualification UG is significantly higher than that of those who are below SSLC, SSLC-HSC, PG and Professional level with the mean scores 124.88, 134.12, 138.5 and 139.64 respectively. Hence students

father having UG have superior scientific attitude than those fathers' of educational qualification below SSLC, SSLC-HSC, PG and professional level.

Comparison of Mean scores of scientific attitude of high school students based on their mother's educational qualification.

H_o5 : Null hypothesis

There is no significant difference in the mean scores of scientific attitude of high school students based on their mothers' educational qualification.

Table : 4.8 Comparison of mean scores of scientific attitude of high school students based on their mothers' educational qualification

Educational Qualification of mother	Mean	SD	Source	Sum of Squares	Df	Mean squares	F	Remark
Below SSLC	125.34	13.22	Between groups	2375	4	593.75	37.86	Significant at 0.05 level
SSLC-HSC	133.1	15.40						
UG	143.23	14.58	Within groups	6195	395	15.68		
PG	140.28	16.67						
Professional	136.79	18.37	Total	8570	399			

From the above table 4.8, it can be see that the 'F' value is 37.86 which is significant 0.05 level with df 399. It means that there is a significant difference in mean scores of scientific attitude of high school students based on their mother's educational qualification. Therefore the null hypothesis that there is no significant difference in the mean scores of scientific attitude of high school students based on their mother's educational qualification is

rejected. Further, the mean scores of high school students whose mothers' having UG qualification are significantly higher than that of the students whose mothers' qualification are below SSLC, SSLC – HSC, PG and Professional level.

The result does not help to identify exactly the pairs of groups which differ statistically. Hence pair wise comparison is used for further analysis.

Table: 4.9 Pair wise comparison of scientific attitude based on mothers educational qualification

Qualification Mother	Mean	SD	N	Pair	t-test	Remark
Below SSLC	125.34	13.22	155	AVsB	4.148	Sig at 0.05 level
SSLC-HSC	133.1	15.40	100	BVsC	4.2765	Sig at 0.05 level
UG	143.23	14.58	65	CVsD	0.959	NS
PG	140.28	16.67	45	DVsE	0.878	NS
Professional	138.79	18.37	35	EVs A	3.489	Sig at o.05 level

The result shows that there is significant difference in scientific attitude among the high school students whose mothers' having below SSLC, SSLC-HSC, and Professional level. The other pair shows that there is no significant difference in scientific attitude among the high school students whose mothers' having the qualification UG and PG level. The mean scores of scientific attitude of high school students 143.23 whose mothers' educational qualification is significantly higher than that of those who are below SSLC, SSLC-HSC, PG and Professional level with the mean scores 125.34, 133.1, and 136.76 respectively. Hence students' mothers' having UG have superior

scientific attitude than those mothers' of educational qualification below SSLC, SSLC-HSC, PG and Professional level.

Comparison of mean scores of scientific attitude of high school students based on their monthly income.

H_o6 : Null hypothesis

There is no significant difference in the mean scores of scientific attitude of high school students based on their parents' monthly income.

Table: 4.10 Comparison of mean scores of scientific attitude of high school students based on their monthly income

Monthly income	Mean	SD	Source	Sum of squares	Df	Mean squares	F	Remark
Below 5000	126.25	12.73	Between groups	1637.88	2	814.94	71.80	Significant at 0.05 level
5000-10000	136.1	16.83	Within groups	4504.67	397	11.35		
Above 10000	139.61	17.43	Total	6142.55	399			

From the above table 4.10, it can be seen that the F-value is 71.80, which is significant at 0.05 level with df 399. It means that there is a significant difference in mean scores of scientific attitude of high school students whose parents having different monthly income. Therefore, the null hypothesis that there is no significant difference in the mean scores of scientific attitude of high school students based on their parents' monthly income is rejected. Further from the mean scores of scientific attitude of students whose parents having monthly income above 10000 is 139.61 which is significantly

higher than that of scientific attitude of high school students whose parents having monthly income below 5000 and 5000-10000.

The result does not help to identify exactly the pairs of groups which differ statistically. Hence, pair wise comparison is used for further analysis.

Table : 4.11 Pair wise comparison of for scientific attitude based on their parents monthly income

Monthly income	Mean	SD	N	Pair	t-test	Remark
Below 5000	126.25	12.73	160	AVsB	5.79	Sig. of 0.05 level
5000-10000	136.1	16.83	150	BVsC	1.53	NS
Above 10000	139.61	17.43	90	AVsC	6.38	Sig. of 0.05 level

The result shows that there is significant difference in scientific attitude among the high school students whose parents having monthly income below 50000 and above 10000. The other pair that there is no significance difference in scientific attitude of high school students whose parents having monthly income is above 10000. The mean scores of scientific attitude of high school students 139.61 whose parents' monthly income is significantly higher than that of those who are below 5000 and 5000-10000 with the mean scores 126.25 and 136.1 respectively .Hence students parents' having above 10000 have superior scientific attitude than those parents' of monthly income below 5000 and 5000-10000.

PROCESS SKILLS IN SCIENCE OF HIGH SCHOOL STUDENTS

Table : 4.12 Descriptive statistics for process skills in science

Mean	22.7
SD	6.16
Count	400

From the table 4.12, it is clear that the total number of sample selected for the present study was 400. The arithmetic mean scores obtained for the total sample was 22.7 and standard deviation was 6.16.

Table: 4.13 Percentage wise distributions of process skills in science of high school students

Process skills in science	**Count**	**Percentage**
Low	65	16.25
Medium	247	61.75
High	88	22.0
Total	**400**	**100.00**

From the above table 4.13, it is clear that 16.25% of high school students possess low process skills in science. 61.75% of students possess Medium process skills in science and 22% of students possess high process skills in science. This indicates that most of the high school students have medium level of process skills in science.

COMPARISON OF MEANSCORES OF PROCESS SKILLS IN SCIENCE OF HIGH SCHOOL STUDENTS BASED ON BACK GROUND VARIABLES

Comparison of Mean scores of process skills in science of high school students based on gender.

H_o7 : Null hypothesis

There is no significant difference in the mean scores of process skills in science of boys and girls.

Table : 4.14 Comparison of mean scores of process skills in science based on gender

Gender	Mean	SD	N	t	Remark
Male	22.75	6.05	178	0.053	Not Significant
Female	22.73	6.1	222		

From the above table 4.14, it can be that t-value is 0.053 which is not significant at any level with df 398. It means that there is no significant difference in the mean scores of process skills in science of boys and girls. Therefore the null hypothesis that there is no significant difference in the mean scores of process skills in science of boys and girls is accepted. Further from the mean scores of process skills in science, it can be said that male and female high school students possess same level of process skills in science.

Comparison of mean scores of process skills in science based on locality

H_o8 : Null hypothesis

There is no significant difference in the mean scores of process skills in science of urban and rural high school students.

Table : 4.15 Comparison of mean scores of process skills in science based on locality

Locality	Mean	SD	N	T	Remark
Rural	22.56	6.16	240	0.603	Not Significant
Urban	22.94	6.17	160		

From the above table 4.15, it can be seen that t-value is 0.603, which is not significant at any level with df 398. It means that there is no significant difference in the mean scores of process skills in science of rural and urban high school students. Therefore the null hypothesis that there is no significant difference in the mean scores of process sills in science of urban and rural high school students is accepted. Further from the mean scores of process skills in science, it can be said that rural and urban high school students possess same level of process skills in science.

Comparison of mean scores of process sills in science based on Type of school

H_o9 : Null hypothesis

There is no significant difference in the mean scores of process skills in science of government and aided high school students.

Table: 4.16 Comparison of mean scores of process skills in science based on type of school

Type of school	Mean	SD	N	T	Remark
Govt	21.89	5.79	202	1.71	Not Significant
Aided 23.56	23.56	6.4	198		

From the above table 4.16, it can be seen that the t-value is 1.71, which is not significant at any level with df 398. It means that there is no significant difference in the mean scores of process skills in science government and aided high school students. Therefore, the null hypothesis that, there is no significant difference in the mean scores of process skills in science of government and aided high school students is accepted. Further from the mean scores of process skills in science, it can be said that government and aided high school students possess same level of process skills in science.

Comparison of mean scores of process skills in science based on Fathers' educational qualification

H_o10: Null hypothesis

There is no significant difference in the mean scores of process skills in science of high school students based on their fathers' educational qualification.

Table: 4.17 Comparison mean scores of process skills in science based on fathers' educational qualification

Educational Qualification of father	Mean	SD	Source	Sum of squares	Df	Mean squares	F	Remark
Below SSLC	20.59	5.02	Between Groups	1698.6	4	424.65	35.87	Significant At 0.05 level
SSLC-HSC	22.90	5.17						
UG	25.08	6.14	Within groups	4678.16	395	11.84		
PG	24.38	7.83						
Professional	25.36	6.36	Total	6376.76	399			

From the above table 4.17, it can be seen that the F-value 35.87, which is significant at 0.05 level with df 399. It means that there is a significant difference in the mean scores of process skills in science of high school students based on their fathers' educational qualification. Therefore, the null hypothesis that there is no significant difference in the mean scored of process skills in science of high school students based on their parents' educational qualification is rejected. Further from the mean scores of process skills in science of students having educational qualification Professional is 25.36,

which is significantly higher than that of students' educational qualification below SSLC, SSLC-HSC, UG and PG level. It may therefore, be said that the students whose fathers' were Professional qualified have significantly more process skills in science than those students whose fathers' who are SSLS, SSLC –HSC, UG and PG professionally qualified.

The result does not help to identify exactly the pairs of groups which differ statistically. Hence pair wise comparison is used for further analysis.

Table: 4.18 Pair wise comparison of for process skills in science based on fathers' educational qualification

Qualification of father	Mean	SD	N	Pair	t-test	Remarks
Below SSLC	20.59	5.02	100	AVs B	3.592	Sig at 0.05 level
SSLC-HSC	22.90	5.17	105	BVsC	0.872	NS
UG	25.08	6.14	60	CVsD	0.476	NS
PG	24.38	7.83	40	DVsF	0.902	NS
Professional	25.36	6.36	35	EVsA	4.599	Sig at 0.05 level

The result shows that there is significant difference among the high school students whose fathers' having qualifications below SSLC and Professional level in their process skills in science. The other pair shows students whose fathers' having educational qualifications SSLC-HSC, UG and PG do not differ in their process skills in science. It is clear that the mean scores of process skills in science of high school students whose fathers' educational qualification UG and Professional level 25.08 and 25.36

respectively are significantly higher than that of those whose fathers' are below SSLC, SSLC-HSC and PG (20.59, 22.90 and 124.38) respectively. Hence students having fathers' educational qualification UG and Professional level were found to have significantly superior process skills in science than those whose qualification were below SSLC, SSLC-HSC, and PG level.

Comparison of mean scores of process skills in science based on mother's educational qualification.

H_o11 : Null hypothesis

There is no significant difference in the mean scores of process skill in science of high school students based on their mothers' educational qualification.

Table: 4:19 Comparison of mean scores of process skills in science based on mothers' educational qualification

Educational Qualification of mother	Mean	SD	Source	Sum of squares	df	Mean squares	F	Remark
Below SSLC	21	5.003	Between groups	1678.55	4	419.14	39.54	Significant at 0.05 level
SSLC-HSC	22.5	6.39						
UG	24	4.40	Within groups	4187.16	395	10.60		
PG	26.44	6.48						
Professional	23.14	8.15	Total	5865.71	399			

From the above table 4.19, it can be seen that the F-value is 39.54, which is significant at 0.05 level with df 399. It means that there is a significant difference in mean scores of process skills in science of high school students based on their mother's educational qualification. Therefore, the null hypothesis that there in significant difference in the mean scores of process

skills in science of high school students based on their mothers' educational qualification is rejected. Further, the mean scores of high school students whose mothers' having PG qualification are significantly higher than that of the students whose mothers' qualification are below SSLC, SSLC-HSC, UG and Professional level .

The result does not help to identify exactly the pairs of groups which differ statistically. Hence pair wise comparison is used for further analysis.

Table : 4.20 Pair wise comparison of for process skills in science based on mothers' educational qualification

Qualification of mother	Mean	SD	N	Pairs	t-test	Remark
Below SSLC	21	5.003	155	A Vs B	1.591	NS
SSLC – HSC	22.5	6.39	100	B Vs C	2.156	Sig. at 0.05 level
UG	24	4.40	65	C Vs D	2.200	Sig. at 0.05 level
PG	26.44	6.48	45	D Vs E	1.960	N.S
Professional	23.14	8.15	35	E Vs A	1.491	N.S

The result shows that there is significant difference in process skills in science among the high school students whose mothers' having SSLC-HSC and UG level. The other pairs shows that there is no significant difference in process skills in science among the high school students whose mothers' having the qualification UG and Professional level. The mean scores of process skills in science of high school students 26.44 whose mothers' educational qualification PG is significantly higher than that of those who are below SSLC, SSLC-HSC, UG and Professional level with the mean scores 21, 22, 5, 24,

23.14 respectively. Hence students' mothers' having PG have superior process skills and science than those mothers' of educational qualification below SSLC, SSLC-HSC, UG and Professional level.

Comparison of mean scores of process skills in science of high school students based on monthly income.

H_o12: Null hypothesis

There is no significant difference in the mean scores of process skills in science of high school students based on their parent's monthly income.

Table: 4.21 Comparison of mean scores of process skills in science of high school students' based on monthly income

Monthly Income	Mean	SD	Source	Sum of Square	df	Mean squares	F	Remark
Below 5000	21.03	5.6	Between groups	224.91	2	12.46	8.94	Significant at 0.05 level
5000-10000	23.4	6.12	Within groups	4993.33	397	12.58		
Above 10000	24.4	6.78	Total	5218.24	399			

From the above table 4.16, it can be seen that the F-value is 8.94, which is significant at 0.05 level with df 399. It means that there is a significant difference in mean scores of process skills in science of high school students based on their parents' monthly income. Therefore, the null hypothesis that there is no significant difference in the mean scores of process skills in science of high school students based on their parent's monthly income is rejected. Further, the mean scores of students whose parents' have a monthly income above 10000 is 24.4 which is significantly higher than that of process skills in

science of high school students whose parents having monthly income below 5000 and 5000-10000.

The result does not help to identify exactly the pairs of groups which differ statistically. Hence pair wise comparison is used for further analysis.

Table : 4.22 Pair wise comparison of for process skills in science based on their parents' monthly income.

Monthly Income	Mean	SD	N	Pair	t-test	Remark
Below 5000	21.03	5.6	160	A Vs B	3.674	Sig. at 0.05 level
5000-10000	23.4	6.12	150	B Vs C	1.195	NS
Above 10000	24.4	6.78	90	C Vs C	4.148	Sig. at 0.05 level

The result shows that there exists significant difference in process skills in science among the high students whose parents' having monthly income between the pairs below 5000 and above 10000. The other pair that there is no significant difference in process skills in science among the high school students whose parents' having monthly income is 5000-10000. The mean scores of process skills in science high school students 24.4 whose parents' income is significantly higher than that of those who are below 5000 and 5000-10000 with the mean scores 21.03 and 23.4 respectively. Hence the students parents' having above 10000 have superior scientific attitude than those parents' of monthly income below 5000 and 5000-10000.

Pearson Product Moment Correlation between Scientific Attitude and Process Skills in Science

The Pearson's product moment co-efficient of correlation is used to find out the extend of relationship between two sets of variable. When the co-efficient of correlation 'r' is positive, we can say that there in positive relationship between the variables. If the correlation 'r' is negative, then we can say the relationship between the two variable in negative. If 'r' in zero, then there is no correlation between the variables.

Table : 4.23 Pearson's correlation between scientific attitude and process skills in science

Variables	Person's Correlation	Verbal Description
Scientific Attitude Process Skills in Science	0.255	Low correlation

The correlation between scientific attitude and process skills in science of total sample is 0.26 is low correlated with each other. There is positive low correlation between scientific attitude and process skills in science of high school students.

TENABILITY OF HYPOTHESES

1. "There is no significant difference in the mean scores of scientific attitude of boys and girls" is accepted.
2. "There is no significant difference in the mean scores of scientific attitude of urban and rural high school students" is accepted.

3. “There is no significant difference in the mean scored of scientific attitude of government and aided high school students” is accepted.
4. “There is no significant difference in the mean scores of scientific attitude of high school students whose father having different education qualification” is rejected.
5. “There is no significant difference in the mean scores of scientific attitude of high school students whose mother having different educational qualification” is rejected.
6. “There is no significant difference in the mean scores of scientific attitude of high school students whose parents having different monthly income” is rejected.
7. “There is no significant difference in the mean scores of process skills in science of boys and girls” is accepted.
8. “There is no significant difference in the mean scores of process skills in science of urban and rural high school students” is accepted.
9. “There is no significant difference in the mean scores of process skills in science of government and aided high school students” is accepted.
10. “There is no significant difference in the mean scores of process skills in science of high school students whose father having different education qualification” is rejected.
11. “There is no significant difference in the mean scores of process skills in science of high school students whose mother having different educational qualification” is rejected.

12. “There is no significant difference in the mean scores of process skills in science of high school students whose parents having different monthly income” is rejected.
13. “There is no correlation between scientific attitude and process skills in science of high school students” is rejected.

CHAPTER - V

FINDINGS AND CONCLUSION

The study in retrospect

Findings of the study

Educational implications

Conclusion

Suggestion for improvement

Suggestions for further study

Bibliography

CHAPTER V

SUMMARY FINDINGS AND CONCLUSIONS

THE STUDY IN RETROSPECT

The study under investigation in entitled as A study of Scientific Attitude and Process Skills in Science of High school students.

A sample of 400 high school students who were studying in different school in Kanyakumari district was selected for the study. (Here the investigator used for normative survey method. The technique used for collecting of sample was random sampling).

For collecting data the tools used were General Data sheet, Scientific attitude scale and process skills in science test. The data were subjected to statistical analysis like mean, standard deviation, t-test, ANOVA and Pearson's product method of correlation.

FINDINGS OF THE STUDY

1. There is no significant difference in the means scores of scientific attitude of boys and girls. (t value = 0.88)
2. There is no significant difference in the means scores of scientific attitude of rural and urban high school students. (t value = 0.79).
3. There is no significant difference in the means scores of scientific attitude of Government and Aided high school students. (t value = 0.33).
4. There is significant difference among the high school students in their scientific attitude based on their fathers' educational qualification.

Further from the mean scores of scientific attitude of students having educational qualification UG is 144.5 which is significantly higher than that students of educational qualification SSLC, SSLC-HSC, PG and Professional level. (t value = 98.91).

5. There is significant difference among the high school students in their scientific attitude based on their mothers' educational qualification. Hence students mothers' having UG have superior scientific attitude. Than those mothers' of educational qualification below SSLC, SSLC-HSC, PG and Professional level. (37.86).
6. There is significant difference among the high school students in their scientific attitude based on their parents' monthly income. Hence students parents' having above 10000 have superior scientific attitude than those parents' of monthly income below 5000 and 5000-10000. (t value = 71.80).
7. There is no significant difference in the mean scores of process skills in science of boys and girls (t value = 0.043).
8. There is no significant difference in the mean scores of process skills in science of urban and rural high school students. (t value = 0.603).
9. There is no significant difference in the mean scores of process skills in science of government and aided high school students. (t value = 1.71).
10. There is significant difference among the high school students in their process skills in science based on their fathers' educational

qualification. It may therefore, be said that the students whose fathers' were professionally qualified have significantly more process skills in science than those students whose fathers' who are SSLC, SSLC-HS, UG and PG level. (t value =35.87)

11. There is significant difference among the high school students in their process skills in science based on their mothers' educational qualification. Further, the means scores of high school students whose mothers' having PG qualification are significantly higher than that of the students whose mothers' qualification are below SSLC, SSLC-HSC, UG and Professional level. (t value = 39.54).
12. There is significant difference among the high school students in their process skills in science based on their parents' monthly income. Hence the students' parents having above 10000 have superior scientific attitude than those parents' of monthly income below 5000 and 5000-10000. (F value = 8.94).
13. There is positive low correlation between scientific attitude and process skills in science of high school students.

CONCLUSION

The following conclusion were drawn the present study. The high school students have average scientific attitude and process skills in science. Educational qualification of Father educational qualification of mother and parents monthly income have influence on the scientific attitude and process

skills in science. Scientific attitude and process skills in science of high school students are positively and low correlated with each other.

EDUCATIONAL IMPLICATIONS

From the present study it in clear that the high school students of Kanyakumari District have average level of scientific attitude and process skills in science. They may be due to the defects in teaching methods.

Science teaching should be in such a way as to enable the pupils to develop scientific attitude and various process skills in science. The following suggestions can be made for improving the scientific attitude.

i. The science classroom should have a scientific atmosphere.
ii. The teacher should respect the right and dignity for improving the scientific attitude.
iii. Teacher should recognize the different attitude and capabilities among students and strive to meet their individual needs.
iv. Teacher should inculcate a scientific out lock among students.
v. The curriculum should be reformed by giving more emphasis on scientific attitude.
vi. Students should be provide opportunities to do experiments individually or in groups.
vii. Methods like demonstration methods, project method, etc. Should be followed in science classroom.
viii. Well-equipped laboratories should be provided in every school.

The following suggestions can be made for improving the attainment of various process skills in science of high school students.

i. In service training should be given to the teachers so as to enable them to teach science by process approach.
ii. The curriculum should be reframed by giving emphasis on process skills.
iii. Well equipped laboratories should be provided in every school.
iv. Students should be encouraged to do experiments individually or by group.
v. Activity method, Heuristic method, project method etc. Should be followed in science classroom.
vi. Teachers should use more audio visual aids.
vii. Science teachers should make use of science club science fairs and field trips to improve the standard of science education in schools.

SUGGESTIONS FOR FURTHER STUDY

In order to make the present more meaningful and effective similar studies in this field can be carried out. The desirable areas for further research are the following.

i. The present study was confined only to High school students. Similar studies can be conducted at various level.
ii. The present study can be extended for a large sample representing the whole state.

iii. An investigation may be undertaken by including the integrated science process skills.

iv. A study on the relationship between scientific attitude and other variables like scientific aptitude, creativity, science interest etc., can be made.

v. Similar studies like physically handicapped, tribal children etc.

vi. A study can be conducted to evolve remedial programmes to get rid of the students.

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APPENDIX : A

N.V.K.S.D. COLLEGE OF EDUCATION, ATTOOR, KANYAKUMARI DISTRICT.

2012-2013
GENERAL DATA SHEET

INSTRUCTIONS:

Certain personal data regarding you are required for my research purpose. The information given by you will be kept confidential and will be used for the research purpose only.

Name of the student	:	
Name of the school	:	
Gender	:	Male / Female
Locality	:	Rural / Urban
Type of Management	:	Govt / Aided / Private
Educational Qualification	:	
Father	:	below SSLC/SSLC-HS/UG/PG/Professional
Mother	:	below SSLC/SSLC-HS/UG/PG/Professional
Monthly Income	:	below 5000/5000-10000/above 10,000

APPENDIX : B

N.V.K.S.D. College of Education, Attoor.

Scientific Attitude scale

Prepared by Mrs.Umamaheswari. R and Mr. C. Bright

Instructions:

The statements are something about science. For each statement there are five alternatives namely SA, A, U, D, SD.

Read each statement carefully and express your views by making tick (√) on any one of the five alternatives please respond all the items.

SA - Strongly Agree

A - Agree

U - Undecided

D - Disagree

S.D - Strongly Disagree.

SCIENTIFIC ATTITUDE SCALE

SL.No	STATEMENTS	SA	A	U	D	SD
1.	Scientific facts can be changed					
2.	Working in a science laboratory is very interesting.					
3.	Search of scientific knowledge is waste of time					
4.	Scientists are very intelligent people					
5.	Scientific inventions help for better living					
6.	Scientific discoveries are harmful to human life					
7.	Scientific laws are verified under natural setting					
8.	Science in my favourite subject.					
9.	All the scientific phenomena cannot be verified.					
10.	Learning science develops critical thinking					
11	Science lessons are interesting					
12.	Scientists cannot answer all the questions in the universe					
13.	I like to work with scientists					
14.	I would prefer to perform experiments rather than reading books.					
15.	Most of the people cannot accept the scientific truths.					
16.	I am very curious to know about the universe					
17.	Scientists need scientific aptitude.					
18.	Working in a science laboratory is very hazardous human health					
19.	All happenings in the universe are based on science					
20.	Scientists report the facts through experiments.					
21.	Scientists cannot have a peace of mind					
22.	Scientific study needs creativity					
23.	All the electronic inventions are valuable products of science					
24.	I get bored when watching science programs on TV					
25.	Sometimes science fails to explain how things happen.					
26.	Scientific knowledge destroys human values					
27.	Scientific works are highly expensive					

28.	Diseases can be cured by prayer than by medicines					
29.	Scientific thinking is necessary for the solution of problem of life					
30.	Scientists are naturally less friendly					
31.	There are no such things as absolute facts.					
32.	All the verified facts cannot be applicable to human life.					
33.	Astronomical phenomena are beyond human control.					
34.	Life of man cannot be improved by the knowledge of science					
35.	Progress of a nation depends on its scientific progress					
36.	For common people knowledge of science is not very essential.					
37.	It is better to read some journals than participating in science fairs					
38.	Science by its nature is hostile to women.					
39.	Hunting animals and birds leads to ecological imbalance					
40.	Learning of science destroys students cultural and moral values					
41.	Scientific facts are used in everyday life.					
42.	Expert astrologists could find out the truths that scientists could not.					
43.	Learning science leads to scientific inquiry.					
44.	Earth quake is caused by the Goddess of anger					
45.	Only scientific knowledge prevents environmental hazards.					
46.	Scientific principles are verified by experimentations					
47.	Doing experiments is not as good as finding out information from teachers.					
48.	Learning science develops good health habits					
49.	Scientific methods are not useful to the public.					
50.	Scientific knowledge is essential for healthy living					

APPENDIX : C

N.V.K.S.D. COLLEGE OF EDUCATION, ATTOOR.

TEST OF SCIENCE PROCESS SKILLS

Prepared by A. Jasmine Agnal and Dr. V.S. Minikumari

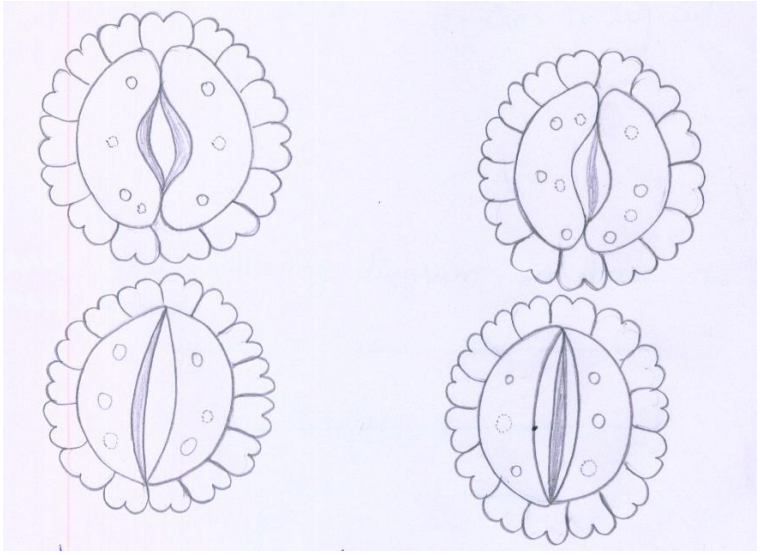
Introduction

- There are 47 items in this questionnaire.
- Read the question carefully and mark your answer in the response sheet.
- Circle the correct answer on the response sheet against the proper question number.
- Do not write or mark anything on this test booklet.

1. Observe the following diagram and identify the type of white blood corpuscles?

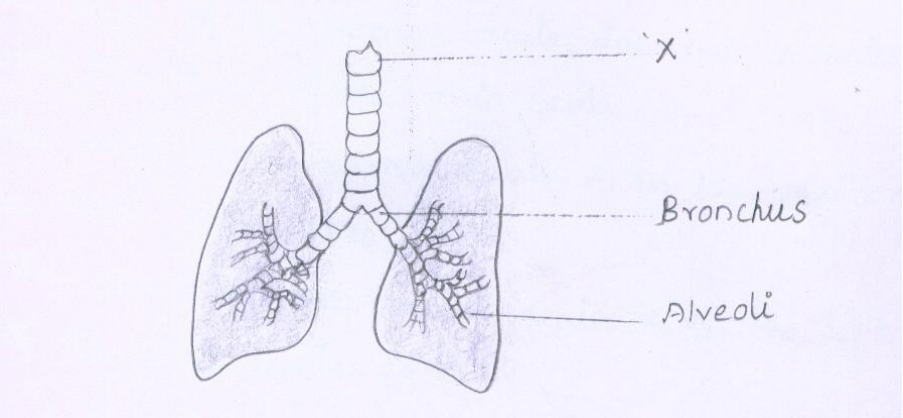
a. Neutrophil b. Eosinophil c. Monocyte d. Basophil

2. Of the following diagram's which one represents open stomata?



a. 1 b. 2 c. 3 d. 4

3. The following diagram shows the structure of lungs. What is the part indicated by ‘X’?



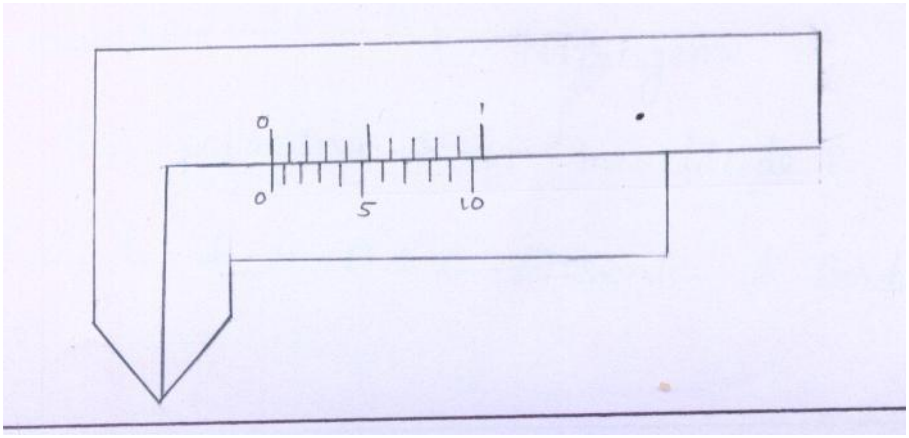
a. Pleura b. Trachea c. Epiglottis d. Pelvis

4. Soda drinks is a mixture of

a. Gas in gas b. Gas in solid

c. Solid in solid d. Gas in liquid

5. Observe the following diagram and choose the correct answer



a. The Zero of the vernier scale coincides with the zero of the main scale.

b. The zero of the vernier scale does not coincide with the zero of the main scale.

c. The zero of the vernier scale is to the right of the main scale zero.

d. The zero of the vernier scale is to the left of the main scale zero

6. Which balance is commonly used in shops for measuring mass?

a. Physical balance b. Two pan balance

c. spring balance d. Digital balance

7. The type of motion exhibited by an running along the circumference of a circular path is

a. Uniform motion b. Non – uniform motion

c. Circular motion d. Linear motion

8. Which of the following is a micronutrient?

a. Carbon b. Sulphur

c. Manganese d. Nitrogen

9. Which of the following is an insecticide?

a. DDT b. 2-4-D c. Arsenic d. Bordeaux mixture

10. Which of the following is not a liquid?

a. Kerosene b. Petrol c. Diesel d. Magma

11. Which of the following is a compound?

a. Water b. Iron c. Sulphur d. soil

12. Which of the following solid undergo sublimation?

a. Iron b. Camphor c. Stone d. Graphite

13. Which of the following is not a fundamental particle of an atom?

a. Proton b. Electron c. Cyclotron d. Neutron

14. The S1 unit of mass is

a. Kilogram b. Meter c. Mole d. Second

15. Which of the following was not used for measuring time in ancient times?

a. Sundial b. Water clocks c. Sandclocks d. Digital clocks

16. Velocity is expressed in

a. M b. S c. m/s d. m/s^2

17. What is the similarity between kidney and skin

a. Both are respiratory organs

b. Both are reproductive organs

c. Both are digestive organs

d. Both are excretory organs

18. Which of the following is incorrect?

a. Manure is natural substance

b. Manure is an inorganic substance

c. Manure can be prepared in fields

d. Manure contain all nutrients

19. Which of the following is not correctly matched?

Organs	Enzymes
a. Salivary glands	Ptyalin
b. Stomach	Pepsin
c. Pancreas	Sucrase
d. Jejunum	Maltase

20. What is the similarity between erythrocytes and leucocytes?

a. Both are respiratory pigment

b. Both are blood corpuscles

c. Both are immunising agent

d. Both are disc shaped cells

21. Which of the following statement is correct?

a. Homogeneous mixtures have double phase and Heterogeneous mixtures have triple phase.

b. Homogeneous mixture have one phase and Heterogeneous mixtures have more than one phase

c. Both mixtures have only one phase

d. Both mixtures no phase.

22. What is the similarity between protons and electrons?

a. Both are positively charged particles

b. Both are negatively charged particles

c. Both are neutral

d. Both are constituents of atom

23. What is the relation between displacement and velocity?

a. Velocity = displacement /time

b. Velocity = time/ displacement

c. Velocity = displacement × time

d. Displacement = velocity/time

24. What is the relation between acceleration and velocity?

a. Acceleration = Velocity × time

b. Acceleration = Velocity / time

c. Acceleration = Velocity

d. Velocity = Acceleration / time

25. How many elements are essential for plant growth?

a. 12 b. 16 c. 4 d. 10

26. How many bones are present in human body?

a. 300 b. 206 c. 100 d. 150

27. How many RBC's are present in one cubic mm of blood?

a. 5 million b. 6 million c. 3 million d. 2 million

28. How many pairs of ribs are present in human body?

a. 10 b. 11 c. 12 c. 13

29. Boiling point of water is

a. 100^{o}C b. 25^{o}C c. O^{o}C d. 110^{o}C

30. Number of electrons in the K. shell of an atom is

a. 12 b. 6 c. 10 d. 2

31. Boiling point of benzene in 353k. Boiling point of toluene is 384 k. then the difference in their Boiling point in

a. 13k b. 31k c. 23k d. 30k

32. A car takes 6 hours to travel a distance of 300km what is its speed

a. 30km/hour b. 50km/hour

c. 60km/ hour d. 10km/hour

33. The distance travelled by 20 sec is 400m. Find the velocity?

a. 10ms^{-1} b. 15 ms^{-1} c. 20 ms^{-1} d. 25 ms^{-1}

34. If the distance travelled by an object and velocity are same, then the time taken by the particle is

a. 1sec b. 0.01sec c. 100sec d. 10sec

35. The mass of a substance is 800 kg and its volume is 20m^{3}. Find the density of a substance?

a. 20kgm^{-3} b. 40kgm^{-3} c. 10kgm^{-3} d. 5kgm^{-3}

36. The experiment to show that transpiration takes place through the leaves is

a. Thistle funnel experiment b. Photo osmoscope

c. Bell Jar experiment d. Ganong's photometer expriment

37. Which of the following is correct procedure to show that oxygen is evolved during photosynthesis?

a. Take some hydrilla plants and insert the hydrilla plant in to a thistle funnel. Place the funnel in a beaker containing water. Fill the test tube with water and invert it over the stem of the funnel. Keep the apparatus in sunlight for sometime.

b. Take some hydrilla plants and insert the hydrilla plant into a thistle funnel. Place the funnel in a beaker containing water. Fill half of the test tube with water and invert it over the stem of the funnel. Keep the apparatus in sunlight for sometime.

c. Take some hydrilla plants and insert the hydrilla plant into a thistle funnel in such away that the cut end faces the stem of the funnel. Place the funnel in a beaker containing water. Fill in the test tube with water and invert it over the stem of the funnel. Keep the apparatus in sunlight for sometime.

d. Take some hydrilla plants and insert the hydrilla plant into a thistle funnel in such away that the cut end faces the stem of the funnel. Place the funnel in a beaker containing water. Fill in the test tube with water and invert it over the stem of the funnel.

38. Which method is suitable method to separate liquid from solid?

a. Decantation b. Distillation c. Filtration d. Chromatography

39. The device used to separate immiscible liquid is

a. Beaker b. Test tube c. Separating funnel d. China dish.

40. When plants do not get sufficient water, sunlight co_2 and oxygen for few days the plants

a. will not grow b. will no give more yield

c. will not produce leaves d. will die

41. What will happen when drugs and alcohols are misused and consumed in large quantities?

a. They affect the teeth

b. They affect the mouth alone

c. They affect all the internal organs in the human body

d. They give more pleasure

42. What will happen if you do exercise regularly?

a. Body needs more energy

b. Body does not function well

c. Internal organs get damaged

d. Body gets more energy and oxygen

43. What will happen when iron is brought near the magnet?

a. Attracts b. Neither attracts nor repels

c. Repels d. Attract once and then repels

44. Take two potted of ‘keerai’ and names them as A and B apply coswdung and sprinkle water for A. Sprinkle water alone for B. keep them in sunlight for 15-20days potted plant A grows faster than B.

a. Plants require both water and manure

b. Plants require water only.

c. Plants require manure only

d. Plants require sunlight only

45. When animal wastes, plant wastes, domestic wastes and sewage wastes are allowed to decompose in a pit for some days compost is formed. What do you infer from this?

a. Compost is formed due to the action of sunlight

b. Compost is formed due to the action of Earth worm

c. Compost is formed due to the action of Bacteria

d. Compost is formed due to the action of water

46. If you pincld skin and let go, it springs back space what do you infer from this?

a. Skin stretch like elastic

b. skin is in elastic in nature

c. Skin is very rigid

d. Skin is soft

47. A leaf from a plant is taken and dipped it in boiling water for 5 minutes. Then it is dipped in alcohol to decolourize it. After that it is washed in water and added few drops of Iodine solution. Then the colour of the leaf is changed to blue. What do you infer form this?

a. Sunlight is essential for photosynthesis

b. Chlorophyll is essential for photosynthesis

c. Carbon dioxide is essential for photosynthesis

d. Water is essential for photosynthesis.

N.V.K.S.D. College of Education, Attoor.

TEST OF SCIENCE PROCESS SKILLS

Prepared by a. Jasmine Agnal and Dr. V.S. Minikumari

RESPONSE SHEET

Please circle the correct answer in the option given below:

Name of the Student :

Name of the School :

Standard :

QUESTION NUMBER	ANSWER				QUESTION NUMBER	ANSWER			
1	a	b	c	d	25	a	b	c	d
2	a	b	c	d	26	a	b	c	d
3	a	b	c	d	27	a	b	c	d
4	a	b	c	d	28	a	b	c	d
5	a	b	c	d	29	a	b	c	d
6	a	b	c	d	30	a	b	c	d
7	a	b	c	d	31	a	b	c	d
8	a	b	c	d	32	a	b	c	d
9	a	b	c	d	33	a	b	c	d
10	a	b	c	d	34	a	b	c	d
11	a	b	c	d	35	a	b	c	d
12	a	b	c	d	36	a	b	c	d
13	a	b	c	d	37	a	b	c	d
14	a	b	c	d	38	a	b	c	d
15	a	b	c	d	39	a	b	c	d
16	a	b	c	d	40	a	b	c	d
17	a	b	c	d	41	a	b	c	d
18	a	b	c	d	42	a	b	c	d
19	a	b	c	d	43	a	b	c	d
20	a	b	c	d	44	a	b	c	d
21	a	b	c	d	45	a	b	c	d
22	a	b	c	d	46	a	b	c	d
23	a	b	c	d	47	a	b	c	d
24	a	b	c	d					