CHAPTER I

INTRODUCTION

1.1 Introduction

India is a country of paradox. On one hand the country is progressing in science and technology which can be seen through the launching of satellites successfully (on 22nd June 2016 ISRO - Indian Space Research Organization has launched 20 satellites). (http://www.thehindu.com/todays-paper/tp-national/isro-launches-20-satellites/article8761811.ece) and on the other hand people regularly gathers for Kumbha mela and take a holy dip with the belief of washing away all sins. In draught condition of 2015, people in Maharashtra demanded water to be released for such bath from dam instead of keeping it for drinking and farming purpose (http://timesofindia.indiatimes.com/city/mumbai/HC-asks-govt-to-reconsider-release-of-dam-water-for-Nashik-Kumbh/articleshow/48961908.cms). People believe in superstitions with false hope that something better will happen to their life without any efforts. They think God is responsible for all the worldly actions. Due to this wrong notion, people don’t engage themselves in any productive and creative activities. Such attitude towards life and work proves to be a prominent hurdle in human progress.

Education is the only means to eradicate superstitions. The aim of education is to bring desired modification in behavior. Learning is natural process which takes place at every conscious moment of an individual and is a product of interaction between human being and environment. Formal education set up is necessary to achieve specific goals of individual and societal development. Learning is a process and takes place between the teachers and taught in the context of environment. School being a formal agency of education needs to carefully plan learning experiences so that learning take place smoothly. The formal education set up tries to create environment which is different from natural so that learning takes place in varied Learning environment.

The conducive Learning environment enables students to acquire knowledge with ease, to put forth their ideas & views clearly, to think and criticize. Teachers should create varied learning opportunities for students. The varied Learning experiences not
only enhance analytical, critical thinking skills but also develop a habit of understanding situation holistically. The varied learning experiences help in providing different ways of learning thereby respecting different leaning styles of individuals. Learning helps in understanding concepts which motivates further to learn and understand new concepts, processes, phenomenon etc. Thus, acquisition of correct knowledge and participation in varied learning experiences will develop scientific literacy among students. These children will think objectively and in logical manner in every aspect of life and will make use of scientific knowledge for the betterment of society.

Science subject plays an important role in developing reasoning ability, logical thinking problem-solving ability, analytical thinking which are necessary to promote enquiry, experimentation etc. Indian Education Commission 1964-66, National policy on Education 1986 and National Curriculum Framework 2005 has included science as a core subject at school level with the following major objectives. (http://www.ncert.nic.in/new_ncert/ncert/rightside/links/pdf/focus_group/science.pdf).

• To acquire knowledge of biological, physical and material environments including forces of nature and simple natural phenomena, and

• To develop scientific attitudes such as objective outlook, spirit of enquiry, truthfulness and integrity, inventiveness, accuracy and precision, avoiding hasty conclusions on insufficient data, respect for the opinions of others.

In short, science education should enable the learner to-

• Know the facts and principles of science and its applications, consistent with the stage of cognitive development,

• Acquire the skills and understand the methods and processes that lead to generation and validation of scientific knowledge,

• Acquire the requisite theoretical knowledge and practical technological skills to enter the world of work,

• Nurture the natural curiosity, aesthetic sense and creativity in science and technology,
• Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment, and

• Cultivate ‘scientific temper’ - objectivity, critical thinking and freedom from fear and prejudice.

It means that science subject occupies important position in school syllabi as it is expected to create broad minded human being which is the basic requirement of any developed country through this subject.

1.2 The Concept of Learning Environment

Environment constitutes variety of things. It includes members in the society, their social customs, traditions, culture, education, training and physical structure. Various studies indicated that environment has remarkable influence on the learning of an individual. An effective classroom learning environment is where the teacher carefully utilizes available resources along with time for instruction. The learning environment is what the pupil experiences in classroom. The experiences are sources of knowledge and promote learning.

The learning process can be explained by using system approach in figure 1.1 (Deshmukh A. & Naik A. Pg. 98)

![Fig1.1 Learning Environment](image-url)
This approach is explained in the following paragraph:

**Input:** Student and teacher are major components of teaching and learning process. The teacher related characteristics are age, gender, SES, adjustment, Attitude towards teaching profession, knowledge, teaching methodologies, conceptual understanding about content matter, value system, outlook towards students etc.

The student related characteristics are age, gender, medium of instruction, demographic areas, parental occupation, socio-economic status, previous knowledge, etc. Students have their own strengths and weakness in the cognitive, affective and psychomotor areas. The Input includes all the human and material resources along with the infrastructure facilities made available to students.

**Process:** The process includes the behavior displayed by teacher and student. The teacher influences students and students’ responses influences teacher’s behavior. So the quality of teaching learning depends on the interaction between student, teacher and resources. The classroom factors like classroom size, structure and infrastructure material, audio visual aids and other resources play an important role in learning.

**Product:** Product is a learning outcome. These outcomes are in different forms; such as knowledge, skills, attitudes and values acquainted by students. The outcome is seen in two forms – long term and short term. The long term output cannot be immediately seen and verified; whereas short term output can be seen and verified immediately.

According to Hiemestra and Sisco (1990) the learning environment includes not only physical features of a classroom but also social, cultural and psychological components. In other words, one’s learning environment includes everything around him or her. The different aspects of learning environment are given by different scholars.

White (1972), Vosko (1984), Hiemstra and Sisco (1990), focused on seating arrangements, furniture, available space for free movement, ventilation, etc. while Tagiuri (1968) considered group dynamics in the classroom, inter and intrapersonal relationship, values, beliefs, traditions and classroom culture. Galbraith (1989, 1990) suggested that the learning environment consists of both the physical environment and
the psychological or emotional climate. Pappas (1990) has identified psychological environment, space and permission for movement, physical characteristics like light, temperature, noise, decor, furniture arrangements, the school traditions and the affective experience (how a person anticipates and responds to a learning setting) as a Learning Environment.

The learning environment is defined as, the sum total of the physical surroundings, psychological or emotional conditions, and social, cultural influences affecting the growth and development of learner. (Himestra1991).

The physical structure or facilities include proper ventilation & lighting, peaceful environment and places with physical comfort, convenient seating arrangements, absence of overcrowding etc. The location of the classroom, arrangement in the classroom, and sanitary facilities etc. all play a key role in efficient learning. Good conditions make it easier to learn.

The teacher preparedness succeeds with the communication of learning objectives to the students. The students without the knowledge of learning objectives are like the sailor sailing the boat without any direction and will never reach to destination. If students know-what is expected to do, will generate some innovative ideas which positively adds on the learning process. If teacher acknowledges brilliant ideas, students develop sense of dignity about their work. It builds up confidence among students.

Diversified learning experiences draw and retain the attention of students. Working in groups, discussions, debates, quiz competitions, posing riddles, visits to exhibitions, narrating science fiction stories, watching science movies, videos, reading science related articles brings variety in learning opportunities. The healthy learning environment results in better output. In short, teacher should plan and organize learning environment as per the requirement. Content should be presented in a meaningful and interesting manner. The conducive learning environment not only motivates individual to learn but the process of learning develops various skills which are essential for acquiring scientific Knowledge.
1.3 The Concept of Science Process Skills

Human being is curious by nature and this nature made him explore world around through experimentation. The curiosity is more prominent in children which motivate them to learn many things by exploring world around. In formal education, science is made compulsory with the intention of creating a human being with broad outlook. Study of science enables a person to develop a skill of solving problems related to life. To solve a problem, one needs to employ scientific method. The scientific method is nothing but a systematic plan of action. In a systematic study one needs to observe, measure, collect data, draw inference, arrive at conclusion, communicate and predict etc. Therefore, these processes are termed as science process skills. These science process skills are the tools that can be used by students to explore the world around and construct knowledge. Students should be trained for the observation, analysis, reasoning and thinking independently. Accurate measurement is possible with careful observation. The accurate observation gives intellectual satisfaction to students thereby finding similarities and differences between sounds, colors, patterns, shapes, sizes in the surrounding. Students participating in scientific activities confidently take part in intellectual debates. Studies in the United States have shown that elementary school students who are taught process skills like observation, inference, measurement, communication, prediction etc, not only learn to use science process skills, but also retain them for future use. Teachers need to select teaching strategies which helps in enhancing Science process skills. These skills can be mastered by students by gaining sufficient opportunities during learning. Deliberate effort must be put in to focus on process skills, more time should be spent on activities that enhance the understanding of Science concepts and improve Science Process skills rather than only conceptual understanding of science subject. Few studies have shown that teaching Science through activity-based approaches significantly improved students’ achievement in Science process skills (Beaumont-Walters, 2001). Padilla (1991) states that Science Process Skills are set of broadly transferable abilities that are reflective of what scientists do. These skills are grouped into two types – basic and integrated. Basic process skills provide a foundation for learning and the integrated skills, which are more complex skills for solving problems or doing Science experiments.
The science process skills are also described by some with terms like scientific method, scientific thinking and critical thinking. The Science process skills are of two types: basic and integrated. The basic process skills help to develop higher – integrated skills. (https://www.narst.org/publications/research/skill.cfm).

Observation is a basic science process skill and is important at every stage of learning. It helps to recognize the diversity in nature. Measurement is the skill which helps to measure or estimate and describe the dimensions of an object or event. Measurement is important in the study of various subjects and has a close application to life. It helps to gather data from nature and draw conclusions about events. e.g. temperature at different places, rainfall, and its impact on growth of plants and animals, etc.

Inferring is required for a learner to draw similarities and differences, group the data, and code it and to arrive at conclusion. e.g. Students collect information about the amount of water leakage from single tap in a day and predicts amount of water wastage in a week & in a year. This helps a student to bring awareness about wise use of water.

Thus, the science process skills, helps to understand the phenomena by reasoning, cause and effect relationship of components involved thereby increasing scientific Literacy. The basic science skills like observing, inferring, communicating and predicting are to be reported by making use of verbal or written language. Science requires use of precise language while employing science process skills which later helps to acquire Scientific Literacy.

1.4 The Concept of Scientific Literacy

Society can be considered as a developed when it has individuals who believe in logical thinking and reasoning and possess broad outlook of societal progress. The Indian society is rigid society and believes in old traditions and customs. Many customs are followed by people blindly which is a major hurdle in scientific thinking. In today’s era society is expected to be computer literate, financial literate, scientific literate etc. so the Literacy is an important indicator of development and scientific literacy is one of several types of literacy. A literate community is a considered as dynamic as its individual’s share their ideas and views. The scientifically literate person is able to identify the
interrelated components, its processes and reasoning behind phenomenon and knows basic scientific facts and its meaning. In the process of becoming scientifically literate; student start thinking analytically, reasoning logically and develops interest in science.

The goal of science education is to prepare scientifically literate students who can use science to improve their own lives, cope with an increasingly complex technological world, and be responsible citizens. According to the Project 2061 panel, the life-enhancing potential of science and technology cannot be realized unless the public in general comes to understand science, mathematics, and technology and to acquire scientific habits of mind. Without a science-literate population, the outlook for a better world is not promising. (http://www.project2061.org/publications/sfaa/online/intro.htm).

In terms of product, science has provided luxury and comfort to mankind. Due to advancement in transportation, it has been possible to have breakfast in India, lunch in Africa and dinner in America. The internet provides millions of results within fraction of seconds, telecommunications provides alerts about forthcoming disasters thereby helps to minimize the damage, white and green revolution had met the need of over growing population. Research in medicine has helped to have healthy and longer life span. This is all about life enhancing potential of science and technology. But, many countries have low literacy rate and high level of poverty. Majority of the people do not use and avail the facilities provided by science. Therefore, a better world is only possible with right amount of scientific literacy.

Scientific literacy is defined as the knowledge, understanding, and skills required for personal decision making, participation in civic and cultural affairs, and economic productivity in a world shaped by science and technology (American Association for the Advancement of Science, 1993; National Research Council,1996). The scientifically literate person judges the worth of scientific information and verifies its authentic sources. The person also finds out how the information is propagated, searches for its proof, and arrives at a conclusion by verifying all data. The person will not believe all what comes in his/her way.
Bybee (1997) has classified scientific literacy at four functional levels for the school students (https://www.pegem.net/dosyalar/dokuman/138340-20131231103513-6.pdf):

a) **Nominal scientific literacy**: Students identify a concept as related to science, but the holds misconceptions about the concept e.g. Some students think that atoms are smaller than electrons.

b) **Functional scientific literacy**: Students presents the term accurately, but does not comprehend it fully e.g. student describes transfer of heat experiment but cannot explain use of wooden coating in kitchen appliances.

c) **Conceptual scientific literacy**: Students develop understanding of the major conceptual schemes of a discipline and relate those schemes to their general understanding of science. The students understand the relationship between different processes. Students can prepare new design or modify the design according to their needs at this level. e.g. radius of curvature and slope of road, vehicle tire design and friction.

d) **Multidimensional scientific literacy**: students with multidimensional scientific Literacy bear deep understanding of various dimensions related to issue. Here students develop some understanding and appreciation of science and technology regarding its relationship to their daily lives. Specifically, students begin to make connections within different branches of science, between pure and applied science, problems against society.

The science learning should be aimed to acquire multidimensional Scientific Literacy.

PISA 2006, scientific literacy refer to four interrelated features that involve an individual’s

1. Scientific knowledge and use of that knowledge to identify questions, acquire new knowledge, explain scientific phenomenon, and draw evidence-based conclusions about science-related issues;

2. Understanding of the characteristic features of science as a form of human knowledge and enquiry;
3. Awareness of how science and technology shape our material, intellectual, and cultural environments; and

4. Willingness to engage in science-related issues, and with the ideas of science, as a constructive, concerned, and reflective citizen (OECD, 2006).

The scientific literacy enables a person to accept that contradiction is possible about already stated theories and also strives for certainty. e. g. earlier it was believed that sun moves from east to west. Now it is well known fact that earth rotates from west to east. The scientifically literate person does not accept the ‘success by chance’. S/he tries to get consistent results by many trials and then only accepts it. Such persons also accept that there is existence of invisible entities which can be explored by using science.

Presently many countries are facing problems of unemployment, health, poverty etc. Science education has capacity to enable people to face such problems. According to various reports all over the world, the Indian population will remain youngest population as compared to other countries for some decades. So, it is demand of time for Indians to be rational in thoughts and action. Education plays a key role in shaping minds of children. In India, the subject science is made compulsory in schools as per the directives of Kothari commission 1966; but the aims of science education are not achieved yet fully. It is known that students perform very well in science examinations but very few develop scientific Attitude which is the main reason for not being able to achieve the status of developed country. Thus it is important to develop individuals who value scientific Attitude.

1.5 Concept of scientific Attitude

The developed society is free from prejudices, superstitions and not restricts to only self-progress but also focuses on the development of deprived section of the society and utilizes maximum resources for everyone. Science subject has important aim to develop individuals with healthy mind and wider outlook towards self and society.

The cognitive, affective and psychomotor are considered as domains of personality. The cognitive domain is concerned with the mental processes which are predominantly developed in school through different subjects. Bloom has given hierarchy
of cognitive development namely knowledge, comprehension, application, analysis, synthesis and evaluation. The affective domain includes receiving or attending, responding, valuing, organization and characterization by a value or value complex in hierarchy. The individual’s sense organ plays important role in attending and receiving information from the surroundings. One’s Willingness to receive information controls attention. Preferred attention leads to second level i.e. responding. For example, in a classroom if teacher shows a snake and discusses its characteristics; asks students to touch snake under supervision; the students may not come forward as they have information that the snake bites and it takes human life. Here, in this case the students do not respond to the stimuli. In general, the person discriminates between available stimuli and responds to it. This discrimination depends upon satisfaction of intellect and attaches emotional significance to it. The next level is valuing. In this level the students see the worth of new information. e.g. when one watch snake and listens interesting information about snakes, its types, knows that all snakes do not bite, how snake venom is being used then they will start thinking of snakes role in ecosystem. In this way, gradual development of different values takes place. In the organization level, the person organizes different values by comparing/ contrasting them. The person tries to fit new information in existing schema and checks that whether new formation is useful. In the characterization level the person shows consistent behavior. The value system decides the behavior whereas the value complex determines the consistency in conduct of an individual. Now, the student will have different opinion about snake and will not rush to kill snakes when sees snakes. Development of affective domain brings the inner growth of an individual and guides ones conduct. Interaction between affective and cognitive domain results into the change in attitude. Information received decides whether to respond or not to respond and further attitude formation.

Attitude influences person’s behavior. Attitude is not only a thought but the thought accompanied by feelings. Therefore, Attitude governs conduct (behavior). e.g. It’s very natural for people to be scared of snakes. Generally people think that all snakes are poisonous and so are dangerous. This misconception results into killing of snakes. In reality, not all snakes are poisonous but very helpful to farmers. If people gets orientation about characteristics of poisonous and nonpoisonous snakes, role of snakes in ecosystem,
handling snake related emergencies and organizations to be contacted after sighting snakes etc; then people will be in more informed and will respond differently. The scientific information will help to develop favorable attitude towards snakes and may help in changing behavior of killing snakes.

ABC model proposed by La Pierre in 1934 asserts that the structure of attitude involves affective, cognitive and behavioral component. (http://www.simplypsychology.org/attitudes.html). According to this model attitude formation is based on the connection between the cognitive domain and affective domain which is displayed via behavior.

Scientific attitude includes respect for evidence, honesty, creativity, flexibility, curiosity, objectivity and skepticism. (https://www.reference.com/science/scientific-attitudes-cc15d0f0a167279) Scientific Attitude includes accuracy, intellectual honesty, open-mindedness, suspended judgment, criticalness and a habit of looking for true cause and effect relationships etc. (http://www.confabjournals.com/confabjournals/images/992013234834.pdf).

Scientific Attitude is the inquisitive approach with an open mind to embrace new things. It gives human beings a rational way of thinking. It makes an individual critical in thoughts and action. It urges one to try hard for the truth and deny blind acceptance of theories & opinions without tests and trial. Scientific attitude enables a person to change decisions by relying on empirical data/the logical argumentation. The scientific attitude supports a person to remove the barriers by rejecting the narrow mindset. It encourages one to face inconsistencies of changing environment/facts and circumstances. Scientific Attitude also builds a constant strive to proceed on the basis of realities among individuals.

Pandit Nehru mentioned in message sent to Indian science Congress in Calcutta 1938 that, ‘science alone could solve these problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition , of vast resources running to waste, of a rich country inhabited by starving people’.

People in India believe in superstitions and follow the blind beliefs and rituals like pouring milk on idols, hangings lemons and chilies to vehicles for protection and don’t react against the acts of intolerance and untouchability. The mere occurrence of eclipse too, is taken superstitiously and results in wasting water and food. The country like India has higher percentage of death due to malnutrition but the citizens don’t mind wasting the food in different festivals as their mindsets and beliefs lack scientific approach. It’s high time that deliberate and hard efforts need to put so that people think rationally and become wise human being.

In 1976, Article 51-A on Fundamental Duties has been added to our Constitution. It asks every citizen of India to develop the scientific temper, humanism and the spirit of inquiry and reform. (http://lawmin.nic.in/coi/coiason29july08.pdf) amendment no. 42 (w. e. f. 3/1/1977). Development of a scientific attitude is an important goal of science education. Current education system in schools urge majority of the teachers to adopt the methodologies that emphasize the development of cognitive domain. This results in neglecting the development of the affective domain.

To develop scientific Attitude among students, teacher needs to create opportunities. Students should be encouraged to collect evidences to support their claims. They should be appealed to be analytical while studying people behavior, events, traditions & things around them. Students must be encouraged to reject biased opinions and unproved theories. They should be able to stick to their assertions until they get contradicted by good and strong evidence. If things differ with their knowledge and beliefs, they should appreciate them and embrace them wholeheartedly. This tendency will create more opportunities to possess right information, alters feelings and emotions towards things/object thereby nourish scientific attitude among students.

In the present study the components of scientific attitude considered are discussed further in detail.

1. **Critical Thinking**

   Critical thinking is the intellectually disciplined process. It involves analysis of available data, reasoning of events actions and causes, synthesis of available data, reflection on the things occurring around.
1. Critical thinking 

The person who has critical thinking ability –

- raises the questions clearly and accurately.
- focuses on the real problem or decision to be taken.
- gathers and classifies relevant information.
- develops well reasoned conclusions and solutions,
- tests appropriateness and validity of the conclusions/solutions.

2. Open Mindedness

Open mindedness is willingness to change own mind in the appearance of reliable evidence and to respect another’s point of view. Open minded person remains ready to change his/her views after verification of truth and always welcomes scientifically proven facts, procedures and processes. Such people remain open for healthy argument and changes decision after verification. They listens carefully & fully to others, are more tolerant and are problem focused rather than person focused.

3. Curiosity

Maslow had postulated that curiosity could be equated with basic desire to know. A curious person

- Reaches positively to new ideas/situations,
- Exhibits a need or desire to know about himself or his environment or both;
- Scans surroundings, seeks new experiences; and
- Examines and explores the object/thing/phenomena.

Natural curiosity of children can be boosted by meeting their queries. The curious person not only sees & hears but looks & listens carefully.

4. Aversion to superstitions

Superstitions are irrational beliefs. Superstition arises due to lack of knowledge or fear of something unknown/mysterious entities. A person believing in superstitions is always anxious about unknown fears and remains uncertain.
Superstitions exist in many societies in different forms. Science is putting efforts to minimize the superstitions. Science Education helps to eradicate superstitions to much extent. A person with scientific attitude doesn’t believe in all beliefs. But, asks evidence to believe in anything and does not allow any space to superstitions. The person with scientific attitude knows that the individual without hands also has definite future and does not believe in palmistry or astrology. Such people do not waste chilies and lemons by hanging them to vehicles. Such people in fact orient others about its falseness and help the society from descending.

5. Suspended judgment

A suspension of judgment is done mostly in case of moral and ethical issues. For the proper judgment under any circumstances, the person must hear what the petitioner says. Person showing this tendency shows empathy towards the person. The process of rationalization is involved in giving the judgment. Person remains critical while searching for the support and evaluation of the same. The judgment is not given on the basis of unsuitable or insufficient support. The person who shows this quality do not jump to any conclusion in hurriedness. This is closely related to a desire to investigate and collect sufficient evidences before giving a judgment.

6. Intellectual Honesty

Intellectual honesty is fundamentally important for the development and acquisition of knowledge. It demands the appreciation of others contribution and is a higher standard than mere honesty. Intellectual honesty is characterized by an unbiased, honest attitude. It is demonstrated in a number of different ways:

Intellectually honest person does not overlook the important facts and information, presents/infers data in an unbiased way, doesn’t misguide others, acknowledges others credits, avoids cheating. This makes a person to be truthful and non prejudiced. This tendency directly governs the intellectual activities of people.
7. **Seeking to adopt different planned procedures in solving the problem**

Problem solving is considered as the one of the most complex intellectual process which requires analytical and critical thinking. A person having scientific attitude thinks for many different ways for solving a problem and selects the appropriate one.

8. **To have respect for scientific experiments.**

Scientific experiments are the tests or procedures which are carried out under controlled conditions to verify the proposed solution. An individual with scientific attitude searches for evidence, which can be tested by performing scientific experiments. Experiments provide empirical data help to arrive at a logical conclusion which can be verified by anyone.

Inculcation of Scientific attitude is the most important but complex task in a rigid society like India. Science is compulsory subject since primary classes. But, the focus of teaching is only on achievement in terms of marks. Attitude development is not only complex but also a long term process. The science process skills can help in the development of scientific attitude. In the present study the researcher tried to study the relationship between learning environment and scientific literacy, science process skills and scientific attitude.

1.6 **Statement of the problem**

**Relationship between Science related Process and Perception of Learning Environment of Secondary school students**

1.7 **Need of the study**

The review of related studies indicates that the studies conducted in relation to learning environment are inquiry based instructions and experience based science activities, Pre service Teacher’s attitude and self efficacy, students’ connections to out of school experiences and factors associated with science learning. Researcher could not find more studies related to learning environment and Perceived learning environment as well.
It is found that the variable Basic Science Process skills is studied in relation to student’s achievement in terms of science content, science process/reasoning, nature of science, and student’s attitude toward science, adaptation of Science curriculum Materials, Analogical Reasoning, Heuristic reasoning in chemistry, Developing Meta cognitive and Problem-Solving Skills, Computer simulations in the high school, Students' cognitive stages, Students’ Patterns of Reasoning, and effectiveness of Guided discovery teaching on critical thinking ability.

The variable scientific literacy is studied in relation with the variables such as mass media, communication technology, some characteristics related home and school, biology and physical sciences, academic success, teaching strategy, student’s feeling of loneliness, role of story writing in enhancing scientific literacy, role of emotional factors. Effectiveness of competency based inductive thinking model in science to develop reasoning ability has been also studied.

It has been observed that majority of the research has been conducted on attitude towards science. Researches are executed to evaluate the effect of gender, SES and academic success on scientific attitude. In some of the studies the variables studied in relation to scientific attitude are: problem based learning, activity based approaches, effect of learning strategy, achievement motivation, model based inquiry, social learning theory, educational opportunities and career options, critical thinking ability, scientific aptitude, scientific literacy etc.

Researcher could not find the particular study which investigates the relationship between the scientific attitude, scientific literacy, scientific thinking skills and perceived learning environment. Hence researcher intended to study the relationship between these variables.

1.8 Research Questions

The study attempts to answer the following questions:

1. Is there any relationship between Perception of Learning Environment and Basic science process skills?
2. Is there any relationship between Basic science process skills and Scientific Literacy / scientific attitude?

3. Is there any relationship between relationship between Scientific Literacy and scientific attitude?

4. Is there any gender difference in the relationship between perception of learning environment & i) Basic science process skills, ii) Scientific Literacy iii) Scientific Attitude?

5. If the effect of two variables is removed, does it influence relationship of other two variables?

6. Does Scientific Attitude is dependent on Perceived Learning Environment, Scientific literacy and basic Science process skills?

1.9 Variables of the study

**Independent Variables**

- Perception of Learning Environment
- Basic Science Process skills
- Scientific Literacy

**Dependent Variables**

- Scientific Attitude

1.10 Operational Definition of the terms

**Perception of Learning environment**

Perception of Learning environment is defined as the students’ perception about the arrangement of physical facilities and opportunities created by the science teacher for the optimum interaction of students with material and human so as to facilitate learning process.

In the present study following components of learning Environment are taken into consideration.

**Teacher preparedness**: Teacher’s readiness and planning about the topic to be taught in class, weekly/monthly planning of declaration of assignments/activities, time allotted for
students for submission, awareness of teaching aids needed, preparedness of evaluation criteria etc.

**Communication of learning objectives:** a teacher makes sure that students do understand that why and what they are going to learn.

**Learning opportunities:** a teacher allowing interaction between peers, arranging topic related learning platforms like corners/ exhibitions maximally, asking students to have ‘out of class’ experience, asking students to have references other that textbook , providing extra references etc.

**Learning resources:** a teacher shows movies/ videos, uses encyclopedias and dictionaries in the class, assists students by providing web links, encourages students to visit science fair, museum, gets science related articles to support learning, etc

**Feedback:** A teacher helps students to overcome mistake and motivates further learning.

**Laboratory work:** optimum use of laboratory for teaching and learning by avoiding accidents.

**Motivation:** A teacher appreciates novel and feasible ideas, guides at necessary situations, gives credit to students so that it helps to develop interest in subject.

**Classroom arrangement:** a teacher allows essential freedom of talk and movement in class, infrastructure arrangement flexibility.

**Science Process skills**

The basic skills such as observing, inferring, measuring, communicating, classifying and predicting possessed by students (Padila M. 1989).

**Scientific literacy**

I is defined as an understanding of seven elements of nature of science is- tentative, empirical, subjective (theory-laden), partially based on human imagination, creativity, and inference, socially and culturally embedded, the distinction between observation and inference, Relationship between scientific theories and laws known as Scientific Literacy (Carrier R. 2001).
Scientific attitude

Scientific attitude is a composite of a number of mental habits, or of tendencies. These habits or tendencies include accuracy, intellectual honesty, open-mindedness, suspended judgment, criticalness, a habit of looking for true cause and effect relationships. (Inamdar R. 2014)

1.1 Aims of the study

1. To study the perception of Learning Environment, Basic Science Process skills, Scientific Literacy and Scientific Attitude of secondary School Students.
2. To ascertain the relationship between Science related processes and perception of Learning Environment.
3. To ascertain the gender difference in the relationship between perception of Learning environment & Basic Science Process Skills, perception of Learning environment & Scientific Literacy, perception of Learning environment & Scientific Attitude, perception of Learning environment & Scientific Attitude.
4. To ascertain the relationship between perception of Learning environment and Basic Science Process Skills of secondary school students after removing the effect of Scientific Literacy and Scientific Attitude.
5. To ascertain the relationship between perception of Learning environment and Scientific Literacy of secondary school students after removing the effect of Scientific Attitude and Basic Science Process Skills.
6. To ascertain the relationship between perception of Learning environment and Scientific Attitude of secondary school students after removing the effect of Basic Science Process Skills and Scientific Literacy.
7. To ascertain the relationship between Basic Science Process Skills and Scientific Literacy of the secondary school students after removing the effect of perception of Learning Environment and Scientific Attitude.
8. To ascertain the relationship between Basic Science Process Skills and Scientific Attitude of the secondary school students after removing the effect of perception of Learning Environment and Scientific Literacy.
9. To ascertain the relationship between Scientific Literacy and Scientific Attitude of the secondary school students after removing the effect of perception of Learning Environment and Basic Science Process Skills.


1.12 Objectives of the study

1. To study the perception of Learning Environment of secondary School Students.
2. To study the Basic Science Process skills of secondary School Students.
3. To study the Scientific Literacy of secondary School Students.
4. To study the Scientific Attitude of secondary School Students.
5. To ascertain the relationship between perception of Learning environment and Basic Science Process Skills of i) TSS ii) boys iii) girls of secondary schools.
6. To ascertain the relationship between perception of Learning environment and Scientific Literacy of the secondary i) TSS ii) boys iii) girls.
7. To ascertain the relationship between perception of Learning environment and Scientific Attitude of the secondary i)TSS ii) boys iii) girls.
8. To ascertain the relationship between Basic Science Process Skills and Scientific Literacy of the secondary i)TSS ii) boys iii) girls.
9. To ascertain the relationship between Basic Science Process Skills and Scientific Attitude of the secondary i) TSS ii) boys iii) girls.
10. To ascertain the relationship between Scientific Literacy and Scientific Attitude of the secondary i) TSS ii) boys iii) girls.
11. To ascertain the gender difference in the relationship between perception of Learning environment and Basic Science Process Skills.
12. To ascertain the gender difference in the relationship between perception of Learning environment and Scientific Literacy.
13. To ascertain the gender difference in the relationship between perception of Learning environment and Scientific Attitude.
14. To ascertain the gender difference in the relationship between Basic Science Process Skills and Scientific Literacy.

15. To ascertain the gender difference in the relationship between Basic Science Process Skills and Scientific Attitude.

16. To ascertain the gender difference in the relationship between Scientific Literacy and Scientific Attitude.

17. To ascertain the relationship between perception of Learning environment and Basic Science Process Skills of secondary school students after removing the effect of Scientific Literacy and Scientific Attitude.

18. To ascertain the relationship between perception of Learning environment and Scientific Literacy of secondary school students after removing the effect of Scientific Attitude and Basic Science Process Skills.

19. To ascertain the relationship between perception of Learning environment and Scientific Attitude of secondary school students after removing the effect of Basic Science Process Skills and Scientific Literacy.

20. To ascertain the relationship between Basic Science Process Skills and Scientific Literacy of the secondary school students after removing the effect of perception of Learning Environment and Scientific Attitude.

21. To ascertain the relationship between Basic Science Process Skills and Scientific Attitude of the secondary school students after removing the effect of perception of Learning Environment and Scientific Literacy.

22. To ascertain the relationship between Scientific Literacy and Scientific Attitude of the secondary school students after removing the effect of perception of Learning Environment and Basic Science Process Skills.

23. To ascertain the relationship of Scientific Attitude with a) perception of Learning Environment b) Basic Science Process Skills c) Scientific Literacy of i) TSS ii) Boys iii) Girls.

1.13 Hypothesis of the study

1. There is no significant relationship between perception of Learning environment and Basic Science Process Skills of i) TSS ii) boys iii) girls of secondary schools.
2. There is no significant relationship between perception of Learning environment and Scientific Literacy of i) TSS ii) boys iii) girls of secondary schools.

3. There is no significant relationship between perception of Learning environment and Scientific Attitude of i) TSS ii) boys iii) girls of secondary schools.

4. There is no significant relationship between Basic Science Process Skills and Scientific Literacy of i) TSS ii) boys iii) girls of secondary schools.

5. There is no significant relationship between Basic Science Process Skills and Scientific Attitude of i) TSS ii) boys iii) girls of secondary schools.

6. There is no significant relationship between Scientific Literacy and Scientific Attitude of i) TSS ii) boys iii) girls of secondary schools.

7. There is no significant gender difference in the relationship between perception of Learning environment and Basic Science Process Skills.

8. There is no significant gender difference in the relationship between perception of Learning environment and Scientific Literacy.

9. There is no significant gender difference in the relationship between perception of Learning environment and Scientific Attitude.

10. There is no significant gender difference in the relationship between Basic Science Process Skills and Scientific Literacy.

11. There is no significant gender difference in the relationship between Basic Science Process Skills and Scientific Attitude.

12. There is no significant gender difference in the relationship between Scientific Literacy and Scientific Attitude.

13. There is no significant relationship between perception of Learning environment and Basic Science Process Skills of secondary school students after removing the effect of Scientific Literacy and Scientific Attitude.

14. There is no significant relationship between perception of Learning environment and Scientific Literacy of secondary school students after removing the effect of Scientific Attitude and Basic Science Process Skills.

15. There is no significant relationship between perception of Learning environment and Scientific Attitude of secondary school students after removing the effect of Basic Science Process Skills and Scientific Literacy.
16. There is no significant relationship between Basic Science Process Skills and Scientific Literacy of the secondary school students after removing the effect of perception of Learning Environment and Scientific Attitude.

17. There is no significant relationship between Basic Science Process Skills and Scientific Attitude of the secondary school students after removing the effect of perception of Learning Environment and Scientific Literacy.

18. There is no significant relationship between Scientific Literacy and Scientific Attitude of the secondary school students after removing the effect of perception of Learning Environment and Basic Science Process Skills.

19. There is no significant relationship of Scientific Attitude with a) perception of Learning Environment b) Basic Science Process Skills and Scientific Literacy of i) TSS ii) Boys iii) Girls.

1.14 Scope and delimitations of the study

For the present study students of standard ninth are selected. The schools are affiliated to Maharashtra State Board of Secondary Education and have English as a medium of instruction. These schools are selected from Navi Mumbai.

1.15 Limitations of the study

The present study deals with perception of Learning Environment, Basic Science Process Skills, Scientific Literacy and Scientific Attitude, therefore the tools used are paper pencil tests. The Scientific Literacy scale is specifically focusing on nature of Science which can bring limitations to the findings.

1.16 Significance of the study

The study has implications to curriculum designers in order to enrich learning environment, basic science process skills and scientific literacy at school level. The specific program in the curriculum of pre service teacher education can be designed to develop scientific attitude and competencies of student teachers so as to enable them to design lessons which can develop basic science process skills. Workshops and orientations can be organized for in service teachers to enhance their pedagogical competencies. The research findings will be useful for School principals so as to motivate teachers in creating the appropriate learning environment for students so that scientific attitude can be developed which is the ultimate aim of science teaching.