Chapter One
Conceptual Framework

1.1 Introduction

Education is preparing the seekers for life by enabling them to get required information, skills, values and attitudes. National Curriculum Framework 2005, (Government of India, NCERT, 2005) has defined education as "True education is that which draws out and stimulates the physical, intellectual, spiritual faculties of the children". Learner of secondary school is in the middle stage of period of adolescence (age fourteen-sixteen) a "crucial" period when development must move one way or another, towards progress or degradation. Secondary students of class IX or X are to be prepared for responsible adulthood who will be a future workforce of the world. Presently there is a cutthroat competition in academics, the limited resources and continuous pressure of expectations from self and the society; leaves the learner in the secondary school confused, aimless and frustrated. Secondly, today's adolescent learner has too much exposure to the world through media and new telecommunication devices. They are at the risk of falling prey to the products popularized by television commercial advertisements, Position Paper, NCERT (2005) focuses on education of adolescents for aesthetic appreciation and creativity because the adolescents' aesthetic sense or taste can be manipulated by market forces easily. They get carried away by the commercials in media. Learners in secondary school take more risk with health, life and future than ever before. Their involvement in health compromising behaviors such as intake of wrong food items, long and unnecessary use of mobile phone, indulgence in extensive use of internet and television has increased than before. If the learner in adolescent stage is able to realize one's own physical, intellectual and financial limitations and strengths, he or she will overcome the frustration and will strive to get the best in the positive way. But in case the adolescent does not realize the practical problem it may divert him or her to immoral ways of earning money. Biological changes, peer group pressure may indulge them in unsafe and unprotected sexual activity in the adolescent stage. Violent and delinquent acts and dropping out of school continues to increase due to frustration and fear of exam (NCF, 2005). The nation may have to pay a heavy price for this in future. In this context, the curriculum and the pedagogy at secondary stage needs an entirely new approach, which helps the learner to

cope with the challenges in their day-to-day life. Even though many programs are developed to reduce these behaviours, the involvement of adolescents in these activities has increased. Hence to accommodate the adolescent learners in the rapidly changing world, the information to be passed on, values and attitudes to be focused, and the skills to be developed require a shift. Umasree (1999) studied the status of teaching science in the secondary schools of Vadodara district found that most of the teachers follow chalk and talk method at secondary level which did not help to achieve the objectives of teaching science. The researcher suggested improvement in the method of teaching science and evaluation in secondary school, unfortunately when the parents, teachers, students and the society all believe in exam oriented education. The method of teaching could be changed only if the method of evaluation is changed was the conclusion drawn by National Knowledge Commission NKC (2008). Taking a cue from the recommendations of Indian Education Commission (1966) the Ministry of Human Resource Development of Government of India decided to introduce Continuous and Comprehensive Evaluation in central schools in 2009 by the act named Right of Children to Free and Compulsory Education Act (RTE, 2009). The Gujarat State Board of Secondary Education for the secondary school teachers implemented it from 2010. It has directed teachers to provide opportunities to encourage physical, emotional, social and academic growth through activities which are assigned to the students for continuous and comprehensive evaluation along with the development of Life Skills. Various low cost or zero cost activities like skits, group discussions, toy making from waste material, visit to public places for survey of scientific data or energy awareness programme etc. can be used for continuous evaluation. This process of evaluation through activities may help the teacher to know the learner and help the adolescent to improve her or his way of learning, giving scope to develop life skills. According to NCF (2005) the learning should make the adolescents happy and ready to face different challenges that life has in store for them. To inculcate the life skills necessary to be adjustable individuals who can accommodate to the changing circumstances of life; life skills should be developed. The report of the meeting held in 1997 by the World Health Organization, reiterated the significance of life skills as a way of one's life and concisely explained it as "life skills are a group of psycho-social competencies and interpersonal skills." "Those skills that

help people to take informed decision, solve problem, think creatively and critically, communicate effectively, build healthy relationships, empathize with others and cope with and manage their lives in a healthy and productive manner". Life Skill Education (LSE) is a student centered participatory process of learning and applying new skills in supportive classroom environment. Vashistha (2006) commented in his research that, "presently the students are actually over loaded with the syllabus" while exploring life skills related to science and technology. In this context integration of Life Skill Education through learning of other subjects is the best method. The activities like drama, storytelling and surveys or small scale experimental research to address locally relevant problems that are experienced by the students in their immediate surrounding have scope to develop life skills in the students. The benefits of life skills education on general educational outcomes are increasingly acknowledged at all levels. As national policies, many countries like Pakistan, Bangladesh and Zambia are increasingly integrating life skill education in their national curricula. 'National Curriculum Framework for School Education' brought out by NCERT (2001) includes life skills in areas linked to health, consumer rights and legal literacy. Some countries like Bosnia, Herzegovina and Jordan have life skills infused throughout the curriculum, or infused into another topic of the curriculum such as the Nepal National Life Skills Education programme infused it into the health curriculum. Development of life skills through teaching of any curricular subject can help the adolescent learners to increase their self awareness, assist them in creating responsible lifestyles and values for themselves along with learning of the curricular subject. It may help in finding solid ground to stand on and have a sense of purpose in their lives. This may help in developing their ability to build up and maintain productive relations with others.

1.1.1 Education at Secondary Stage

Primary education is a basic enabling factor for enjoying life with dignity and it aims at overcoming basic deprivation while secondary education is a gateway to prosperity. Secondary education opens the world of work to the youth of the country, contributing to the socio-economic development of the country. Secondary education which encompasses the education of students of class IX to class XII is a crucial stage in the

educational hierarchy as it prepares the adolescents for the higher education and world of work. India has been practicing LPG (Liberalisation, Privatisation and Globalisation) model of economy since 1991, as a result rapid changes are witnessed in scientific and technological world. Many new opportunities for work are developed. A horde of new abilities, skills and capacities are looked for in the candidates who apply for the jobs. In this respect secondary school pass-outs need to acquire higher level of skills and knowledge than what they are provided in the eight years of elementary school. This can lead to improvement in the quality of life and reduction in the poverty. The document NCF (2005) has defined aims of education in the direction of development of Life Skills.

1.1.2 Aims of Education at Secondary Stage

The Aims of education as given by NCF (2005), which direct education to development of life skills, are:

- To develop interdependence of thought and action, value based decision making, both independently and collectively. To develop empathy to other's well being, feelings, together with knowledge and understanding of the world, this should form the basis of rational commitment to values.
- Education should aim at learning to learn and the willingness to unlearn and relearn in order to respond to new situations in a flexible and creative manner, pointing to develop problem solving skill and creative thinking skill.
- It should help the learner to make right choices in life which needs development of critical thinking and decision making skill.
- Education should aim to provide the means and opportunities to enhance the child's creative expression and the capacity for aesthetic appreciation. This aim suggests development of creative thinking skill.
- It should aim to develop the ability to participate in democratic processes and contribute to the society in many ways suggesting development of critical thinking and problem solving skills.

NCF (2005) further focuses on education for aesthetic appreciation and creativity as the aesthetic gullibility of the citizens of developing country, allows for opinion and taste to be manufactured and manipulated by market forces. Finally, education should develop the ability to work and participate in the economic processes and social change. The

expectations of the NCERT from teachers and students of secondary school are many and ideal but what is the actual intellectual, moral, physical, emotional and social status of secondary school adolescent in India? It needs to be understood.

1.2 The Adolescent in Secondary School

Adolescence is the span of years of life between childhood and adulthood. Adolescence is described as a phase of life that begins in biology and ends in society. Secondary school students are experiencing dramatic changes in physical development, although the rate at which this development occurs varies individually. This heightened physical growth, together with their tendency to be very active, causes frequent fatigue in early adolescence. Many of them find it difficult to cope with the hormonal changes taking place in them and compare themselves unfavorably to their peers. Changes in height, weight and in the body chemistry are taking place, along with rapid sexual development. Adolescence can be divided into three phases; Early Adolescence (ages eleven-thirteen), Middle Adolescence (ages fourteen-sixteen) and Late Adolescence (ages sixteen-nineteen). The characteristics of each group are marginally different.

1.2.1 Characteristics of Adolescents

According to Seth (2010) Characteristics of various stages of adolescence

Characteristics of Early Adolescence (ages eleven-thirteen) are,

- Withdrawal from family
- Impulsive, moody, behaviour driven by feelings
- Spontaneity, spirit of adventure
- Self esteem defined by others
- Pre-occupation with physical appearance
- Concerned with acceptance by peers
- Use peer group to evaluate self
- Develops interest in some interaction with opposite sex

Characteristics of Middle Adolescence (ages fourteen-sixteen)

- Becomes isolated, seeks privacy
- Moves away from parents towards peers
- Strengthening of peer group bonds

- Influence of peer on appearance, extracurricular activities
- Spirit of defiance, challenges rules
- Attraction to opposite sex has special meaning
- Family influence on religious values, education and career

Characteristics of Late Adolescence (ages sixteen-nineteen)

- Attempts to identify adult roles and responsibilities
- Better understanding of self strengths, weaknesses, opportunities and threats
- Greater understanding of consequences of behaviour
- Improved skill of problem solving
- Better skill of Decision making for choosing career
- Conflict between traditional values and new roles.

1.2.2 Further Classification of characteristics of Middle age Adolescents

Class I to Class VIII students study in primary section. The young students of primary are in the stage of early adolescence. The students of Secondary school enter in the middle stage of adolescence at the age of thirteen or fourteen. Psychologically they are in the concrete operational stage of learning. According to Edlin (2011) the characteristics of middle age adolescents (ages fourteen-sixteen) are further classified into, Intellectual, Moral, Physical, Emotional / Psychological and Social.

1.2.2.1 Intellectual Characteristics of Middle age Adolescents

- Display a wide range of individual intellectual development
- Are in a transition period from concrete thinking to abstract thinking
- Are intensely curious and have a wide range of intellectual pursuits
- Prefer active over passive learning experiences
- Prefer interaction with peers during learning activities
- Respond positively to opportunities to participate in real life situations
- Have a strong need for approval and may be easily discouraged
- Develop an increasingly better understanding of personal abilities
- Are inquisitive about adults, often challenging their authority, and always observing
- May show disinterest in unconventional academic subjects but are intellectually curious about the world and themselves.

Activities like Know Your Electricity Bill and Save Electricity, Performing Drama on Motion assigned to teams of adolescents are in accordance to their intellectual characteristics. Presentation of small skit on the major invention in the life of scientists like e.g. Rutherford's gold foil experiment or study of Adaptation by species and their evolution by Darwin on Galapagos island such activities can satisfy their desire to know the world using unconventional methods.

1.2.2.2 Moral Characteristics of Middle age Adolescents

- They have special concern for animals and the environmental problems that our world faces
- They are moving from acceptance of adult moral judgments to development of their own personal values; nevertheless, they tend to embrace values consonant with those of their parents
- They rely on parents and significant adults for advice when facing major decisions
- At times they are quick to see flaws in others but slow to acknowledge their own faults
- Owing to their lack of experience are often impatient with the pace of change, underestimating the difficulties in making desired social changes
- They are capable of and value direct experience in participatory democracy
- They greatly need and are influenced by adult role models who will listen to them and affirm their moral consciousness and actions as being trustworthy role models
- The middle age adolescents are increasingly aware of and concerned about inconsistencies between values exhibited by adults and the conditions they see in society

Activities like making power point presentation on effect of pollutants on animals or plants and present it either individually or in team, Health Survey in Public Park to find attitude of adults towards communicable diseases conducted in group can take care of moral characteristics as well as their social needs.

1.2.2.3 Physical Characteristics of Middle age Adolescents

- Experience rapid, irregular physical growth
- Undergo bodily changes that may cause awkward, uncoordinated movements.

- Have varying maturity rates, with girls tending to mature one and half to two years earlier than boys.
- May be at a disadvantage because of varied rates of maturity that may require the understanding of caring adults.
- Experience restlessness and fatigue due to hormonal changes.
- Need daily physical activity because of increased energy.
- Develop sexual awareness that increases as secondary sex characteristics begin to appear.
- Are concerned with bodily changes that accompany sexual maturation and changes resulting in an increase in nose size, protruding ears, long arms, and awkward posture.
- Have preference for junk foods but need good nutrition.
- Often lack physical fitness, with poor levels of endurance, strength and flexibility.
- Are physically vulnerable because they may adopt poor health habits or engage in risky experimentation with drugs and sex.

Activities like designing a low calorie, low cost but high protein diet for themselves and presenting it in team in the form of Poster presentation assigned in group, making and presenting a PPT on Human Reproductive System or on HIV/AIDS followed by discussion in the class or assigning them project to design a game and play it to show effects of eating junk food can give them chance to understand their physical needs.

1.2.2.4 Emotional/ Psychological characteristics of Middle age Adolescents

- Experience mood swings often with peaks of intensity and unpredictability
- Need to release energy, often resulting in sudden, apparently meaningless outbursts of activity
- Seek to become increasingly independent, searching for adult identity and acceptance
- Are increasingly concerned about peer acceptance
- Tend to be self-conscious, lacking in self-esteem, and highly sensitive to personal criticism
- Exhibit intense concern about physical growth and maturity as profound physical changes occur

- Increasingly behave in ways associated with their sex as sex role identification strengthens
- Are concerned with many major societal issues as personal value systems develop
- Believe that personal problems, feelings, and experiences are unique to themselves
- Are psychologically vulnerable, because at no other stage in development are they more likely to encounter so many differences between themselves and others.

Team activities assigned to students give them scope to listen to each member's view, adjust with each other, think critically on problem posed to them and resolve issues to take right decision. Activities like make PPT on classification of Animals or Plants in a team and present it before the class in the presence of teacher, followed by question answer session can help the student to get peer acceptance, help them to share their emotional problems with each other giving scope to develop problem solving, decision making, creative thinking and critical thinking.

1.2.2.5 Social characteristics of Middle age Adolescents

- Have a strong need to belong to a group, with peer approval becoming more important as adult approval decreases in importance
- May exhibit immature behaviour because their social skills frequently lag behind their mental and physical maturity
- Experiment with new slang language and odd behaviours as they search for a social position within their group, often discarding these "new identities" at a later stage
- Must adjust to the social acceptance of early maturing girls and the athletic successes of early maturing boys, especially if they themselves are maturing at a slower rate
- Are dependent on parental beliefs and values but seek to make their own decisions
- Desire recognition for their efforts and achievements like fads, especially those shunned by adults often overreact to ridicule, embarrassment, and rejection
- Are socially vulnerable because, as they develop their beliefs, attitudes, and values. The influence of media and negative experiences with adults and peers may compromise their ideals and values.

Activities like Interviewing people to know about their understanding of sustainable development, concept of recycle, reuse and reduce the use of sources of energy or interviewing their own grandparents and senior citizens living in their neighbourhood to

gain knowledge about home remedies for small health problems gives them opportunity to socialise with elders. The adolescents can gain knowledge and earn respect in the family. To make adolescents realise the falsity of claims made by commercials on advantages of the products as shown on television or internet, they can be asked to critically examine the advertisements that market food products, cosmetics and enact it in the team to show the truth about the products. The study of above mentioned characteristics of middle age adolescents helped the researcher to design activities of LSE programme. It has helped to understand the need for development of life skills in adolescents of secondary school as emphasized by the central education board and state education boards at secondary school level. Yet there are some other reasons too to develop thinking skills at secondary level.

1.3 Purpose of developing thinking skills in adolescents at Secondary Level

Today the school girls and boys attain puberty at the age of ten to twelve years compared to the children of a decade ago. By the time they enter secondary school they are between fourteen to sixteen years of age. Nair (2005) conducted a study on adolescents and concluded that adolescence is a period of experiencing, and expanding. The exposure to modern means of communications, entertainment, modern food habits, and change in life style of their family are the main factors responsible for the growth of kids. The period of middle level adolescence has increased. The adolescent today is techno-savvy, activeness inclined to hyper activity and swiftness tending to impatience is observed by the investigator in the secondary school. Generally bigger students are their ideal. Under peer pressure adolescent learners may get provoked that leads to watching of porn films, reading porn material. Here the investigator sees the role of a science teacher to make them aware about pros and cons of having safe sex and risks at adopting wrong ways of getting experience of sex. The science curriculum of class IX and X has scope to teach them the why, what and how of reproduction. Amelia (2007) reported in New York Times that India has included sex education in its national curriculum since the late 1980s. Along with the physical, emotional and social concern about own performance they are often concerned about their ability to learn and feel doubtful. Students of this age are sensitive and have a strong need for approval from others especially peer group; thus, deflating comments or criticism sometimes have debilitating effects. Conversely, they are

frequently thoughtless and calloused in their relationships with one another. They seek associations, relationships, and links with people, things, and new ideas. They are particularly concerned about peer approval and acceptance, and they need close friends of their own age that can provide the comfort and understanding they find hard to get from adults. Most early adolescents enjoy team sports, thrive on competition, work hard at perfecting athletic skills, and respect good sportsmanship. They seek values in simplified, concrete forms; are often hyper idealistic; and demand fair treatment. They are usually excitable, easily motivated, creative, inquisitive, and eager to explore; but if not active participants in learning situations, they may easily drift into daydreams. Adolescent learners of secondary school needs help and guidance in decision making, problem solving and critical thinking, developing interpersonal skills, self-awareness, and empathy, coping with stress and managing emotions.

1.4 Academic Status of secondary school student

The students admitted to secondary section of the school in India have learnt basic three Rs like reading, writing and arithmetic in primary classes up to class VIII. In class IX and X these adolescents study ten subjects like First language (language of medium of instruction), National language, Regional language, Mathematics, Science, Social Science, Computer Studies, Physical Education, Drawing and Fourth language. They appear for ten theory and three practical examinations in each summative evaluation. They are loaded with syllabus of too many subjects. The problems are acute for English Medium students as the language spoken at home is vernacular while medium of instruction is English. This leads to loss of self-confidence and lack of understanding the contents of the state board textbook. The concepts in science, mathematics or civics textbook look impossible to understand. In such case, it is imperative to reframe the secondary school teacher's role in making them understand the concepts. Especially the abstract concepts of science can be taught by participatory method. Chemical reactions can be understood by actually doing experiments related to their real life, making toys to prove Newton's Laws or enact like molecules to feel transfer of heat by conduction. If the teacher makes the student use the participatory processes like performing skits to convey a scientific thought, preparing and presenting a paper on any content in the science textbook, storytelling, improvising the apparatus to perform the experiments in science

there is a possibility of developing life skills, which will be useful to them to enhance the quality of their life. Here the questions that posed in front of the investigator were what are life skills? What are thinking skills?

1.5.1 Definition of Life Skill

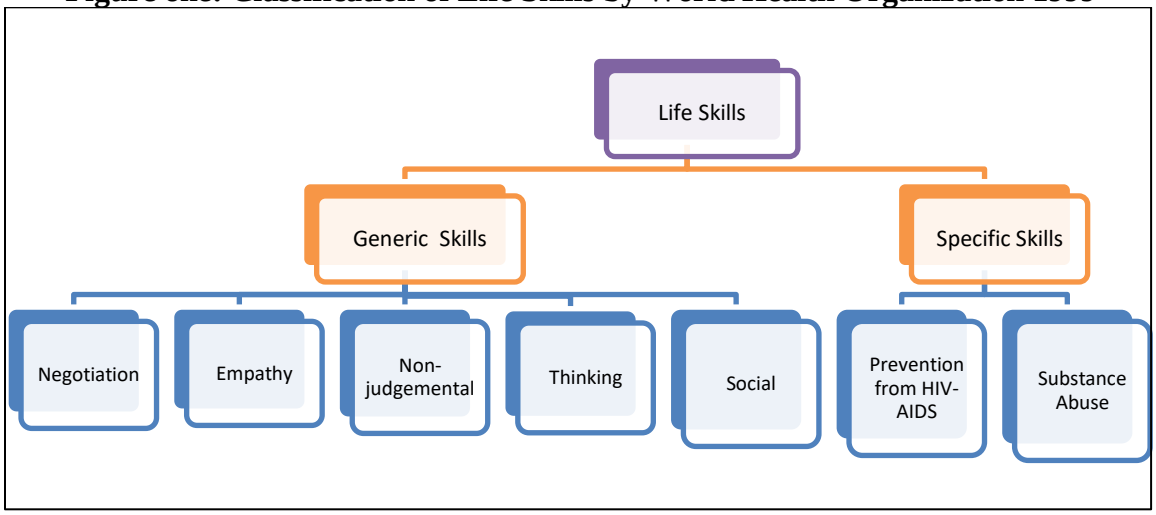
The Dakar Framework for Action on Education For All (EFA) and the declaration of commitment on HIV and AIDS, in the agendas of multi-lateral agencies such as the World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) led to the rapid expansion of Life Skill Education initiatives UNESCO (2000). It was done with a very wide spectrum of content, scale, approaches and goals that show the challenge of defining and operationalising a concept as broad, complex and multi-faceted as life skills. It reported the concept of Life Skill as "person's ability to maintain a state of mental well being and to demonstrate the same in adaptive and positive behavior while interacting with others or his or her environment". Life Skill is broadly defined as psycho-social competency to deal effectively with the demands and challenges of everyday life. Life Skills are skills, relevant to many diverse experiences throughout life. According to WHO (1999) 'life skills are living skills or abilities for adaptive and positive behaviour that enable individuals to deal effectively with demands and challenges of everyday life'. During the meeting on Life Skills Education for Mental Health Promotion held at WHO headquarters in 1998, decided to define life skills as psycho-social and interpersonal skills to cope with problems in day to day life. According to Yadav (2002), "The term skill has two general meanings: One describes a constellation of behavior that make up "a skill" e.g. flying skill, secondly skill refers to something the individual possesses as a capability to perform a task with higher order of proficiency". Over the past two decades Life Skill Education has come to be seen as the integral part of education to prepare young people and adults to negotiate and mediate everyday challenges and risks and enable productive participation in society. The life skills mentioned below are basic, broad skills known as Generic skills while the skills defined to combat substance abuse or prevention from HIV AIDS are called Content Specific. The development of Generic skills will be sufficient to resolve problems of daily life in normal course. UNICEF (2012) has reported specially defined content specific skills like skill to prevent the people suffering from acute substance abuse or skill

to deal with HIV AIDS. UNICEF (2012) recommends the educationist to develop life skills at the school level itself. Amongst all the stages of growth, middle stage adolescence i.e. especially the stage of student of secondary school is the most vulnerable stage for falling prey to the substance abuse or unsafe sexual practice. The adolescents of secondary school can be turned into responsible adults by developing Generic life skills through Life Skill Education Programme implemented in school through Integrated Approach without adding the pressure of 'Life Skills' as a separate subject. Generic Life Skills as explained in the report for mental health WHO (1999) are the skills that can be developed over a period of time through specially designed Life Skill Curriculum and Life Skill Education Programme or through Integrated Approach i.e. inculcating life skills through teaching of school subjects. There are five basic areas of Generic Skills given by World Health Organization.

1.5.2 Type of Life Skills / Basic Areas of Generic Life Skills

The life skills were mainly classified into Thinking, Social, Negotiation, Non- judgmental and Empathy by WHO (1999).

Figure one: Classification of Life Skills by World Health Organization 1999



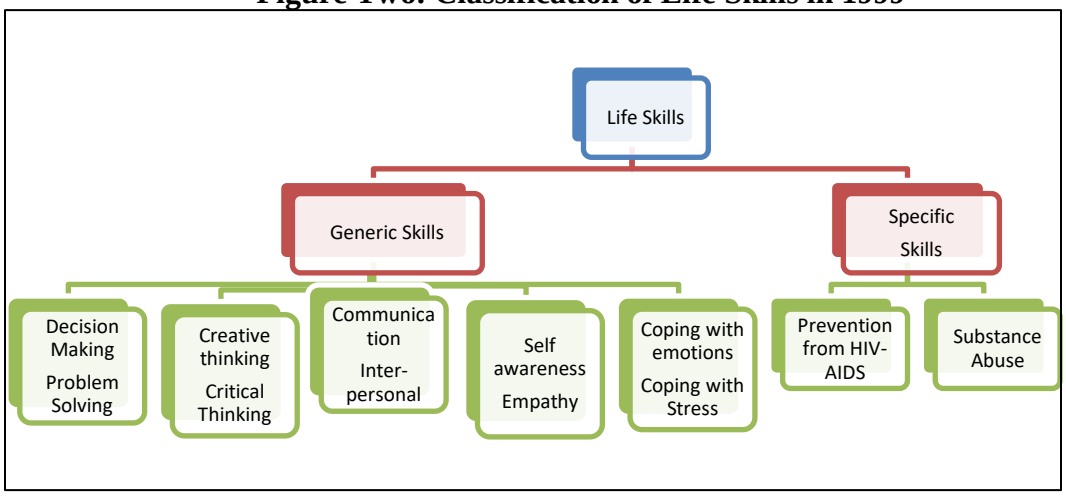
WHO (1999) department of Mental Health identified five basic areas of life skills that are relevant across the cultures now:

- Decision-making and problem solving
- Creative thinking and critical thinking
- Communication and interpersonal skills
- Self-awareness and empathy

- Coping with emotions and coping with stress

Thinking skills are grouped into Self-awareness, Critical thinking, Creative thinking, Problem solving and Decision making. Kinds of social skills are Inter personal relationships, appreciating others, coping with stress and taking responsibility. The kinds of negotiation skills are skill to be assertive, say no to risky situations and Communication skills. The kinds of non-judgmental skills are, avoiding personal values and respect for others' values. The kinds of empathetic skills are compassion and care. The researcher has focused on four thinking skills only, as main objectives of teaching of science are to develop scientific attitude and develop science process skills. Science process skills are named as observing qualities, measuring quantities, sorting and classifying, inferring, predicting, experimenting and communicating which require critical thinking, problem solving, creative thinking and decision making skills. NCERT (2001) has given specific objectives for secondary stage class (IX, X) as to understand the basic concepts, principles, and laws of science, to apply those principles in finding solutions to the problems related to agriculture, energy, health, nutrition etc. It also states the objectives as to develop problem solving and decision making skills, to acquire process skills, which form part of the attitude for developing a scientific temper.

Figure Two: Classification of Life Skills in 1999

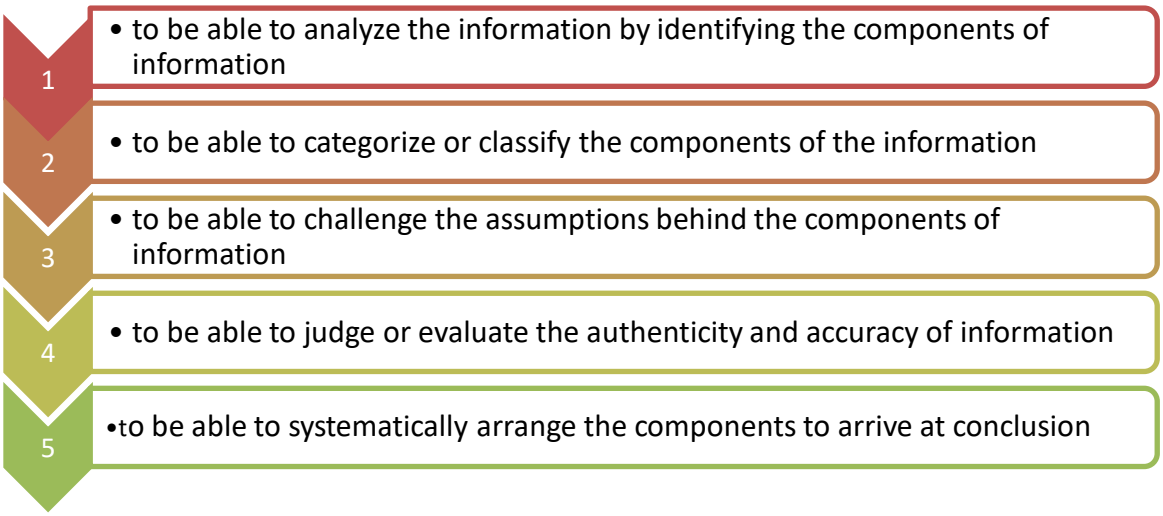


1.5.3 Thinking Skills and their Components

The kinds of thinking Skills focused by the investigator in the present study are critical thinking, creative thinking, problem solving and decision making.

1.5.3.1 Skill of Critical Thinking

Critical mindedness or critical thinking insists upon evidence to support another person's statement, questions to the source of information and its reliability; often asks questions like how do you know, why do you believe this and what evidence do you have? Questioning, arguing, re-thinking, and reflecting were seen as necessary skills for an individual to contribute to society and provide a platform for change Brookfield, (1987). The cognitive skills most often associated with critical thinking include: i) interpretation, ii) analysis, iii) evaluation, iv) inference, v) explanation and vi) self-regulation; Facione, (1992). While Patel (1997) defined critical mindedness or critical thinking is the ability to evaluate any accepted rules or procedures. For developing critical thinking, it is important for adolescents to begin with listening and asking questions. Information is needed to think critically so that appropriate decisions and choices can be made. This skill will also lead young adolescents to introspect oneself and never follow blindly any path howsoever may be the pressure from peers. Paul and Elder (2006) mentioned in the guide for educators that critical thinking in the student can be identified when the student can identify the components of given data, classify them, can see the assumptions behind those assumptions, can check the trueness of the data and can arrange the data to derive the idea from it. Helaiya (2010) mentions indicators of critical thinking skill in her study as,

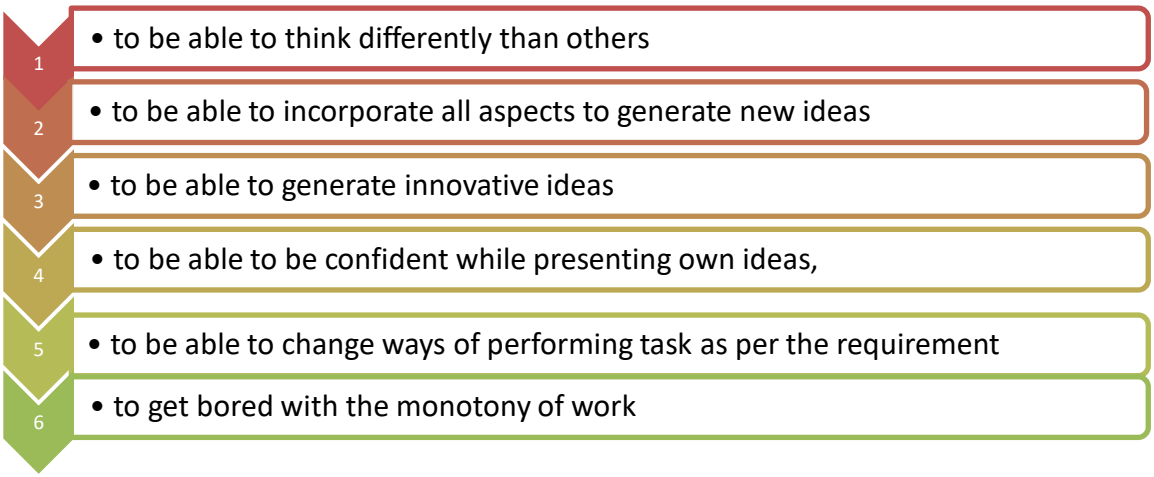


The activities assigned to adolescents of class IX like skit/role play to show characteristics of the animals of particular phylum or critical analysis of advertisements on food products shown on television give scope to develop critical thinking.

1.5.3.2 Skill of Creative Thinking

It requires patience and persistence and helps in searching new answers to old questions. Creativity is a process of generating unique products by the transformation of existing products. Creative people are more sensitive to the existence of problems, have a somewhat greater tendency toward emotional disturbance, but also have more self control for dealing with this tendency. They are able to think both convergently, solving problems that have only one correct answer and divergently, solving problems that have many possible answers. They demonstrate greater determination and perseverance higher than average intelligence but do not often measure in the "genius" range. They are more open to experience and less defensive about accepting new information and see themselves as responsible for most of what happens to them. Creative people enjoy being playful and childlike, have the ability to “toy” with the environment. They engage more frequently in solitary activities, especially as children and are more likely to question the status quo. They are more independent of the judgment of others and are less afraid of their own impulses and hidden emotions. They like to do their own planning, make their own decisions, and need the least training and experience in self-guidance. They do not like to work with others, and prefer their own judgment of their work to the judgment of others. They seldom ask other students or their teachers for opinions and take a hopeful outlook when presented with complex and difficult tasks. They have the most novel ideas, given a chance to express, individual opinion is presented. These ideas frequently evoke the ridicule of others. They are most likely to stand their ground in the face of criticism and are the most resourceful when unusual circumstances arise. The creative students are not necessarily the "best" students. They show an imaginative use of many different words and are more original. Their ideas are qualitatively different form everyone else's. Scot & Sidney (1985) defined creativity as “making and communicating meaningful new connections no one else has made.” Creative thinking is to help our students think of many possibilities, experience many different perspectives of an issue and ways of stretching the imagination. This skill can lead to the production of original product that meets the criteria of purpose and value established. George (2006) quotes in the study that, “the intervention program conducted in schools to enhance life skills among middle school students indicates positive impact of creative thinking on academic

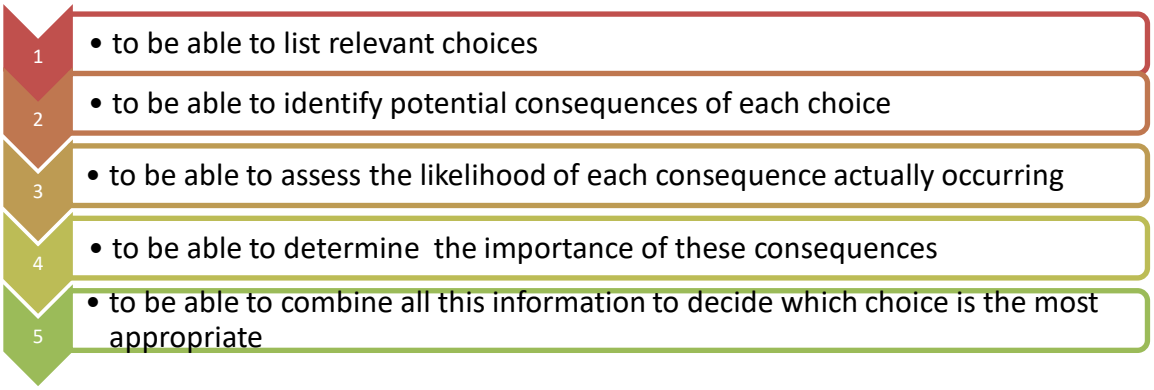
performance". On the similar lines Shah concludes in the study that, "the creative thinking skills development program led to the development of fluency and originality skill in the grade nine students of Saurashtra". The indicators of creative thinking skill according to Helaiya (2010) are,



The activities like making power point presentation for the given theme or preparing a model to explain given concept or making of a chart offers opportunity to develop creative thinking skill.

1.5.3.3 Skill of Decision Making

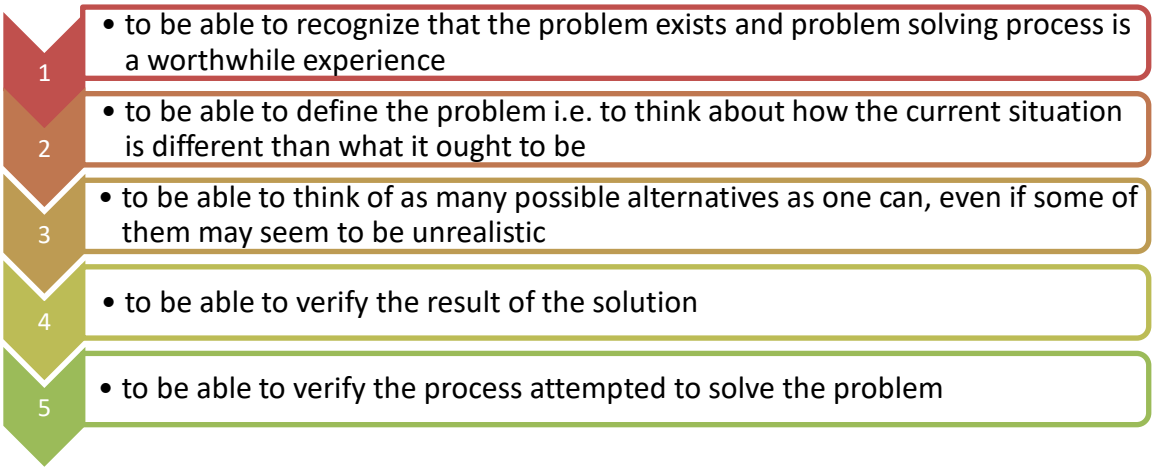
There is a strong tendency to accept authority of parents. Decisions and problems, in our society are most often left to the head of the family. Decision Making can be defined as making logical conclusion, solving problems and taking appropriate actions. The adolescent who is having more protected environment in the family and authoritative parents acquires this skill with difficulty. The indicators of Decision Making Skill listed by Helaiya (2010) are



When the adolescents are exposed to the activities related to the curricular subject that involve decision making then they get opportunity to develop decision making skill.

1.5.3.4 Skill of Problem Solving

Patel (1997) observes that "NCERT workshop at Chandigadh (1971) mentioned in its summary that scientific attitude can be a valuable result of the problem solving approach to learning. It is encouraged when study of a subject is attacked through, i) identifying a problem, ii) making valid observations, iii) drawing objective conclusions, iv) verifying the conclusions to a new but related to the problem". Solving problems in orderly manner leads to the development of an objective attitude (Scientific attitude) that is applicable to many solutions. Vashistha (2006) defined it as the process of understanding a problem and coming out with a solution. In addition, it is important to learn that there can be different ways to solve the same problem. Hence, components of problem solving skill are generally considered as the skill of defining the problem, skill of solution generation, skill of devising a plan in order to solve the problem and to measure the skill of predicting consequences of the solutions on the problem. Helaiya (2010) listed the indicators of problem solving skill as,



If adolescents are given opportunity to look at different perspective of an issue, the pros & cons of allowing one decision over the other, it can make them realize the negative consequences of making hasty and unplanned decisions. While doing this the skill of critical thinking and creative thinking are needed so there is a scope to develop these along with decision-making and problem solving skill. The development of life skills in

adolescents of secondary school can be attempted only if the characteristics of middle staged adolescent and indicators of thinking skills are considered as mentioned above.

1.6 Thinking Skills and their relation to the subject Science at Secondary level

Padilla (1990) wrote three arguments that stress on the need and importance for including activities based on science process skills in classroom learning. First is generalisability of these skills to life. Secondly such activities accurately reflect the nature of science and what scientists do. Third activities based on science process skills involve the development of formal reasoning abilities. According to Ismail (2001) both the science process skills and the thinking skills are interrelated. The stimulation of students' formal reasoning or thinking abilities represents main aim of science education. Curriculum of Science gives enough scope to develop thinking abilities in the learner. According to NCERT (2006) the curriculum for the particular age of learner is designed keeping focus on the learner's mental development and the learner's context. The aims of science education direct the teachers of secondary school to develop thinking skills like critical thinking, problem solving, decision making and creative thinking. When science teacher makes the student learn the concepts with innovative activities i.e. through various learning experiences they give more scope to develop critical thinking, creative thinking, problem solving and decision making skills in students. Mental capacity of the secondary school adolescent is on the threshold of abstract learning. Looking into the nature of science it is understood that teaching of science to students should include activities that give scope to develop indicators of scientific skills like proposing problems, defining the problem, thinking of many solutions, setting up hypotheses and their testing with controlled experiment, rethinking of new solution, discarding personal opinion in the light of new evidence and suspending judgment in case of conflicting evidence, challenging the principle of authority if needed thus distinguishing between scientific information and popular information. Comparing the skills to be developed through teaching of science with the indicators of skills of critical thinking, creative thinking, problem solving and decision making it can be concluded that development of life skills through teaching of science is possible and easy. Relating the principles of experiential learning like a) learning through real-life contexts, b) learning by doing, c) learning though projects, and d) learning though solving problems with teaching of science in

secondary section Knobloch (2003), the assignments like role play for presentation of concept, presentation of projects or experiment conducted based on the content of science and the activity like grow your herbarium or survey followed by probing and discussions brings 'learning' in the learner with a sure move towards the development of thinking skill. It is the fundamental right of every child to get quality life and it is possible only after seeking right education in this technologically advanced world. Today the world has changed drastically and shrinked. In the last decade, number of work opportunities in other fields like commerce, entertainment, journalism, world of media, beauty treatments etc. have opened, than in the field of science and technology alone. Rather each field of work is now done with a scientific attitude and using technology. Hence the parents of adolescents and the school managements give lot of importance to the teaching and learning of subject science. Secondly the nature of subject science is such that a science teacher has easy access to the development of thinking skills in adolescents of secondary school while teaching scientific method to them. The questions arise here are: What is science? What is its nature? What are the domains of science? What is the status of teaching of science at secondary level in India? What are the objectives of teaching science at secondary level? What are the recommendations of various commissions and committees of department of education of government of India for teaching of science?

1.7 Teaching of Science at Secondary Stage

It is essential to know definition of science, its nature and its application in human life before discussing science education.

1.7.1 Definition of Science

The subject science is defined as intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment. Science (from Latin *scientia*, meaning "knowledge") is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. In an older and closely related meaning, "science" also refers to a body of knowledge itself, of the type that can be rationally explained and reliably applied.

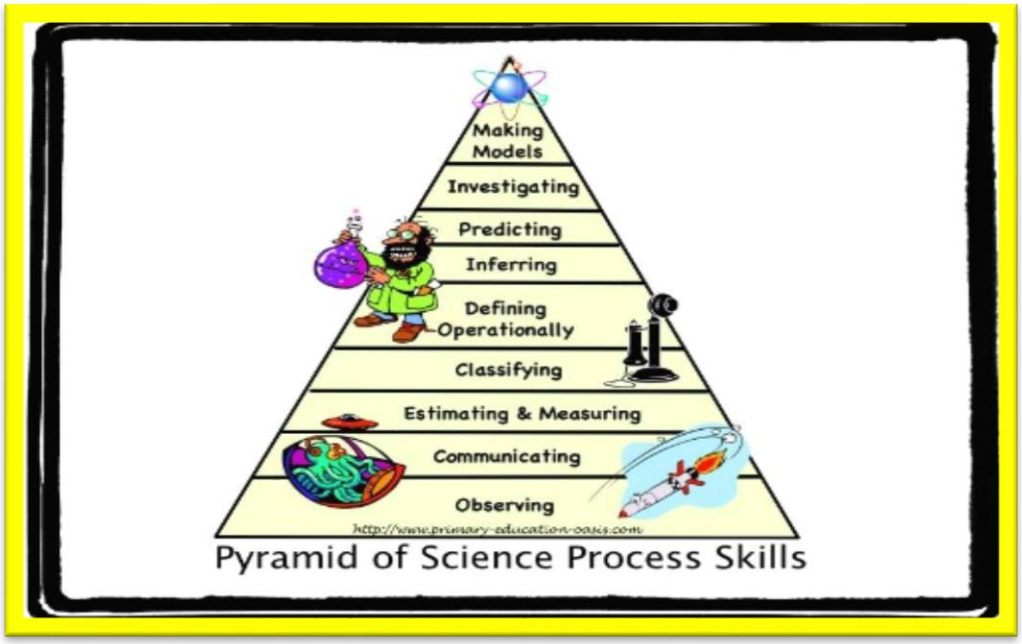
1.7.2 Nature of Science

The subject Science is defined as the organized body of knowledge concerning the physical world, both animate and inanimate, and the attitudes and methods through which this body of knowledge is formed. Science is the systematic study of nature. "Science is a cumulative and endless series of empirical observations, which result in the formation of concepts and theories, with both concepts and theories being subject to modification in the light of further empirical observations. Science is both a body of knowledge and the process of acquired knowledge" NCERT (2005). Science is an open-ended exploration; its results are not fixed in advance. "The three basic characteristics of the nature of science can be identified as i) an accumulated and systematized bodies of knowledge (product), ii) the scientific method of inquiry (process) and iii) the scientific attitude (application to life). These characteristics indicate science as the product and process and when applied to address real life problems, develops scientific attitude. The subject science gives reasons for almost every happening around us.

1.7.3 Science as a process

As a process it includes observation, record observations, asking question, drawing inference from evidence, developing ways to find answers, classify and check the answers. It involves the process of measurement, experimentation, classification, verification and evolving a thesis, antithesis and emerging with synthesis. The scientific method or science as a process as mentioned by Sharma (2006) includes; i) observation, ii) classification, iii) number relations, iv) measurement, v) space-time relations, vi) communication, vii) prediction, viii) inference, ix) making operational definitions, x) formulating a hypothesis, xi) interpreting data, xii) identifying and controlling variables, 13) experimenting and concluding". Amin (2011) states that science is not just a subject but it is a method to acquire knowledge generate new knowledge and check the existing knowledge with the new observations. The steps of scientific method can lead to scientific attitude that can be a valuable result of the problem-solving approach to learning. Scientific attitude, as defined by Patel (1997) has components like Rationality, Curiosity, Objectivity, Open-mindedness and Critical mindedness, Intellectual Honesty, Observation, Humility, Environmental Awareness and Courage to question.

Plate: 1.1 Pyramid showing order of science process skills



(Source: http://www.k5chalkbox.com)

1.7.4 Science as a product

Science as a product is in the form of knowledge. This body of scientific knowledge can be classified into facts, concepts, generalizations, theories and laws, which form the structure of science. The pieces of information collected by the scientists as a result of their studies of nature have emerged as a large body of verified, tested knowledge. This knowledge is arranged into different subjects like, biology, geology, physics and chemistry in the form of product of science. Scientific knowledge can be seen in the form of interrelated concepts, laws that together support further investigation. Continuous chain of investigations gives rise to discovery. Science as a product that is as a body of knowledge when applied in real life leads to inventions, new techniques and technology. Pure Science and application of science i.e. technology covers almost all domains of life today.

1.8 Recommendations of Various Commissions related to Teaching of Science

The **Indian Education Commission** of 1964 resulted in the preparation of the National policy of Education, in 1968. "The destiny of this country is shaped in the classroom and laboratories of schools and colleges." The commission gave its report in 1966, named it

as ‘Education and National Development’. This report recommended that: i) science should be taught as a discipline of mind and preparation for higher education at secondary stage ii) science curriculum from primary to masters level should be planned very well iii) science should be taught from primary to university for prosperity of nation Amin, (2011). Higher quality institutions like Indian Institute of Technology (IIT), Indian institute of science (IISc), dozen institutes of National importance, two hundred odd universities and over eight thousand colleges were established. India has supported whole heartedly to the policy of developing science and technology skilled human resource and has provided second largest technical manpower to the world. The report of **Indian Education Commission** (1966) states that, “Education has always been important but, perhaps, never more so, in man’s history than today. In a science based world, education and research are crucial to the development process of a country, its welfare, progress and security.” The constitutional amendment of 1976 placed science and technology education in the concurrent list which implies that science education is a joint responsibility of central and state government. To promote education and science education in particular, **University Grants Commission (UGC)** and the **All India Council for Technical Education (AICTE)**, by acts of parliament were given the rights to superintend the functioning of higher education in science and technology. Various education commissions were set up to discuss and recommend the necessary changes in the system of education. These commissions and committees have suggested improvements, in accordance with the changing needs of the Indian Society to compete in the world. Science and technology has played a pivotal role in the development of the society, hence the subject ‘Science’ in the secondary school curriculum was renamed as ‘Science and Technology’ by National Curriculum Framework for school Education in the millennium year of 2000. School education has been central theme in the deliberations of the **National Knowledge Commission** (NKC,2008) since its inception. Its report suggests improvement in quality of school science education with the use of ICT in education, continuous teacher training, reforms in teaching methods, examination, and focus on life skill development. The NCERT has published specific objectives for teaching science curriculum to achieve the broader goals of education.

1.8.1 Objectives of Teaching Science

The general objectives of teaching science curriculum as mentioned in the position paper by NCERT in 2006 are, 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,
- develop a historical and developmental perspective of science and to enable the learner to view science as a social enterprise,
- relate to the environment (natural environment, artefacts and people), local as well as global, and appreciate the issues at the interface of science, technology and society,
- 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.

The objectives of teaching science directed the researcher to know the status of teaching of science in India and particularly in Gujarat.

1.8.2 Status of Teaching Science in India and particularly in Gujarat

The pedagogy adopted by science teachers in any country depends basically on the ideology decided by its National Policy of Education. The ideology chosen decides the objectives of teaching science which leads to the science curriculum. The curriculum helps to make the syllabus of the subject which is decided by various state boards and the central board. In a particular state of the same country the curriculum for teaching science at a particular stage, e.g. secondary level is same as the centre but syllabus for each state board is different which is based on the cultural, political, social and geographical aspects of that particular state. The methodology or pedagogy of teaching science at secondary stage depends on the nature of the topic, availability of resources, teacher's skill and will. The report of the **Indian National Education Commission,** stated that, in an average,

school instruction still confirms to a mechanical routine therefore remains dull and uninspiring. The commission identified barriers in achieving objectives of teaching science such as, majority of science teachers of secondary schools used lecture method, lack of scientific manpower to administer science education enterprises, reduced admissions to science stream in high schools and universities. The report of the survey conducted by **Indian National Science Academy INSA**, (2005) stated that one third of students complained that they were not motivated in school to continue study of science after tenth standard. Indian students lack in knowledge, understanding and application of science in daily life. Bhuyan (2005) of Assam found that in the General Science Curriculum less stress is given on development of experimental skills, affective dimension and development of social, moral and aesthetic values. There are a number of topics, which have no utility to the daily life of the students and to fulfill the needs of the community, there are some anomalies in organization of the curriculum, mistakes in major and minor concepts present in the existing secondary school science textbooks of Assam, which need correction. The researcher's findings include suggestions for the teachers as: inclusion of compulsory project work, fieldwork and topics related to removal of superstitions. Rajput (1978) conducted a study in secondary schools of western region of India. It was found that practical work was not attempted in class IX in about fifty five percent schools in Gujarat. Shah (1981) conducted a study entitled "An experimental investigation of the effects of selected teaching strategies on the development of creative thinking and achievement in science" in Petlad, Gujarat. The researcher compared different teaching strategies, and concluded that maximum use of lecture + discussion + experiment + audio visual aids in the classroom teaching followed by discussion is useful for enhancement of creative thinking, it was found that this strategy produced significantly high mean scores for achievement of pupils than all other strategies. Desai (1985) conducted an investigation into efficacy of different instructional media in the teaching of science to pupils of class VIII in relation to certain variables. He found that the discussion approach followed after slide show was more effective than the traditional way of teaching science. Umasree (1999) conducted a study entitled "science curriculum and its transaction: an exploratory study in secondary schools of Vadodara". The instructional activities operating in the secondary school classrooms of Vadodara,

Gujarat are centered on the textbook. In none of the classes under observation, problem solving or inquiry based teaching or skill development had been noticed. In short, teaching of science in Indian schools has a scope for modification as it has drawbacks in the findings mentioned above. Gujarat Council of Educational Research and Training GCERT (2001) have made continuous attempts locally to improve the quality of science education by imparting in service training to the teachers of the Gujarat state. Amin (2011) reported that majority teachers use lecture, project and assignment but few of them demonstrate in the classroom. The review of the studies conducted in the field of teaching science in Gujarat reflects on the need to change the traditional teacher centered style of teaching science to participatory, student centered method of teaching science.

The findings of all the researchers mentioned above leads to the conclusion that science education at secondary stage needs to be vibrant and flexible. The learners of secondary school are in transitional stage of growth called adolescence. At the same time the characteristics of adolescents are changing rapidly with the passage of time. Here the question arises of what is the need for development of life skills for adolescents of secondary school and how to develop thinking life skills through teaching of science?

1.9 Need for development of life skills in adolescents of secondary school

Beneath frequent violent outbursts, sudden mood swings and related interpersonal problems of an adolescent, there may be a person crying out for a professional help. It may not be possible for every parent or child to seek professional help. In fact school education, particularly learning of science should help her / him to be able to think rationally to address her / his real life problems. But objectives of teaching science do not seem to have achieved when incidences of crime committed by adolescents are seen in the society. *"I have decided to end my life because the pressure of exams is getting to me. I can't take it any more"*, wrote Sudhanshu Pandey of Delhi Public School (Noida), in his suicide note on March Four TOI (2005).The education that should give hope, teach the worth of life, develop capabilities to shape it, is often taking their life and enabling very few. This quote of NCF (2006) is thought provoking in the light of the statistics given by UNESCO. "There are around 125.4 million young people between the ages of fifteen to twenty four who are illiterate in the world, and 99.5% of them (124.8 million) live in the developing world. More than half of them (51.8%) are found in South Asia, and India's

share of these is around 62%. In fact, India alone is home to a little less than one-thirds (40.4 million; 32.2%) of all the young illiterate people in the world" NUEPA (2011). It means that majority of them are adolescents. Education in its true sense is inevitable for the young adolescents to be able to take right decision and be capable citizens of this globe to sustain the development of human civilization. Psychologically, adolescence refers to a period of identity crisis. Crisis, in fact does not mean a breakdown or catastrophe but rather a "crucial" period when adolescent's development must move one way or another. According to Piaget the adolescents have crossed concrete operational stage of development or are in the transitional stage or in the formal operational stage. In the concrete operational stage they can conserve and think logically with practical aides but in formal operational stage they can think logically purely in mind too. According to 'Child, adolescent and Development theory' of Piaget the wider social context of early and middle adolescence (fourteen-nineteen) provides varied situations in which adolescent needs a supportive environment at home, school and the community to enable them to understand the complexity of challenges of the stage, and be able to respond with a sense of responsibility. According to Mangrulkar (2001) when adolescents are deprived of environment which is conducive for learning, it may lead to various psychosocial problems like academic problems, truancy, adjustment problems, low self-esteem etc. In varied situations adolescent needs to practice new skills with peers and other individuals outside of the family. Hence developing skills and competencies are recognized as critical to a child's developmental pathway and sense of oneself as an autonomous individual. The other theories like Social learning theory of Bandura (1977), Cognitive Problem Solving theory of Shure and Spivac (1980), and Constructivist Psychology theory of Piaget and Vygotsky (1978) justify and recommend life skills development and provide differing perspectives on why these skills are important. Some focus more on behavioral outcomes. They justify skills development as a way to move adolescents towards the behaviors that developmental expectations, cultural context and social norms find appropriate. Others focus more on the acquisition of skills as the goal itself, since competency in problem-solving, creative thinking, decision making and critical thinking can be seen as crucial elements of healthy human development. Finally, "these theoretical perspectives view thinking skills as a way for adolescents to actively participate in their

own process of development and the process of constructing social norms" Mangrulkar (2001). "By teaching young people how to think rather than what to think, by providing them with the situations or experiences for solving problems and making decisions by engaging them in participative methodologies, skills development can become a means of empowerment" NCERT (2005). If thinking improves all other life skills like communication and interpersonal skills, self awareness and empathy, coping with emotions and coping with stress are easy to develop as thinking is the root of every action. It is essential to design Life Skill Education Programme integrated with the curriculum of school subject / subjects to develop life skills on the basis of characteristics and needs of the focused group. Life Skill Education Programme is a guide to develop life skills in the target population. Practitioners of Life Skill Education Programme all over the world have followed different approaches and methods to develop life skills at secondary level. The Life Skills Education Programme that mainly focuses generic thinking skills integrated with the curriculum of the subject science is a good support system for adolescents at secondary school level. Before designing Life skill education programme, it is necessary to know that can life skills like thinking skills be developed through teaching of school subject. Which life skills can be easily developed through teaching of curricular subject like science? What are the approaches used for developing life skills? Can a teacher develop thinking skills through teaching of a curricular subject in the given time frame and natural set up of the school classroom? How can development of life skills be conducted? Is there any approach that can help the subject teacher to develop life skills through teaching of the school subject in the natural setting of the classroom? The researcher has tried to find answers to these questions through review of related literature and the experimental study.

1.10 Approaches and Methods for developing Life Skills at Secondary Level Life Skill Education has come to be seen as an important contributor to the quality of education, through an approach that emphasizes the acquisition of competencies. It is observed that content which is relevant to everyday life is chosen and student centered participatory teaching and learning methods are used to develop life skills and promote cooperative learning. The investigator has come across two approaches to develop life

skills in adolescents through review of related literature, like: Integrated approach and Exclusive Life Skill Education approach.

1.10.1 Exclusive Life Skill Approach

Many practitioners of education develop life skills through exclusive life skill education program following the syllabus of the subject 'Life Skills' as they define operationally the content specific life skills. Botvin et al (1980), Botvin, Baker et al (1984), Bharat and Kumar (2002), Prasad (2002), Botvin, Griffin (2003), Zollinger et al (2003), Gamble (2006), Patel (2006), Ahmed, Azad, Galgali and Mehrotra in (2008), Lineo, Nagpal and Srinivasan (2009) and Martin (2013) have tried to develop content specific life skills for prevention of drug abuse or alcohol or prevention from AIDS through experimental studies using separate curriculum of the subject named 'Life Skills'. These researchers have designed a curriculum and strategy to develop life skill to address a particular problem existing with the adolescents and tried to enhance the quality of physical health of adolescents. While some of them develop life skills through teaching of a curricular subject other than the subject named 'Life Skills', generally used to develop generic life skills. Development of content specific life skills is either conducted by the teacher appointed for Life Skills or by peer educator approach. Another approach to develop life skills is integrated approach.

1.10.2 Integrated Approach

When development of life skills is tried through teaching of other curricular subject like psychology or physical education or physics the subject teacher designs the Life Skill Education program by assigning the activities related to the subject that he/she teaches, this approach is known as Integrated Approach for development of Life Skills. Meghani (1999) developed the strategy to develop critical thinking skill by LSE programme through integrated approach. Creative thinking skill is developed by the researchers named Paltasingh (2008), George (2006), Hanumanthaiah (2000) and Singh (2008). Meghani (1999) tried to develop life skills through teaching of psychology while Mark (2012) tried to develop life skills through teaching of physical education. These researchers have evaluated the implementation of LSE program to develop life skills through particular curricular subject other than 'Life Skills'. Life skills education

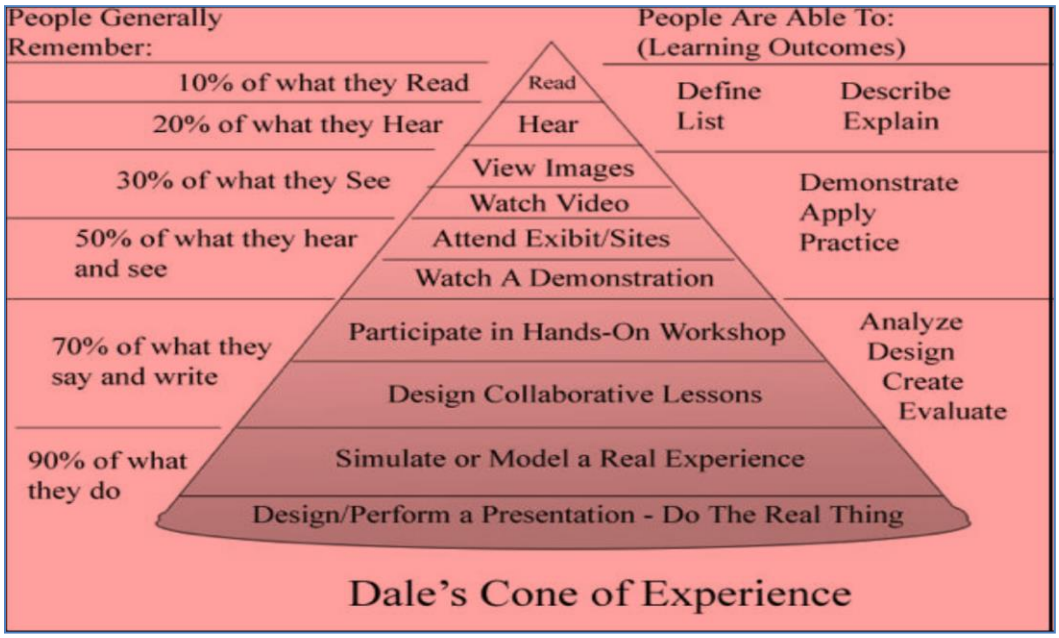
involves a dynamic teaching process. The methods used to facilitate active involvement of learners include working in small groups and pairs, brainstorming, role plays, games and debates. Opportunities to develop thinking skills are embedded in the experiences and outcomes across the curriculum or the syllabus prescribed by the education board for all stages of learning. In considering how to support the development of skills across the curriculum it is important for practitioners to continue to recognise and value the diversity of individuals and their broad range of talents, abilities and achievements whilst creating an ethos of achievement (designing life skill education programme) for all learners within a climate of high expectation. To ensure that all children and young people are able to access opportunities to develop a broad range of skills it is essential that effective support is provided by management and parents to remove any barriers to learning. Evans (1998) emphasizes that using an Infusion approach to environmental education i.e. integrating skills and content into the existing school subjects is the best way as it is problem-solving, action-oriented, project approach. Secondly it gives scope to develop life skills needed to save environment. UNESCO with the Ministry of Human Resource Development organized a workshop on life skills education in December 1998. To allow the learners to handle negative pressures from their peers it was discussed that life skills should not be taught in isolation, but should be with health and major life issue education. The main conclusion of the workshop was that everybody needs life skills and programmes should be developed to integrate them with the formal education curriculum. According to Singh (2008), the approach for effective life skill transaction has been through experiential learning. Singh emphasizes that Life skill education should not to be taught as a separate subject but infused in existing subjects. National Institute of Open Schooling has adopted the curricular approach of seamless integration in every subject to ensure effective internalization of life skills. Integration has been achieved on a pilot project basis at senior secondary level in ten subjects. In future five subjects of secondary level will be considered for developments of life skill base learning material. The lessons developed promote lifelong learning, thereby enhance excellence in education. Singh (2008) concludes the study as "life skills learning need to be included in curricula and not to be delivered as separate, stand-alone programmes except where conditions may require." In order to develop life skills in adolescents of class IX, Life Skill Education

Programme can be developed, for which principles of Experiential Learning can be used, helpful in designing experiential activities. Experiential activities are discussed below.

1.11 Experiential activities for Integrated Life Skill Education

Creating a variety of opportunity is the essence of experiential learning activities. Researchers used different experiential learning activities and techniques for developing knowledge and skills. In 1969, Edgar Dale suggested various learning experiences in his cone of experience (Molenda, 2003). According to Edgar Dale cone of experience, learners retain more information and skills, and gain concrete learning experiences when they engaged in "doing" purposeful activities. Reading and listening are the least experience. The Edgar Dale (1969) cone of experience is shown in the Picture_1.1.

Plate_1.2: Edgar Dale's Cone of Experience



(Source: Beard and Colin, 2007, www.fsu.edu **Edgar dale 2002)**

Taylor (2004); Horwath, (2004); Miller et al, (2005); Askeland (2003); Cummins (2006); Cummins Sevel and Pedrick (2006) also used diagrams, individual and network activities, reality play approach, multimedia learning environment, and use of reading and writing are the experiential activities (Wong, 2007). Educationist Beard and Colin (2007) listed some of the experiential learning activities such as projects, experiments, sensory simulation, problem solving, the use objects for variety of purposes, training kits, outdoor recreation, cartoon production, theatre, drama, art, storytelling and writing and reading,

role play, simulations. Beasley (2010) used three experiential learning methods in secondary education such as experiments/lab activities; service learning projects, and field trips. Helaiya (2010) used situational discussion, role play, brain storming, group activities, group discussion under the experiential learning methods and techniques. Hendrix et al (2011) concluded in their study that 'Creative drama' was an effective strategy to increase science conceptual learning in the students when used as an active extension to teach science curriculum. Thomas (2012) selected the following experiential learning activities and methods such as role play, video clips, laboratory activities and storytelling to develop spiritual intelligence and emotional intelligence, findings revealed that the selected activities and methods significantly influence for the development of spiritual and emotional intelligence among the teacher educators. According to Ramesh (2014) there are range of experiential activities and technique available for facilitators to help pupil to learn through experience.

1.12 Rationale for this study

Adolescence is very crucial stage in the development of human beings. Secondary school adolescents at this stage have to be guided at home, school and in the society. In the school they can be guided through the curriculum of different subjects. In secondary school much importance is given to the subject science, which has dual nature. It is a body of knowledge as well as it is seen as a process of thinking. The learning of the subject science should be developing critical thinking, problem solving, creative thinking and decision making in the students of secondary stage which are in the transitional stage of growth and soon will be entering the world of work. Through science education which is activity based it is possible develop core life skills like thinking skills and direct them towards better and happy life. Position paper on 'Teaching of science' by NCERT (2006) at various stages states the purpose of teaching science at secondary stage categorically. At the secondary stage the students should be engaged in learning science as a composite discipline, in working with hands and tools to design more advanced technological modules than at the upper primary stage, and in activities and analysis on issues surrounding environment and health. The position paper by National Focus Group on Science Teaching shows emphasis on systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects

involving science and technology as important parts of the curriculum at this stage. Training in the scientific method, inculcation of scientific attitude is needed today especially to meet the challenges posed in daily life of the adolescent due to the characteristics of adolescence, fierce competition, market economy and rapidly changing world. "People today are faced with fast-changing world where the most important skills are flexibility in adapting to new demands of society and creativity in taking advantage of new opportunities. Teaching of science and technology can develop such skills" NCERT (2005). Siraj (2014) has reported about the development of life skills in schools at Bhubaneswar. Education programme in Bhubaneswar supported by United Nations Fund for Population Activities (UNFPA) aims at developing skills of students to tackle various problems in life. Training for teachers, principals and district education officers in developing life skills is recommended by the observer of UNFPA. The Central Board of Secondary Education (CBSE) of India and the Gujarat Secondary and higher Secondary Board of Education (GSHSEB) has introduced continuous and comprehensive evaluation system in secondary schools with the emphasis on life skills and value education. (GSHSEB) have imparted training to the secondary school teachers across the state in the area of Life Skill Education with the help of Gujarat Council of Educational Research and Training (GCERT). The activities that are to be assigned or to be conducted with students for formative assessment by the subject teachers can be designed in such a way that gives scope to develop life skills. Rather well designed Life Skill Education Programme based on the concepts in the curriculum of the subject can help the subject teachers to evaluate the students for formative assessment too. Nature of science invokes abilities like proposing problems, defining the problem, thinking of many solutions, setting up hypotheses and their testing with controlled experiment, rethinking of new solution, discarding personal opinion in the light of new evidence and suspending judgment in case of conflicting evidence, challenging the principle of authority if needed thus distinguishing between scientific information and popular information in students while teaching the subject science. Comparing the skills to be developed through teaching of science with the indicators of skills of critical thinking, creative thinking, problem solving and decision making it can be concluded that development of life skills through teaching of science is possible and easy. Experiential Learning method and its

principles can be used to design the activities Ramesh, (2014). Using integrated approach to develop life skills through teaching of science was found most appropriate by the researcher before conducting the present study. On referring literature related to life skills, teaching of science, nature of adolescents various questions arose in the mind of the investigator. They are framed in the form of Research Questions as stated below.

1. 12.1 Research Questions

1. How to measure existing status of life skills in the adolescents of secondary school?
2. How can Life Skill Education Programme be developed for teaching the curriculum of Science as prescribed by the state board?
3. How can the development of life skill be tested?
4. What will be the effectiveness of Life Skill Education Programme on the students of secondary school? How can it be measured?

1.12.2 Statement of the problem

Development of Life Skills through teaching of science

1.12.3 Objectives of the study

1. To develop Life Skill Education Programme for the students of class IX of English Medium High School.
2. To implement the developed Life Skill Education programme.
3. To study the effectiveness of the Life Skill Education programme on students of class IX of English Medium High School in terms of the differences with respect to,
   A. Critical thinking skill. B. Creative thinking skill
   C. Decision making skill D. Problem solving skill.
4. To study the effectiveness of Life Skill Education Program in terms of Students' response at the end of each activity of Life Skill Education Programme.

1.12.4 Explanation of the term:

Life Skill Education Programme (LSEP):

Life Skill Education Programme is a student-centered schedule of activities to be conducted for the chosen content of the subject 'science and technology.' LSEP is an activity based programme designed using principles of experiential learning, considering

needs of adolescents that provided opportunities to the adolescents of secondary school to develop Life Skills. The activities like skits, seminars, investigation, scientific toy making, health survey, mime, drama, survey on use of medicinal plants by Grandpa, visit to health museum etc. were conducted. The topics for Life Skill Education Program are chosen from the textbook of 'Science and Technology' of class IX recommended by Gujarat State board of Secondary and Higher Secondary Education, Gandhinagar. The order of topics was according to the order given by the Education Board for each Semester of the academic year 2012-2013. Each activity gave scope to the student to think which focuses on some or all indicators of Thinking Skills chosen for the study. (Appendix_3.18)

1.12.5 Operationalisation of term:

Effectiveness of the Life Skill Education Programme

Effectiveness for the present study was seen comprehensively as indicated below.

This includes both quantitative and qualitative dimensions:

- The difference between the mean scores of indicators of Critical Thinking, Creative Thinking, Decision Making and Problem solving Skills of the students in pretest and post test with respect to the treatment given through LSEP to Experimental Group.
- The difference between the gain scores of the Critical Thinking, Creative Thinking, Decision Making and Problem solving Skills of students of the experimental group to that of control group.
- The difference between the mean post test scores of Critical thinking, Creative Thinking, Decision Making and Problem solving Skills of the students between experimental group and control group.
- Students' feedback and ranking of each of the activity and their opinion after the implementation of programme.

1.12.6 Hypothesis of the Study:

The present study involves five variables; four dependent and one independent variable. The score of the indicators of critical thinking skill, creative thinking skill, decision making skill, problem solving skill and students' response to the Life Skill Education Program are dependent variables while the treatment given through Life Skill Education

Program is the independent variable. To achieve the above mentioned objectives following null hypotheses were framed to study the effectiveness of the Life Skill Education Program designed by the researcher.

H01: There will be no significant difference in the mean scores of indicators of Critical Thinking Skills of the students in pretest and post test with respect to the treatment given through LSEP to Experimental Group

H02: There will be no significant difference in the mean scores of indicators of Creative Thinking Skills of the students in pretest and post test with respect to the treatment given through LSEP to Experimental Group

H03: There will be no significant difference in the mean scores of indicators of Decision Making Skills of the students in pre test and post test with respect to the treatment given through LSEP to Experimental Group

H04: There will be no significant difference in the mean scores of Problem Solving Skills of the students in pretest and posttest with respect to the treatment given through LSEP to Experimental Group

H05: There will be no significant difference in the gain scores of the critical thinking skills of students of the experimental group to that of control group.

H06: There will be no significant difference in the gain scores of the creative thinking skills of the experimental group to that of control group.

H07: There will be no significant difference in the gain scores of the Decision making skill of the experimental group to that of control group.

H08: There will be no significant difference in the gain scores of the problem solving skill of the experimental group to that of control group.

H09: There will be no significant difference in the mean post test scores of Critical thinking skills of the students between experimental group and control group.

H10: There will be no significant difference in the mean post test scores of Creative thinking skills of the students between experimental group and control group.

H11: There will be no significant difference in the mean post test scores of Decision Making Skills of the students between experimental group and control group.

H12: There will be no significant difference in the mean post test scores of Problem Solving Skills of the students between experimental group and control group.

1.12.7 Delimitations of the study:

1. The study was delimited to the selected contents from the Gujarat State Board Textbook of class IX named ‘Science and Technology’ of the secondary school.
2. It was delimited to the development of few life skills like critical thinking, creative thinking, decision making, problem solving.

1.12.8 Limitation of the Study:

The study was limited to develop life skills like thinking skills mentioned earlier. However it was not intended to find its effectiveness related to science process skills or achievement scores of understanding of content, which should be science teacher’s primary goal.