CHAPTER I

THE PROBLEM AND IT’S CONTEXT

1.1 INTRODUCTION

Education is the channel between the “Existing knowledge” and “The Evolving knowledge”. The “Evolving knowledge” is the central theme of human existence and human resources. A scientist, a philosopher, a doctor, an educationist, an engineer, an industrialist, a technician, a poet, a painter or a farmer – all share their adequate worth in the growth, development and progress of a nation.

The following anecdote illustrates, how a scientist’s creative thinking ability allows the existing knowledge to evolve.

“In 1921, on a voyage from Europe, Dr. C. V. Raman, the Indian Nobel Laureate, was deeply watching the dashing waves of the ocean, around the ship. A curious thought struck his mind. He wondered why the ocean was blue! And questioned himself – Did it have anything to do with the scattering of light, which accounts for the blueness of the sky? The genesis of his famous work, “Raman Effect” was in those musings. “Raman Effect” was not only important in itself, but it also opened up many other areas of study. It had put scientists on the fringe of a fascinating new region of research - Problems of radiation, Wave theory, Atomic and Molecular spectra, Chemistry and Thermodynamics. “It answered so many questions but asked many more”.

Need to say – “Education gives a power to think creatively!”

Ancient Indian spiritual philosopher Adi Shankaracharya defines Creative Thinking –

“Navanavonm Esalineebudhiih” – a power to think of newer and newer ideas.
Thus, creativity forms the base of all Arts and Technology. Poetic talents, Painting skills, Dramatic resourcefulness, Musical proficiency, Dancing gifts or in general, the aesthetic sense in arts and innovative talents in technology are but the offshoots of creativity in man.

Science, “The crest jewel of twentieth century, is leading us into the age of Super Technology”. From dawn until dusk and dusk until dawn, we enjoy the blessings of science. The great advancement in science has thrown open new horizons of knowledge that challenge day in and day out with more problem solving skills required from the knowledge gentry. For science education and its processes should acquire new dimensions and invent new methods to evoke creative talents in the learners. Such learners have critical appreciation for the intellectual and aesthetic values, which have been created by the great creative persons through the ages. Thereafter every one of them can contribute his own to enrich human knowledge, through his free and original effort. But the present “Science Education Scenario” appears different.

1.2 SCIENCE EDUCATION SCENARIO

The less creative children in our schools today are the living testimony to the degree to which creativity can be killed off easily. Once it appears on the surface, its reappearances can be assured by use of all the techniques that cause behavior to reappear. But it doesn’t appear unless certain conditions are present that cause it to come forth, nurtured properly for the benefit of the individual and the society. The present condition of science education in India is reflected in the National Curriculum Frame Work Review – 2005 that, “For the last many decades, science education in India has been an enterprise of unresolved dichotomies and contradictions. For almost three decades now, science is a compulsory subject up to Class X throughout the country, yet this universal science education continues to be largely irrelevant to most students and its quality unacceptably poor. Though the over-all conceptualization of science curriculum at the national level has matured steadily and kept pace with evolving contemporary trends in science education the world over; yet this has hardly translated into any significant improvement in the actual science teaching. Therefore,
for a majority of students, science is just another demanding and difficult subject to be learnt by rote, with no meaningful learning outcomes. This results a small number of students with outstanding competence in science comparable to international standards.

From the above it is evident that, science education in schools emphasizes the products of science but not the processes of science thus curbing the intuitive and inquiry skills of the students. This trend is a mortal blow to the tender trait – ‘Curiosity”. Teaching science has become merely a one-way traffic. Dialogue – the first step in the process of acquisition of knowledge is seldom encouraged. It is essentially a free and uninhibited dialogue between an inquisitive student and our experienced teacher that leads to the expansion of the horizons of opportunity for a student to think frankly, to create, and to innovate. Unfortunately, the system turns out students who lack curiosity, innovativeness and are devoid of creativity and self-confidence (Bhide, V.G. and Dr. Frank, 1997).

Prof. C.N.R. Rao, Scientific Advisor to Prime Minister of India expressed his grief about the basic sciences. He lamented, “Information Technology and its related services transformed the population service-oriented rather than manufacture-oriented. The latter would have been possible if the youth had willingly taken up pure sciences leading to indigenous technology development. He also reasoned it due to very shift resulted in the youth with scientific potential being weaned away from pure sciences, leading to the decline of Science in India. He also claimed that there are hardly any students taking up scholarships and research activities in pure sciences. Finally he warned that India has to pay a heavy price in near future”. (Vijay Times-13 November 2006). Professor C.N.R. Rao’s remarks are supported by many a learned men in the country.

It is also depressing that in the recent International Journal – ‘Nature’, it has been indicated that India’s contribution to the world of science is deteriorating. However, it mentioned that the trend is a spreading global phenomenon, differing in proportions.
Professor R.M. Kalra (Former Dean, NIE, NCERT), in a seminar titled – “Science Education at Cross Roads in the 21st Century, at New Delhi, 1997”, opined that – “to popularize science among students especially at the school stage, we may have to re-engineer our science education system in the 21st Century. To accomplish this, we have to evolve standards of science education at different stages of school education and determine the attitude of students towards science”.

Dr. Frank, in the same seminar, further suggested, “We must begin early by providing children with a challenging and stimulating introduction to science in the elementary grades. Experienced persons should give them a taste of real science and build an appetite for more”. Hence, humanizing our science education is imperative. The interest of young students in science can be created and widened if our science educators, curriculum developers, policy makers of the school system and national science and above all the teachers assume and fulfill their responsibility and moral obligation towards the present society. Therefore the science educators need to innovate or to adopt alternative strategies of science teaching to ignite the learners’ minds for creative emergence. This need is further emphasized through the words of The President of India, Dr. A.P.J. Abdul Kalam

“The way to development is through purposeful activity. The young especially have to be guided properly, so that their lives find a proper direction and their creativity is allowed to flower. To facilitate this, certain educational reforms must be initiated”.

1.3 CREATIVITY AND SCIENCE EDUCATION

In a country of billion persons, as India, enough creative persons are available and a sizeable number amongst these would be school going children. The paradox of the situation is that in India mostly students are not given the opportunity of developing creative maturity throughout their entire school career (Aggarwal, 1999).

Creativity can only be developed, and its development depends upon the environments into which it is introduced and circumstances that condition it. Despite past researches and currently in progress, little is known about the experiences and conditions that foster creativity. However it is generally felt that creativity can be
developed in students if in the learning process the teacher provides creative situations to which students can react accordingly.

Studies indicated that students develop better abilities in the multiple domains of applications in Science – Technology – Society instruction compared to textbook oriented classes (Banerjee and Yager, 1992; Yager 1992, 1993). Among the multiple domains of applications – Creativity, Problem Solving Ability, Attitudes, Analytical powers are the domains more vital than any of the denotative system of education. Moreover, the teaching learning processes have neglected the student thinking and learning processes that would assist them greatly to develop visualization, imagination and sensory perceptual abilities. The models so often presented to the students in their textbooks emphasize linear thought processes, ignoring intuitive, analogical and metaphorical thinking that are the functions of the right hemisphere (D. Venkatraman, 1996). Darnell et al. (1991) share the opinion that to turn into creative learners, students value their freedom to express their creative ideas without fear of interpersonal judgment. Hence it is still an important classroom goal for the teacher to make a valuable and dedicated attempt to induce a creative learning environment that forms a breeding ground to sharpen their existing skills, acquire new skills, conceive and experiment with new ideas, enhance their creativity levels, and perfect their independent pursuit of knowledge.

1.3.1 Fostering Creativity Through The Science Teaching

How can we motivate Creativity?

What is the right stimulus for attracting “the cerebrally rich pupils” to the unfolding outlets of human creativity?

How do we intrigue the younger generation for more creativity, for more efficient effort, for scientific and technological research?

All such questions focus that the real development of science education lies in the development of abilities of the learners’ in multiple domains of application to daily life - creativity, processes, attitudes and perceptions apart from concepts and understanding.
The prevailing patterns of education are heavily biased towards left cerebral functioning and are antithetical to the right cerebral functioning. It is now emphasized that many of the objectives of education can be achieved and youth problems can be solved through kind cooperation of the right hemispheric functions. Therefore, it is important to develop certain teaching strategies activate the functioning of right hemisphere for development of creativity factors.

A number of curricular and co-curricular activities are recommended to induce right brain functions (D. Venkataraman, 1996). Some of them significant to the present study are

1. Problems of specific issues related to curriculum contents can be given to the students and they can be asked to solve the problems in different ways to harness their problem solving skills.
2. The teacher can use metaphors and analogies in subjects to enhance analytical thinking of the students.
3. Creativity techniques, such as Synectics, Brain storming etc., can be applied in teaching and learning process of students.
4. In the classroom divergent questions may be asked, so that students can think and answer in different ways.

Thus, there is great need for a new approach or new methods and new tools in teaching to harness the skills and capacities of the student.

1.3.2 Emergence Of Models Of Teaching

In the history of pedagogy, though myriad methods of teaching have emerged and evolved, teachers all over the world including our own country follow fixed ways of classroom teaching. Teachers following such a fixed ways of teaching fail to achieve a variety of instructional objectives, for which teaching is designed and performed. They further fail to meet the needs of pupils with multi-dimensional personalities with different learning styles. Complementing such deficient implications teachers should use different strategies of teaching to match the objectives of teaching and the different learning styles and personalities of students (Passi, Singh and Sansanwal, 1990).
Dunn and Dunn (1979), Fischer and Fischer (1979), Ellis (1979), Joyce and Weil (1980) have strongly believed that the strength in education resides in the intelligent use of the powerful variety of approaches – matching them to different goals and adapting them to the students’ styles and characteristics. Competence in teaching stems from the capacity to reach out to different children and to create a rich and multi-dimensional environment for them.

“Models of Teaching” emerged out of search by Joyce and Weil (1972) to find a variety of approaches or strategies of teaching to match the various learning styles. A model of a bridge does not guide an engineer to construct a building. It is meant for a particular purpose. In the teaching – learning process, models have the same interpretation as they have in the case of bridges, dams etc. Thus, models of teaching present the steps necessary to bring about a desired outcome.

According to Joyce and Weil (1972), a teaching model is a pattern or plan which can be used to design face-to-face teaching in classrooms or any other settings to shape instructional materials, and curricula and long-term courses of study. They further glorified the models of teaching as follows

“Models of Teaching are really Models of learning. As we help students acquire information, ideas, skills, values, ways of thinking and means of expressing themselves, we are also teaching them how to learn”.

The models of teaching enjoy the following significant characteristics:

- Models of Teaching are some sort of plans or guidelines or patterns or strategies of teaching.
- Models of teaching are not haphazard combination of facts but are, on the other hand, systematic procedures to modify the behavior of the learners.
- Models of teaching specify the learning outcomes or instructional objectives in terms of observable and measurable performance of students.
- Models of teaching specify in definite terms the environmental conditions under which a students’ response should be observed.
- Models of teaching specify the criteria of acceptable performance expected from the students.
The concept of Models of teaching thus reveals three major functions in the learning process. They are –

- Designing of Curriculum or Courses of study;
- Development and selection of instructional materials; and
- Guiding the teacher’s activities in the teaching learning situation.

During the last two decades, a lot of attention has been paid to improving the process of teaching, resulting in the development of a number of models of teaching by various researchers. All these models are based on empirical researches, theories, hunches, postulates, hypothetical propositions, etc. Among them, the monumental work of Joyce and Weil (1980) collected 24 teaching models. These models of teaching because of their interactive, participatory, adaptable, implementing and persuasive nature have a great potentiality for achieving the aims and objectives of education. They are classified into four families namely – 1. Information Processing Models, 2. Social – Interaction Models, 3. Personal Models and 4. Behavior Modification Models.

No single model, from the above families is superior for all purposes. Every model has its dramatic effect in specific applications. Among them Inquiry Training Model, Concept Attainment Model, Advanced Organizer Model, Biological Inquiry Model and Inductive Thinking Model are relevant to teach concepts in science.

“The Personal Models Family” stresses on personal development of an individual and the development of self-hood. These models emphasize the processes by which individuals can establish a productive relationship with their environment, construct, and organize their unique reality. They are more concern with human feelings and emotion and try to move towards the development of an integrated functioning self.

“Creativity” like “Love” is a many splendoured thing (Guilford) – a multifaceted phenomenon. A peep into the creativity literature reveals that creativity is seen not only as a person, as a process, as a product but it sometimes results from the person and his interaction with the environment which is known as ‘Press’. To
foster such a magnificent trait in learners’ “Synectics Model” from the ‘Personal Models Family’ is found more appropriate.

1.3.3 Rationale In Selecting The Synectics Model For Study

“SYNECTICS” is a teaching model, developed by William J.J. Gordon, to “Enhance Creative Thought”. Synectics is found to be developing Problem Solving Abilities and Favorable Attitudes towards Learning (Passi, 1990).

The investigator finds the assumptions of the Synectics Model to be very realistic as they confront the conventional views about creativity. They are

- Creativity is important in everyday activities.
- Creative process is not at all mysterious.
- Creative invention is similar in all fields.
- Creative inventions are very similar whether they are individual or group in generation.

The Synectics process is based on a set of three assumptions about the psychology of Creativity. They are

- By bringing the creative process to consciousness and by developing explicit aids to Creativity, one can directly increase the creative capacity of the individuals and groups.
- Emotional component is more important than the intellectual, the irrational more important than the rational. The irrational state is important than the rational (Gordon, 1961).
- “Emotional, irrational elements must be understood in order to increase the probability of success in a problem solving situation”.

In addition, the “Personal Analogy” phase in the Synectics process requires the participant to loose his self thus transporting himself into another space or object. It gives a great chance to maintain a greater conceptual distance from the concept to the analogy. It imbibes the participant so close to the analogy that he involves himself into

1. First-person description of facts.
2. First person identification with emotion.
3. Empathetic identification with a living thing, and
4. Empathetic identification with a non-living thing.

While selecting the Synectics Model of Teaching the following were some observed criteria that suit better to realize the objectives of the study.

- It fosters Creativity as “Disinhibition.” The pupils need to be able to let go off conventional perspectives (Strickland, 1989). They should feel free to recombine things in new and different ways, even if those combinations seem silly or even wrong.
- The Metaphoric activity in Synectics renders Creativity to emerge as a conscious process. It frees the participant himself to develop imagination and insights into everyday activities.
- The strategy – II facilitates to break set and conceptualize the problem in a new way in order to suggest fresh approaches to it in personal life as well as in the classroom.
- It lets the pupils throw off their rigidity.
- It suits to pupils of all ages (Krishna Murthy, B. 1989; Kumari Sucheta, 1990)
- It increases pupil’s tendency to combine things in new ways and to see relatedness among divergent stimuli (Isen, Daubman, and Nowicki, 1987).
- It adopts playful attitude – thus “Suspending Judgment”.
- Breaks the monotony of the conventional classroom teaching.
- Democratic and Interactive in approach.
- Applicable, functional and workable in Indian settings.
- Instructional and nurturing effects matched with the objectives of the study.
- Suits to explore individual differences.
- Universal learning experiences can be applied.
- Emphasizes both processes of skills and knowledge of the content.
- Synectics has so far been used in many schools. Varied teaching material and techniques have been developed to make the use of synectics more effective in school situations. In India, a majority of them fall in the fields of languages and social studies.
Apart from the foregoing, a detailed discussion on the relevance of Synectics Model to the present study is given in the Chapter – 2: “The Conceptual Framework”.

Teaching Science in a comprehensible way, in general, needs exclusive use of analogies. Hence, the investigator intends to use such analogies through the syntax of Synectics to find whether the fostered Creativity and its components lead to induce Problem Ability and better Attitude towards Science.

1.4 NEED AND IMPORTANCE OF THE STUDY

The need and importance of the study is reflected through the following significant captions:

1.4.1 Educational Value

In the National Curriculum Frame Work – 2005, the NCERT, looking at the complex scenario of science education in India, has envisioned three unmistakably alarming issues.

*First, science education is still far from achieving the goal of equity enshrined in our constitution.*

*Second, science education in India, even at its best, develops competence but does not encourage Inventiveness and Creativity.*

*Third, the overpowering examination system is basic to most, if not all, the fundamental problems of science education in India.*

National Curriculum Frame Work for School Education developed by NCERT (2000) made a mention that “Learning of science in school augments the spirit of enquiry, creativity and objectivity along with aesthetic sensitivity”. In addition, one of the objectives for organization of curriculum at higher secondary stage has been suggested as – “to promote problem solving abilities and creative thinking in the citizens of tomorrow”.

While the first quote indicates as to what impact the learning of science can have, the second quote suggests what we should aim at while deciding the curriculum. In both the cases, the common factor is the development of an attitude leading to
creative thinking. Further, to develop the desired attitude, training in the ways or processes required for creative thinking is essential.

Torrance (1970) describes “Creativity as a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, identifying the difficulty, searching for solutions, making guesses or formulating hypotheses about the deficiencies, testing and retesting these hypotheses and modifying and retesting them, and finally communicating the result”.

It means creativity brings behavioral change in the learner and enriches his character and personality. Science gives opportunity for creative thinking and constructive imagination through cultivated disciplinary qualities of mind that enable him to hone his problem solving skills by the way of integrated intellectual honesty, perseverance, concentration of mind and broadmindedness.

In fact, all the discussed disciplinary qualities of mind emerge from the scaffolding called “Scientific Attitude” – instilling positive attitude is a significant concern of the process of science education.

In this connection, the Rethinking Science Education mentioned the characteristics of scientific attitude as “open mindedness, a desire for accurate knowledge, confidence in procedures of seeking knowledge and the expectation that the solution of the problem will come through the use of verified knowledge”. Therefore, it is the primary duty of the science teachers to make the students practice, observe and feel science, and develop the components of scientific attitude in their minds.

The National Curriculum framework – 2005, has called to introduce a paradigm shift in science curriculum at all stages, emphasizing exploration, inventiveness and creativity through activities, experiments, technological modules, contextualized as far as possible. All the foregoing has converged to the idea, to explore into the significant implications offered by the fostered Creativity on “Problem Solving Ability” and “Attitude towards Science” through Synectics Model of Teaching Science.
1.4.2 Human Perspective

Creativity is a natural endowment of the human being. Within human nature rests the capacity to go beyond the existing present status. Man in this sense is the bearer of the creative process (Sen Guptha, 1984). “He is a unique representation of the universe, in which the Unconscious Creativity of nature becomes Conscious Creativity” (Radhakrishnan, 1960). The creativity when carefully nurtured, consciously developed, and effectively utilized, manifests in itself in the form of new approaches to traditional problems, thereby contributing to innovation and change in a product, process and technique.

Torrance (1967) stated that the old myth, that “Creativity is the function of superior genes and that the talent will come out”, has to be discarded.

Today the researchers and the theorists are in agreement that every individual is creative in greater or lesser degree and that the development of creativity cannot be left to chance. Studies on the possibility of improving creativity by desirable attempts have shown encouraging results. Hence, the students under study will benefit and further throw light upon their needs to be explored in future to manifest a better learner in them irrespective of geographical barriers.

1.4.3 Student Perception

Research reports on perceptions of school students towards science teachers, science classes, the values of science and science careers indicate that many students in typical classrooms have negative attitudes (NAEP, 1988; Yager and Pennick, 1986). In fact, the negative perceptions deepen and worsen as students go from elementary, to middle, and to high schools (Yager and Pennick, 1986, 1989).

The critical analysis made by the intellectuals’ and research studies have stressed the need that children would require focused attention on their learning needs as they have a right to a healthy and congenial environment that nurtures their creativity and furthers their learning. The present situations in majority of our institutions are far below the desired level in most of these aspects.

Hence, it is the duty of educators to integrate certain strategies with curious topics of study. Thus, strengthening the tie between students and creative work,
encourage student involvement, inspire them and see their grey matter working towards innovation. Therefore, the present research work may facilitate to explore the importance and relevancy of the teaching strategy in changing the perceptions of the students from different social contexts.

1.4.4 Rural Scenario

In the National Curriculum Frame Work – 2005, the N.C.E.R.T. lamented that there exists a huge gap in the education in general and science education in particular between the rural and urban students. The inequality, amongst other things, is mainly due to poor infrastructure, inadequate support systems, lack of access to information and other resources in rural areas, and a clear urban bias in various educational inputs. A review of literature for studies on creativity shows clearly that very few studies have considered the relationship between sociality, social class and creativity. There are sufficient reasons to believe that a creative personality is a subjective aspect of culture (Torrance, 1969). Certain studies reported the superiority of the rural children over their urban counterparts (Torrance, 1960 and 1962; Mehdi, 1973; Sharma, 1974; and Azmi, 1974) and vice versa (Passi, 1971; Singh, 1977; Srivastava, 1978; Singh, 1979, 1980; Dharmagandhan, 1981; Shukla, 1982 and Ashok K. Hota, 2000) and also no difference them (Singh, 1980; Aaron et al, 1969; Hussain and Subay, 1975) Thus, the obtained results remained inconclusive.

During the decade, a number of high schools were established in rural areas with the interests of villagers. The above research findings show that though the progress in education made is quite satisfactory, villages have still to go a long way.

The process of learning in the rural and urban areas is not the same. Several factors other than academic are influencing the enrollments, retention and learning levels in rural schools. In most of the rural and urban schools, there are no pressure groups to fight for the improvements in the quality of education. Children belonging to the socially and educationally disadvantaged groups have been failing to achieve a minimum level of learning in mathematics and language. There are hundreds of studies to prove that unteachability is still prevalent in most of the rural areas in India. These students have several problems of adjustment in the mainstream schools. Thus,
urban and rural children are deprived of sufficient motivational factors for learning life skills and it is the present investigators intention to find whether the proposed strategy of teaching sufficiently motivates the Rural and Urban learners alike.

The foregoing information emphasizes the need to frame a research study that involves teaching curricular content in a creative approach and to assess whether it fosters life skills in the rural and urban learners alike.

1.4.5 Gender Issue And Science Education

Studies have shown that girls in the same class get science education different from boys. The National Curriculum Framework – 2005 stressed the need of gender fair science education in schools. It also mentioned that most discerning efforts are needed to weed out the gender bias from classroom practices. Teachers are required to implement or to be sensitized to promote equitable classroom practices to ensure “Science Experiences” of comparable quality to girls. There are studies which support the superiority of male over the female students (Strauss and Strauss, 1968; Raina, 1971; Naintara, 1981 and Dharmagandhan, 1981) and vice versa (MacGregor and Smith, 1965; Harlow, 1967; Oglethra, 1971; Passi, 1972, 1973; Harison, 1973 and Hussain, 1974). Some other studies reported “No Sex Difference” (Hussain and Hussain, 1975; Pandey and Pandey, 1984; Badrinath and Satyanarayana, 1979) with respect to certain components of creativity.

The present study is also a humble venture to look into the aspects of gender bias through the strategy of science teaching in respect of certain dependent variables like Creativity, Problem Solving Ability and Attitude towards Science.

1.4.6 Guidance Value

Creativity, like intelligence, significantly influences the school accomplishment (Ashok K. Hota, 2000) and also found remarkably correlated with academic achievement (Yadav, 1987). This further strengthens the reason why many of the present talent search examinations being designed to test the levels of creativity of the tested.

Therefore, exploring comparatively into the Rural and Urban students’ Creativity and related aspects may help the educators counsel them in to a right path.
of learning and living. Thus the present study may form a modest venture in contributing to the above need.

1.5 STATEMENT OF THE PROBLEM

The process of learning in the rural and urban areas is not the same. In most of the rural and urban high schools there are no pressure groups to fight for the improvements in the quality of education. In this age of knowledge explosion a lot proportion of pupils from these schools select Arts stream after their secondary level. This shows that pupils of rural and urban schools are deprived of certain learning activities that influence their right brain domains – Creativity, Problem Solving Ability and Attitudes. Problem Solving Ability and Attitude towards Science is adequate enough or can be fostered through Synectics Model of Teaching Science.

The present study intends to find whether the levels of Creativity, Problem Solving Ability and Attitude towards Science are adequate enough or can be fostered through Synectics Model of Teaching Science.

“Effect of Synectics Model of Teaching on Creativity, Problem Solving Ability and Attitude towards Science at Secondary level”.

1.6 RESUME OF THE SUCCEEDING CHAPTERS

This thesis is divided into seven chapters. The first chapter being the “Problem and its Context”, the second chapter deals with “the Conceptual Frame Work”, the third chapter has “Review of the Related Literature and its Synthesis”, the fourth chapter transacts with “The Methodology”, while the fifth chapter details about “The Development of Tools”, the sixth chapter presents “Data Analysis and Interpretation” and the last Chapter VII concludes with “Summary of the Study, Findings, Conclusions, Recommendations and Suggestions for further research.