Chapter I

INTRODUCTION
“Full many a gem of purest ray serene
The dark unfathomed caves of the ocean bear.
Full many a flower is born to blush unseen.
And waste its sweetness on the desert air”

(Gray, 1751)

1.1 BACKGROUND OF THE STUDY

Education is the realization of self. Education is one of the processes of modernization, which generates new forces in bringing about changes in the value structure of the society. Education is well-structured process to promote the all-round and harmonious development of a person. Thus it has become complex whole which enables man to combine the process of learning, living and working.

Since it is the time of Information Technology, it brings forth fundamental and far sighted changes in educational practices so as to equip the students better to meet the challenges of world. The various demands, though differing in substance emerged from a similar concern, that only the education should develop in children the basic skills for life.

The National Council for Educational Research and Training and The Department of Education of Science and Mathematics took the responsibility of improving the Science education at school level and prepared syllabi, textbooks, instructional materials at the national level. The Department of Education of different states in collaboration with the State Council for Educational Research and Training, State Institute of Science Education and other agencies are busy to implement the NCERT-curriculum at their respective states and are trying to modify them according to the specific needs of the situations of their states.

One of the recommendations of the Education commission (1964-66) was that science should be made a compulsory subject in school education. The recommendation was accepted and science was made compulsory up to class X in several states and Union territories.

Science is unique as a subject in the curriculum of schools all over the world. This uniqueness results from the variety of materials and experiments
necessary for its effective teaching. Science has become a synonym of progress and a symbol of culture and enlightenment. It has made man free, free from those tasks which he used to carry out and is now accompanied by machines, enabling him to devote himself more to the art of enjoying his leisure—so necessary for his cultural growth. As man has gradually gained control over the forces of nature, he has reached out up to space and has split atom. In short the vital role which science plays today in the progress of civilization cannot be over estimated.

“Science moves but slowly, steadily creeping on from one point to another but actually the progress has been rapid.” - Tennyson (1923).

Science education aims at the development of child’s efficiency on all dimensions and this can only be possible if we shift our focus from acquisition of knowledge to development of scientific attitude, reflective thinking, skills socially desirable habits, interest in scientific literature and impact of subject on daily life which provides work for leisure and training for better living. At the societal level, one of the major objectives of science education is to equip individuals to participate in the creation of a society which is free from poverty, hunger, disease and evils such as violence, exploitation and oppression.

Einstein (1953) says that “Science is the attempts to make the chaotic diversity of our sense experience correspond to a logically uniform system of thought. In this system single experience must be correlated with the resulting co-ordination is unique and convincing”. Open-mindedness, arousal and maintenance of curiosities, putting questions on the origin of all things, collection of data, demand for verification and proof, respect for mathematical arguments and logical proofs including statistical reasoning, suspending judgment, acceptance and warranted conclusions and willingness to change one’s opinion in the light of new evidence are the ferments which characterize the scientific enterprise.

It is high time to revamp the existing system of the school education based on the three H’s of education - head, heart and hand. We need to tackle this issue seriously so as to bring back the simple joys of going to school and to strengthen the bonds between the teacher and the taught. In this age of scientific and
technological advancement, everybody should have at least some basic knowledge of science for making some effective and useful contribution to life. Considering this, science has been included in the curriculum starting from primary stage.

According to Richards (1997) “Science is taught because of the recognized need for general scientific literacy or dependence upon scientists and engineers and the value that we place upon critical thoughts”.

The Columbia Encyclopedia (1963) defines science as “an accumulated and systematized learning in general usage restricted to natural phenomena”. The progress of science is marked not only by an accumulation of facts but by the emergence of scientific method and of the scientific attitude and interest. Interest is a driving force not only helps the children to acquire certain learning experiences but also add colour and fashion to their attitudes, aptitudes and other personality traits (Cooley and Reed, 1962).

Interests are innate as well as acquired dispositions. “Interest in science” denotes a range of meanings from positive feelings towards science to complete absorption in scientific enquiry (Hason, 1975).

1.1.1 Multiple Intelligences Theory

The Multiple Intelligences theory proposed by Gardner (1983) challenged the traditional psychological view of Intelligence as ‘a single capacity that drives Logical and Mathematical thought’. According to him (Gardner, 1983; p.81) intelligence is defined as “the ability to solve problems or create fashion products that are valued within one or more cultural settings”. In the same direction, he described intelligence as a Bio-psychological potential that could be influenced by experience, culture, and motivational factors.

Gardner’s theory (1993) proposes different and autonomous intelligence capacities that result in many different ways of knowing, understanding and learning about the world to have a better understanding of it. There is a constant flow of new information on how the human brain operates, how it differs in function between genders, how emotions impact on intellectual acuity, even genetics and environment both impact children’s cognitive abilities. While each
area of study has its merits, he initially identified seven different kinds of intelligence that we possess. This has particularly strong ramifications in the classroom, for identifying learners’ different strengths; concerning these intelligences, it is possible to accommodate different learners’ capabilities more successfully based on their orientation to learning.

Gardner initially proposed seven Intelligences that in combinations enable people to understand and to perceive the world and to express themselves and they are Linguistic, Spatial/Visual, Logical/Mathematical, Interpersonal, Intrapersonal, Bodily-Kinesthetic and Musical. Recently he has added three more Intelligences such as Naturalistic intelligence, Existential intelligence and Moral/Spiritual intelligence to his Multiple Intelligences theory (Gardner, 1999).

According to Gardner (1999), all human beings possess all different Intelligences in varying degrees and each individual manifests varying levels of these different Intelligences and thus each person has a unique ‘cognitive profile’. All human possess all the above mentioned Intelligences, but are located in different areas of the brain and can either work independently or together. He argues that by applying Multiple Intelligences we can improve education and these Intelligences may define human species and their intelligentsia.

Modern studies about intelligence are highly pertinent in science learning. Traditional teaching method has the notion that intelligence is innate and remains unchanged. Hence, there exists a thought that certain children are poor in rationality, arithmetic operations and analytical skill and they might be backward in learning science.

Science is considered as an important subject in school curriculum as many professional and applied courses, directly or indirectly uses the knowledge to apply. Moreover, the present age is the era of science which is close to any nation’s health and strength for the well being of its people. Since science touches the lives of every individual and gives an essential background of knowledge for cultural development, it gives many opportunities to foster the scientific method of discipline. It trains the pupil to observe and think clearly and carefully. It stresses the need to appreciate the meaning of scientific life, spirit and endeavour – open mindedness, intellectual, honesty, self sacrifice and devotion – which ought to serve as ideals to the future citizen. It acquaints the pupil with knowledge
of chemical facts needed not only for many trades and professions, but also for many citizens, enabling them to lead happy, well-balanced and useful lives.

Studies revealed that low achievement and under achievement in science subjects are often related to a number of psychological and sociological factors like intelligence, interest, anxiety, achievement motivation and self concept.

Our present educational system is heavily biased towards the Linguistic and Logical-Mathematical modes of instruction. Teachers traditionally teach science using two approaches – Linguistic approach and Logical-Mathematical approaches. These approaches benefit only those students who are linguistically and mathematically talented. They could achieve high marks in science. But others will soon fall hopelessly behind and become discouraged. This situation not only will result in efficient instruction but may easily become a fertile-breeding ground for discontent, loss of interest and possible disciplinary difficulties. If instruction is really effective, the subject matter must be selected and organized in such a way as to make it appropriate and suited to the age and intellectual development of the students. Since students do not learn with equal facility at equal rates, there must be chances for differences in achievements.

Multiple Intelligences approach encourages teachers with regard intellectual ability more broadly. The theory of Multiple Intelligences implies that all individuals are able to know the world through Language, Logical-Mathematical analysis, spatial representation, Musical thinking, the use of the body to solve problems, to make things and understanding of us. Here individuals differ in their strength of these components of Intelligences and in the ways in which intelligence is invoked and combined to carry out different tasks, solve diverse problems and progress in various domains. Multiple Intelligence pedagogy insists to teach the subject by incorporating all the ten components of intelligence. This will help the teachers to identify, appreciate and nurture the Intelligences in all the students. The teacher could assess the intellectual strengths and weakness of each student. Thus the teacher could help the student to learn the subject through their well-developed intelligences. In the meanwhile, they could help the students to develop neglected Intelligences as well as to activate under developed or paralyzed intelligence.
When the learning of the subject takes place through the preferred Intelligences of the students, they will have interest for learning. This will create a favourable attitude and interest towards the subject as well as will help the learner to attain high achievements in science. The learner will score more, only when he has strong interest in science subjects. Knowing the components of Multiple Intelligence well, we can predict which component of Multiple Intelligences foster more for the development of Science Interest.

1.2 NEED AND SIGNIFICANCE OF THE STUDY

The Multiple Intelligences theory challenged traditional beliefs in the fields of education and cognitive science. According to a traditional definition, all people were born with uniform cognitive capacity and adaptability for the new problematic situations. But according to Gardner (1983), intelligence has the following theoretical basis;

- The ability to create an effective product or offer a service that is valued in a culture.
- A set of skills (Intelligences) that make it possible for a person to solve problems in life.
- The potential for finding or creating solutions for problems, which involves gathering new knowledge.

This new outlook on intelligence differs greatly from traditional view and claims that all human beings have Multiple Intelligences. This can be nurtured and strengthened or ignored and weakened, which has ten components of Intelligence and has different intellectual composition in each person. The theory states that all the Intelligences are needed to productivity function in society. Thus the theory of Multiple Intelligences implies that educators should recognize and teach students with a broader range of talents and skills.

Since science is an essential component of education at the present age, more attention should be paid to the teaching of science. Science and its teachings
Introduction

can solve the problems of hunger and poverty, insanitation and illiteracy of superstitious customs and traditions of vast resources running to waste in an affluent country inhibited by starving people to a great extent. The scientific and technological revolution of the present scenario has necessitated that every country should have an adequate number of Scientists, Technologist and Technicians without which, it is being feared and the country will bound to take a backward pace in the nation’s race of progress. Hence the school should provide certain opportunities of such kind are right from the primary classes, so that the innate potentialities of each learner will get developed. This will facilitate the learner to study about himself and in turn he will be made fit to work for the nation’s future progress. “Any interest or ability is redefined as intelligence” (Gardner, 1985).

The study intended to assess the interrelationship among Multiple Intelligences and Science Interest, so that a clear image on the area of intelligence will be obtained through which we can promote science interest. This study acknowledges that while all students may not be verbally or mathematically gifted, they may have an expertise in other areas such as Music, Spatial relations or Inter or Intra personal Intelligences. Though the students are expertise in other areas of Intelligences interest of science is being promoted. This is the prime focus of this study.

The investigator selected primary school students because young prodigies in science could be identified at an impressionable age level through a pictured form of Picturised Science Interest Inventory (PSII), which will be more convenient to channelize them to the science stream for enhancing better achievement in future. Through the Multiple Intelligences analysis (creating Intelligence profile) we can assess which components of Multiple Intelligence could foster science interest among students of elementary stream.
1.3 STATEMENT OF THE PROBLEM

The study intends to identify the Interrelationship among the components of Multiple Intelligences with Science Interest on elementary school students. The study is entitled as INTERRELATIONSHIP AMONG MULTIPLE INTELLIGENCES AND SCIENCE INTEREST: AN ANALYTICAL STUDY ON STUDENTS AT PRIMARY LEVEL.

1.4 DEFINITION OF KEY TERMS

a) Interrelationship:

Interrelation is defined as the word that indicates the “mutual or reciprocal relation or relatedness to any act or acts or items” (Biswa, 1998). Here interrelationship means the mutual and reciprocal relationship between the components of Multiple Intelligences and Science Interest.

b) Multiple Intelligences:

According to Gardner “Intelligence is a bio-psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture”. He proposed that ten components of Multiple Intelligences exist in all individuals and they are Verbal-Linguistic, Musical, Interpersonal, Intrapersonal, Bodily-Kinesthetic, Logical-Mathematical, Spatial, Naturalistic, Existential and Moral/Spiritual Intelligence.

c) Science Interest:

Science Interest can be defined as an interest for science and allied areas of work. It may also be defined as a positive feeling attached to the abstract and concrete aspects of scientific activity, which manifests in the form of acceptance for and a satisfaction in all activities and movement connected with science. It is pre-occupation of an individual with problems or activities originating in observations and experiences when the individual is free to choose.

According to Super (1957), science interest involves a desire to understand why and how biological and physical processes helps an individual to add new knowledge in the entire corpus of knowledge and put such knowledge into use.
Here the investigator intends to prepare a Picturised Science Interest Inventory (PSII) in pictorial form so that a clear image on the items will be obtained to children for selecting items according to their relative interest.

The Picturised Science Interest Inventory (PSII) has taken as innovative model from Picturised Interest Inventory of Wilbourn and Alley (1978).

d) Analytical Study:

Analytical study refers to the “having the ability to analyze” or “division into elements or principles” (Agnes, 2004). Here it means the systematic examination of relationships among the components of Multiple Intelligences and Science Interest on Elementary School Students.

e) Primary Level:

“Primary school is a school of the first six grades (At times first eight grades), where basic subjects are taught” (Agnes, 2004). In the context of primary education in Kerala, both Lower Primary and Upper Primary Schools are put together.

So the investigator selected those students studying in the Upper Primary classes such as standard V, VI and VII of the schools in Kerala.

1.5 OBJECTIVES OF THE STUDY

Objectives of the study are;

1. To construct and standardize Multiple Intelligences Test Battery (MITB) for measuring components of Multiple Intelligences at Primary level.
2. To construct and standardize a Picturised Science Interest Inventory (PSII) for measuring the interest in Science at Primary level.
3. To identify the levels of components of Multiple Intelligences of students at Primary level for the Total sample and the relevant sub samples.
4. To compare the components of Multiple Intelligences for sub samples based on
   1) Gender (Boys & Girls)
   2) Locale (Rural & Urban)
   3) Type of Schools (Government, Aided & Unaided)
5. To find out the Interrelationship among Components of Multiple Intelligences of students at Primary level for the Total sample.

6. To identify the levels of Science Interest of students at Primary level for the Total sample and relevant sub samples.

7. To compare the levels of Science Interest of students at Primary level for sub samples based on
   1) Gender (Boys & Girls)
   2) Locale (Rural & Urban)
   3) Type of Schools (Government, Aided & Unaided)

8. To find out the relation between Science Interest and components of Multiple Intelligences of students at Primary level namely:
   a. Verbal-Linguistic Intelligence
   b. Musical Intelligence
   c. Interpersonal Intelligence
   d. Intrapersonal Intelligence
   e. Bodily-kinesthetic Intelligence
   f. Logical-Mathematical Intelligence
   g. Spatial Intelligence
   h. Naturalistic Intelligence
   i. Existential Intelligence
   j. Moral/Spiritual Intelligence

9. To find out the relation between components of Multiple Intelligences and Science Interest for sub samples based on
   1) Gender (Boys & Girls)
   2) Locale (Rural & Urban)
   3) Type of Schools (Government, Aided & Unaided)

10. To find out which components of Multiple Intelligences have significant impact on Science Interest.
1.6 HYPOTHESES

The major Hypotheses formulated for the study were the following:

H₁: There is significant relation between components of Multiple Intelligences for the total sample and relevant sub samples based on

1) Gender (Boys & Girls)
2) Locality (Rural & Urban)
3) Type of Schools (Government, Aided & Unaided)

H₂: There is significant relation among the components of Multiple Intelligences of students at Primary level for the Total sample.

H₃: There is significant relationship between scores of Science Interest for the total sample and relevant sub samples based on

1) Gender (Boys & Girls)
2) Locality (Rural & Urban)
3) Type of Schools (Government, Aided & Unaided)

H₄: There is significant relationship between Science interest and components of Multiple Intelligences such as

a. Verbal- Linguistic Intelligence
b. Musical Intelligence
c. Interpersonal Intelligence
d. Intrapersonal Intelligence
e. Bodily-Kinesthetic Intelligence
f. Logical- Mathematical Intelligence
g. Spatial Intelligence
h. Naturalistic Intelligence
i. Existential Intelligence
j. Moral/Spiritual Intelligence
H₃: There is significant relationship between Multiple Intelligences and Science Interest for sub samples based on

1) Gender (Boys & Girls)
2) Locality (Rural & Urban)
3) Type of Schools (Government, Aided & Unaided)

H₄: The components of Multiple Intelligences have significant impact on Science Interest.

1.7 METHODOLOGY

1.7.1 Method Used for the Study

According to Best and Kahn (1995) “Research is considered to be the more formal, systematic, intensive process of carrying on the scientific method of analysis. A pre-planned and well described method will provide the researcher a scientific and feasible plan for attacking and solving the problems under investigation. The present study was based on Normative Survey method.

1.7.2 Sample for the Study

The investigator studied a sample of 400 Upper Primary school Students to try-out both the tools for Item analysis through random sampling technique, after which he studied yet another sample of 1000 Upper Primary school pupils, including both Genders from various types of schools like Government, Aided and Unaided belong to the Urban and Rural areas for Upper Primary class students. The study conducted on students of various Upper Primary Schools of Kollam and Thiruvananthapuram Districts through Random Sampling method.

1.7.3 Tools Used for the Study

i) A Multiple Intelligences Test Battery (MITB) prepared and standardized by the investigator for assessing the components of Multiple Intelligences;
   a) Verbal–Linguistic Intelligence
   b) Musical Intelligence
   c) Interpersonal Intelligence
d) Intrapersonal Intelligence

e) Bodily – Kinesthetic Intelligence

f) Logical- Mathematical Intelligence

g) Spatial- Visual Intelligence

h) Naturalistic Intelligence

i) Existential intelligence

j) Moral/Spiritual Intelligence

ii) Picturised Science Interest Inventory (PSII) prepared and standardized by the investigator for assessing the Science Interest.

iii) General Information sheet

1.7.4 Statistical Techniques Used

The collected data were consolidated, codified suitably and subjected to analysis. For analyzing the data suitably, various statistical techniques such as Edward’s Method and Kelley’s Method (for Item Analysis), Split half Method, Cronbach’s Alpha Formula and Kuder-Richardson 20 Formula (for Validation), Percentage, Mean, Standard Deviation, Karl Pearson’s Product Moment Coefficient of Correlation, Partial Correlation Coefficient, Level of significance between Mean and Level of significance between correlation, Post Hoc Group Comparisons in ANOVA, Scheffe’s test of multiple comparison and Multiple Linear Regression (Entry method) and Beta coefficient were majorly used.

1.8 PROCEDURE ADOPTED

The investigator used the normative survey method for collecting the data. It involves three steps.

Step-I (a). The investigator constructed a Test Battery covering the various components of Multiple Intelligences (MITB) for Upper Primary school students and administered to a sample of 400 Upper Primary school students for pilot test. After the collection of expert opinions and pilot test scores, the Investigator made the Battery as standardized by using Edward formula for Item analysis.

(b). The investigator constructed a pictorial version of a Picturised Science Interest Inventory (PSII) covering the various areas of Science Interest for Upper
Primary school students and administered to a sample of 370 Upper Primary school students for pilot test. After the collection of expert opinions and pilot test scores, the Investigator made the Inventory as standardized by using Kelley’s formula for Item analysis.

**Step-II** The Final Tests were administered to 1000 Upper Primary school students of various schools of Kollam and Thiruvananthapuram Districts.

**Step-III** The analysis of the data was conducted by using the above mentioned statistical procedures.

### 1.9 SCOPE AND LIMITATIONS OF THE STUDY

The tools prepared by the investigator to identify the Intelligence profile and science interest of pupils of Upper Primary Schools of Kerala syllabus. Both tools are effective to recognize the real cause for science interest and circumstances that lead the student towards achievement in science. It helps a teacher to identify the real cause behind it with the same intensity and depth. It helps a teacher to identify intelligence profile of a child and at maximum extent of his science interest. It is a valid tool to measure the various intelligence levels among boys and girls, urban and rural, Government, Aided and Unaided schools.

It is designed to use the tools for the pupils of standards V, VI, VII of the schools of Kerala where the medium instruction is Malayalam. It is developed as a Picturised Science Interest Inventory (PSII) and may be administered to a class of 40 pupils at a time. The test can be completed in the course of 45 minutes.

However, the test can be used for other parts of the country provided; it should be translated into the language of the respective regions.

Only a few tests have been developed for measuring the science interest for primary school students in Kerala. The investigator has undertaken the task of constructing a test of Science interest as a part of comprehensive scheme of test development.

The questions were given in the Test Battery (MITB) in the statement form because the investigator could experience all Questionnaires of this sort including
Gardner’s, the exponent of this technique. Almost all the intelligence test is found nonverbal.

The investigator intended to develop a Standardised tests for measuring Science interest of the Elementary School students to crystallise their interest for channalising them to a desired area.

One of the limitations of this study is, it conducted only in Kollam and Thiruvananthapuram District.

The present study is intended to find out the level and interrelationship of the components of Multiple Intelligence of the Upper Primary school students on Science Interest. An earnest attempt has been made by the investigator to find out the interrelationship of the above mentioned variables on the whole sample and on the varied sub samples, the findings of the study may help the parents, teachers and administrators to realize the importance of Multiple Intelligences and Science Interest.

Even though all possible precautions were taken to get valuable and reliable results, the study has some limitations owing practical difficulties. The study is limited to two districts of Kerala. The investigator has to rely upon the information received from the Primary school students. The sample may have certain underlying unidentified characteristics which may influence their responses.

1.10 ORGANISATION OF THE REPORT

This research report has been divided into Six chapters.

Chapter 1: Introduction:

It presents the background of the study, importance of science, intelligence and Science interest, Multiple Intelligence theory, Need and significance of the study, Statement of the problem, Definition of key terms, Objectives and Hypotheses, Methodology of the study along with the scope and limitation of the study.
Chapter 2: Theoretical Overview:

It is presented two parts

i. Introduction, Theories related to Multiple Intelligence and strategies, Benefits and drawbacks, Multiple Intelligences and science.

ii. Report details on science, its purpose and characteristics of science interest, its nature, measurement of interest, Interest Inventory and present situation of Kerala in science interest inventory and followed by conclusion.

Chapter 3: Review of Related Literature:

It presents introduction, studies related to Multiple Intelligences, studies related to science interest and relation between Multiple Intelligences and science interest/science followed by conclusion.

Chapter 4: Methodology:

It describes the Method selected, Tools used, Sample selected, Procedure adopted in the survey method and Statistical techniques used.

Chapter 5: Analysis and Interpretation:

It gives the analysis of the data collected along with the interpretation based on the values arrived through the statistical treatment.

Chapter 6: Conclusion and suggestions:

It offers conclusion of the study, implications and suggestions for further research in the area.