## CHAPTER I: INTRODUCTION

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1.1 INTRODUCTION:

This chapter deals with meaning of small groups learning, Science in the modern world, science as a component of education, science education for the 21st century, teaching of science, need for the study, significance of the study, objectives of study, delimitation of the study, chapter scheme and conclusion.

1.2 MEANING OF SMALL GROUPS LEARNING

Small groups learning is defined as students working together to "attain group goals that cannot be obtained by working alone or competitively" (Johnson, Johnson, & Holubec, 1986). The main purpose of Small groups learning is to actively involve students in the learning process; a level of student empowerment which is not possible in a lecture format. The underlying premise is founded in constructivist epistemology. It is a process which requires knowledge to be discovered by students and transformed into concepts to which the students can relate. The knowledge is then reconstructed and expanded through new learning experiences. Learning takes place through dialog among students in a social setting. Small groups learning is a methodology that employs a variety of learning activities to improve students' understanding of a subject by using a structured approach which involves a series of steps, requiring students to create, analyze and apply concepts (Kagan, 1990). Small groups learning utilizes ideas of Vygotsky, Piaget, and Kohlberg in that both the individual and the social setting are active dynamics in the learning process as students attempt to imitate real-life learning. By combining teamwork and individual accountability, students work toward acquiring both knowledge and social skills. It is a teaching strategy which allows students to work together in small groups with individuals of various talents, abilities and backgrounds to accomplish a common goal. Each individual team member is responsible for learning the
material and also for helping the other members of the team learn. Students work until each
group member successfully understands and completes the assignment, thus creating an
"atmosphere of achievement" (Panitz, 1996). As a result, they frame new concepts by basing
their conclusions on prior knowledge. This process results in a deeper understanding of the
material and more potential to retain the material.

Small groups learning may be broadly defined as any classroom learning situation in
which students of all levels of performance work together in structured groups toward a
shared or common goal. According to Johnson, Johnson and Holubc, (1994): "Cooperative
learning is the instructional use of small groups through which students work together to
maximize their own and each other's learning", In classrooms where collaboration is
practiced, students pursue learning in groups of varying size: negotiating, initiating, planning
and evaluating together. Rather than working as individuals in competition with every other
individual in the classroom, students are given the responsibility of creating a learning
community where all students participate in significant and meaningful ways. Cooperative
learning requires that students work together to achieve goals which they could not achieve
individually.

Students that are involved in cooperative learning achieve many social and academic
benefits. Cooperative classrooms are classes where students group together to accomplish
significant cooperative tasks. They are classrooms where students are likely to attain higher
levels of achievement, to increase time on task, to build cross-ethnic friendships, to
experience enhanced self-esteem, to build life-long interaction and communication skills, and
to master the habits of mind (critical, creative and self-regulated) needed to function as
productive members of society.

There are two major theoretical perspectives associated with cooperative learning:
motivational and cognitive (Swortzel, 1997). First, because students perceive that their
success or failure is dependent upon their ability to work together as a group, students are likely to encourage each other to do whatever helps the group succeed. They are also more likely to help each other with the task(s) at hand. Therefore, cooperative learning increases student motivation to do academic work (Johnson, Johnson, & Holubec, 1986).

The other theory is that cooperative learning helps students acquire critical thinking skills. Because cooperative learning creates a situation in which students must explain and discuss various perspectives, a greater understanding of the material is obtained. Elaborative thinking is promoted because students give and receive explanations more often (Johnson, Johnson, & Holubec, 1986).

The use of cooperative learning (CL) also helps students clarify concepts and ideas through discussion and debate. Because the level of discussion within groups is significantly greater than in instructor led discussions, students receive immediate feedback, thus advancing the level of discussion. It is through this process of interacting with students of differing viewpoints that cognitive growth is stimulated. Emphasis is placed on learning how to cooperate in order to find the best possible solution to a problem. According to the constructivist approach, when students formulate their own solutions in this manner, they are truly thinking critically (Davis, Mahler & Noddings, 1990).

1.3 SCIENCE IN THE MODERN WORLD

Great achievements in science and technology and the use of scientific inventions and discoveries have been promoting well-being of the mankind through their application in the fields of industry, communication, transport, education, engineering, agriculture, medicine, etc. This has made science indispensable now. Science has, in fact, radically transformed the material environment of the modern world. It is liberating and enriching the mind and enlarging the human spirit. Nothing comparable to the scientific revolution in its impact on
man's development and outlook has happened since the beginning of the 20th century. There is no aspect of human life today which has not been influenced by science in one way or the other. Science has shrunk the world and totally changed the human outlook. With the great advancement in both science and technology, the threat to the very sustenance of environment is also increasing at an alarming rate. This is mainly due to improper and illegal applications of scientific knowledge motivated by selfish needs, greed and lack of foresight. Basic understandings of the nature, personal health and public hygiene, peaceful and dangerous uses of science, basic skills of civic life and an enquiring, questioning and exploring attitude are very much essential for the progress and development of a society as well as for the healthy growth of science and technology. Science education has the potential to create the required awareness, understanding and attitude which are all the more important in a developing country, like India.

1.4 SCIENCE AS A COMPONENT OF EDUCATION

Science is not only a systematized body of knowledge about physical and natural phenomena but also a way of life, a way of thinking and a way of doing things. It is to be integrated into the process of development and improved quality of life. This is possible only through a properly planned science education. In the past, science had to struggle hard and long for its rightful place in the school curriculum. Science education, in one or the other form, has a recognized place in school education now. The role of science education becomes critical because science and technology have become the growing edges and these are influencing human life and environment in diversified ways. Pearson Karl (1924) in his book "Grammar of Science", emphasizes the importance of 'training the mind to an exact and impartial analysis of facts, with a view to developing sound citizenship and international relations universally. The real significance of science had not been realized till the beginning
of the 19th century and that is why science had no place in the school curriculum during the earlier periods.

Many educators, thinkers, committees and commissions at different points of time emphasized the importance of science education. The initiative for emphasizing and popularizing science education began during the 15th century by Gilbert (1544-1603), Francis Bacon (1561-1626) followed by Sir Isaac Newton (1687), Michael Faraday (1791-1867), The Charter Act (1813), Herbert Spencer (1820-1903), Tyndall (1820-1893), T.H.Huxley (1825-1895) and others. They stressed the need of science education for development of society. The University Education Commission (1948), The Secondary Education Commission (1952-53). The Education Commission (1964-66), NPE (1986) and the Committee set up by MHRD (1991) to set out Minimum Levels of Learning (MLL) have all highlighted the need and importance of science education and strongly advocated the teaching of science as a compulsory subject at all levels of education.

Man is living in a world today, which is guided by science and technology. Science is no longer confined to a few seriously devoted persons. The present world requires basic understandings of scientific facts and principles. Science has now become everyday science for everybody. Teaching of science for everybody has become an unavoidable part of life. Further, science, as a subject, has two very important virtues distinctive to it. The study of science involves training in 'scientific method' and develops 'scientific altitude' in learners. Along with this, science cultivates disciplinary qualities of mind such as systematic observation, persistence, patience, concentration of mind, logical thinking. Objective and unbiased judgments, respect for truth, etc., which are essential for further exploration and scientific advancements. These qualities can be cultivated only through science subjects, which can qualify the learners to live as truly efficient citizens in a science-guided society.
The learning of science and technology in our schools, colleges and universities is necessary to develop new skills. It is also essential for fully comprehending the processes of society so that they can be altered in accordance with the highest code of morality, and the enrichment of human personality. It is, therefore, essential that science should be used to promote the spirit of free inquiry to promote national wealth, to abolish inequality between nations and classes and to test all assumptions in the crucible of scientific analysis.

A well-planned science education programme can be a fruitful effort in developing the desired attitudes and shaping the scientific outlook. Recognizing the importance of science and science education, Nehru (1946) opined that 'it is science education alone that can solve the problems like hunger and poverty, insanitation and illiteracy, superstitions, vast resource wastage of a rich country like India inhabited by starving people. Even more than the present, the future belongs to science'. The societies of the twenty-first century will, quite clearly continue to be shaped by science education; also, science education is indispensable in helping the societies from where they are now to where they aspire to be in the next century. Therefore, the proper and responsible use of science education is an urgent need of all societies especially in a developing country like India, in order to achieve the twin goals of development and improved quality of life. This is possible only through a properly planned science education.

Science is now a compulsory subject in every system of school education right from the elementary stage to various levels of education for its value content, such as intellectual, practical or utilitarian, cultural, moral, aesthetic and disciplinary values. The importance and usefulness of science and science education has been derived on the basis of the contributions of science through its application to economic growth and development and its role in the creation of a democratic culture through education. The values of science education are
realized by formulating and executing appropriate science curriculum at different levels of education.

Since the middle of the 19th century, there has been a realization of the importance of learning the processes of science. In England, Thomas H. Huxley, Hooker and John Henslow (1973) held a view that "the unique characteristic of science as a branch of learning was the method by which knowledge was acquired. These methods were of utmost significance from an educational point of view than the conclusions reached". The 'process' aspect of science was considered more significant than its 'product' aspect. Hence, science has to be studied in schools not only for its informational benefits but also because it trains the powers of observation and reasoning. Science is no longer treated merely as a body of knowledge; it is regarded as a systematic and dynamic process of life.

The rapid advancement of science and technology and increasing need for scientific application have made it all the more important to provide for science education in schools. Even the Secondary Education Commission, 1952, had recommended that every Secondary School pupil should study General Science as a compulsory subject, so that he/she gains a basic quantum of scientific knowledge as a part of his/her general education. In addition, provision should be made for elective subjects in science for those students who want to pursue higher study.

For the first time, the 42nd amendment to the Indian Constitution adopted in 1976 included several fundamental duties of a citizen. This is in contrast to the fundamental rights included in the Constitution of 1950. One of the fundamental duties of a citizen is to develop 'scientific temper', and the schools are expected to develop scientific temper among the students. This also justifies the inclusion and need of science as a subject in school education. In view of the manifold values of science, especially the utilitarian value, which are indispensable for the efficient discharge of responsibilities of a good citizen in an age of
science, it has been elevated to the status of a compulsory subject at all stages of schooling. With the introduction of compulsory and free education for all, science has been assigned an important place in the curriculum and has been made one of the compulsory subjects till the lower secondary stage to make all students realize the need of science for society. At secondary stage, science is one of the core subjects. As a whole, science education in secondary schools has been fashioned to perform three-dimensional functions, viz. (1) as an integral part of general education; (2) as a preparatory course to college science; and (3) as preparation for vocation.

1.5 SCIENCE EDUCATION FOR THE 21ST CENTURY

Since living in the present world invariably warrants, to variable degrees, knowledge of simple scientific facts and laws, science has become 'everyday science' for everybody. Teaching of everyday science for everybody has become an integral part of general education. In this context, one has to think of the status and nature of science education that has been given from the recent past to the present day. Can the on-going system of science education help students of future generations to solve the present and unforeseen problems that may arise? If not, what changes are required in the present pattern of science education? These and similar questions need to be pondered over.

The impact of modern science on society is such that it has necessitated a great spread of awareness of social implications of science. Students of modern world need to understand and appreciate the dependence of the modern society on science and the changes in the social structure that have been brought about by the achievements of science and technology. They should not only be able to appreciate the modern marvels of science but should also understand the social use of the scientific achievements. This can be justified from the fact that modern liberal education has a much wider orientation, and thus, the idea of developing scientific attitude and appreciation, should be considered as one of the aims of teaching
science in the years to come. The science teacher should teach science in such a way that the pupils realize varied social functions of science, think, act and contribute to the welfare of the future world. They should appreciate science as a part of modern living and that science should always be used only for the benefits of the society and not for selfish needs. In this context, future education - science education in particular - will undergo changes that one needs to envision. Students of the present and future generations deal with ideas drawn from all parts of the world. Thus, science education that is to be provided to him / her should extend beyond the classroom to encompass community agencies, industrial processes, research centers, natural habitats, and space beyond the earth. Classrooms of the future schools may consist of well equipped laboratories, cubicles for using teaching machines, space for individual work, conference rooms and rooms in which students can prepare aids and materials with the guidance of technicians and teachers. The study of science may be pursued in various places, viz., laboratory, natural milieu, social environment, peer group projects, wherein students seek, discover, innovate, invent and create ideas, principles and phenomena through self efforts.

Facilities for learning are numerous and varied. The laboratory develops children's interest in problems of science. It contains well-equipped and child centered experimental set up for students' self-investigation. In processing their information, children use individual learning aids such as computers, tape recorders, televisions, charts, globe, maps, and other modern gadgets (Caffery 1967).

The increased use of electronic aids on a massive scale makes possible science instruction that is more individualized. It makes it possible for children working independently, to practice skills, develops concepts and obtains data for experimentation and verification. Instruction is made more heuristic, self explorative with auto-instructional devices. The role of science teacher in the present day situation is to facilitate the learners
with a balanced mix of motivation and guidance. The teachers are clinical specialists who
guide the learning of each child individually, basing their guidance on computerized data that
reveal the child's background, needs, interests, and intellectual maturity. Auxiliary personnel
help teachers to prepare materials, keep records, maintain facilities in the laboratory and
supervise tutorial learning (Hendricks 1966).

Self-education needs to be cultured on a large scale so that new generation pupils may
live successfully in a world highly loaded with scientific applications. Emphasis on the
methods and processes of science should desist teachers from following the path of least
resistance that is, taking short-cuts. There is thus less interference with the vision of a more
fundamental objective of teaching science which is to develop among the vast body of pupils
the patient, systematic observation of facts, the design of experiments to isolate what is to be
studied, the formulation of hypothesis for subsequent verification, the willingness to abandon
any hypothesis not substantiated experimentally, and the consistent maintenance of an attitude
of detached objectivity in their day-to-day thinking (Charles 1959).

Science education that is offered to the students of the twenty first century should be
properly designed and executed to visualize and achieve the aims and objectives of teaching
science extended to the future context. The aim of the whole course extending from the
elementary level to the post-graduate level should be to enable the student to acquire scientific
knowledge, and in addition, come to possess some understanding of the methodology of
science and further, in the very process of acquiring this understanding, the student should be
enabled to develop scientific attitude. The terminal goal of the entire science education
programme should be to enable the student to emerge not only as a science expert but also a
young scientist imbibed with scientific spirit and mentality necessary to solve the problems of
the surrounding environment. (Srinivasan, K 1987). In addition to this, other ultimate aims of
teaching science that are more emphasized in the future context would be: the new science
education programmes should enable the pupils to understand the whole world better factually - specially the world as it affects them concretely and to help pupils investigate ways of increasing the range and depth of understanding natural processes and to relate this understanding to the many puzzling complexities of industrial society. Keeping these aims in view, science education should offer varied direct and purposeful learning experiences through which students can identify the problems and they also find solutions to them through scientific method. (Vaidya, 1996). Science education has become an international activity, growing out of national frontiers. Incidentally, accidentally and intentionally, the contribution of this type of constructive science education strengthens the national economy, creates new resources, accelerates vast employment and attempts to build global outlook on problems which affect human society. Perhaps this type of futuristic science education eventually changes pupil's behaviour and his/her idea of his/her role in the world, so that tomorrow's citizens grow with inquiring minds and creative spirits ready to face the challenges of the twenty first century.

1.6 TEACHING OF SCIENCE

Science Teaching Today: Science is basically concerned with the objective understanding of natural phenomena and through science education one can acquire the required knowledge and understanding of these phenomena. The search for knowledge and understanding about reality can be done through the process of science teaching which requires certain skills. The knowledge and understanding of natural phenomena, and the skills developed by studying science are applied in life situations. This utility aspect of science can be realized only through effective teaching of science in classrooms.

Teaching of science is not just handing out facts and information about science. It is much more than that. Besides motivating and presenting things in an interesting way, the teacher must be able to create suitable learning experiences which reflect an atmosphere for
students' self exploration, problem solving, inductive reasoning, etc, which are necessary for the development of science process skills such as observation, identification of problem, collection of data, experimentation and verification, manipulation, recording, analyzing, etc.

To achieve this, there are varieties of methods of teaching available and the teacher has to select such method or methods, which are suitable for the given set of students in a given context.

Science teaching in Indian classroom contexts is in a very bad shape. Students are successfully passing their examinations, without absorbing knowledge about the nature of scientific enterprise. Teachers fail to build quality into their science teaching. Innovation and research bent of mind are not built into it. In spite of many efforts which include continued research, experimental trying out of varied methods of teaching, teacher-training programmes, etc, the broader aspects of scientific knowledge, namely, the methodology of teaching science and the kind of learning outcomes which it is expected to generate seem to have had little impact on the minds of pupils. It was expected that persons who have had the benefit of science education would imbibe the spirit and mentality of science and would considerably contribute to the transformation of the traditional outlook in the direction of a rational attitude towards life and its problems along with the development of scientific skills. It is indeed disappointing to note that this has not happened to any significant extent. It is mainly due to the fact that the methods of teaching employed by the teacher are less effective which emphasize more on 'product' aspect of science rather than 'process' aspect (Vaidya 1996).

The present-day state of affairs in science education and science teaching in India were generalized in the following way (Vaidya 1974). The situation is not reported to be much better today.

i. Science teaching is still oral in character. Demonstration lessons are occasionally interspersed. There is very little of practical work up to the tenth class. At the higher
stages, a prescribed list of experiments is mechanically followed by the teacher in the laboratory, which is mostly in the nature of verifying knowledge, or working according to set the rules which are made explicit before introducing the real experiment to students. The element of investigation, training in the use and practice of the scientific method and even mastery of the research operations (the discovery approach to learning) are conspicuous by their absence, even at those places where laboratory facilities and equipments are generous.

ii. The aims and objectives of science education at various levels, when spelt out in detail, look grand on paper and most of them vaporize during execution.

iii. Science teaching is based strictly on the prescribed textbooks. Both students and teachers follow them strictly.

iv. Methods employed for science teaching are dull; teacher-centered and lack objectivity.

It is for these reasons that science teaching is not considered to be related to the immediate environment at all. Consequently, training in scientific method, problem solving, creative thinking, and the development of scientific skills, interests, attitudes and appreciation remain in an utter state of neglect. Another commonly cited defect of science teaching is that it is almost totally information-based. This makes science education at the lower levels very drab and a matter-of-fact business which often bores students. At the higher levels it runs through the risk of becoming out of date before the student reaches maturity and takes up any scientific work on his own. Learning becomes highly limited. Science, which is an admirable synthesis of learning, and production activity, is becoming a stereotype. The characteristic features of science of being open-ended, of welcoming change, and of being based on reason, are given scant attention. Due to this, science education, instead of becoming a liberating and intellectually stimulating experience, becomes another kind of cut-and-dry dogma. The
science classroom appears to be a place where children make little use of their talents and tools because the methods of teaching in vogue are not only mechanical in nature but also devoid of constructive imagination. Even though, science teaching, at all levels has changed radically, in both content and form in the wake of the recent scientific revolution, science teachers from their unexamined day-to-day classroom teaching have formed firm opinions about their wards which is too difficult to change or eradicate. In spite of many major developments in the pedagogy of science which include multi-media approach, mass communication instruction, individualized instruction, group-learning, team teaching many versions of scientific method such as inquiry approach, problem solving method, brain storming method, heuristic method, inductive method, etc, teachers all over the world in India, are employing fixed ways of teaching science in classroom. Even though a number of methods are evolved over a period of time, only some of them were rarely practised at school and very few of them have been employed by teachers for science teaching on a large scale. This is true especially in the Indian context where schools and classrooms lack infrastructure and physical resources required for modern, technical and scientific approaches of science teaching, overloaded syllabus with less span of academic schedule and lack of initiation, motivation, exposure and innovative attitude among science teachers. The commonly used methods by teachers for science teaching are lecture method, discussion method, lecturer-cum demonstration method, topic method and assignment method. A few additional methods that have been used are question-answer method, textbook method and reference method. Methods such as project method, laboratory method, and heuristic methods are used occasionally in schools with required facilities. These methods employed by the teachers are associated with teaching aids such as models, charts, specimens, objects and audio-visual aids. Other methods and approaches such as programmed instruction, heuristic approach, model approach, Simulated Social Skill Training (SSST) are very rarely used and, by and large, restricted to experimental tryout or used for demonstration and research purposes.
1.7 TEACHING OF SCIENCE, TEACHER EDUCATION AND MODELS OF TEACHING

The foregoing review of teaching of science in schools and preparation of science teachers leaves much to be desired. The ground realities in regard to science teaching need large-scale improvement. At the same time, research on learning and teaching of science in schools has been advancing. Experimentation and field try-outs have established the value of several new models/methods of teaching which contribute to the efficiency of science teaching and effectiveness of schooling. There is normally a time-gap between laboratory/scientific research and its large-scale application and acceptance in field condition. Even in regard to science teaching, there is reluctance and suspicion among science teachers and science method masters in teacher education regarding the efficacy/feasibility/efficiency of some of the new models of teaching science under the given conditions of science teaching in schools and teacher education programmes. It is in this context that there is a need for replication of results of experimental models of teaching under diverse field conditions of science teaching in schools and teacher education programmes. It is common knowledge that replication is an important technique for establishing validity of any new innovation in education including models of teaching. With this perspective, a transition will be taken to examine the needs for the study.

1.8 NEED OF THE STUDY

Students of modern world need to understand and appreciate the dependence of a modern society on science and changes in the social structure that have been brought about by the achievements of science and technology. The teaching of science for better human relations should become a major objective. Students may gain scientific knowledge and
perhaps desirable scientific attitude, but fail to transfer their attitudes and behaviour outside
the class. So, it has become necessary to bring about changes in the methods of teaching
science with structural and organizational activities in the actual classroom settings. Research
and experiments are required for innovative practices in classroom instruction and to develop
a science of behaviour applicable for educational situations. Many past research studies have
revealed the avenues of programmes that reflect much better ways of making teacher-pupil
interaction effective resulting in enhanced achievement on the part of the pupil.

Teachers occupy a key position in the field of education by playing the role of
facilitator for learning by organizing the instructional activities and required learning
situations. They can't play this significant role effectively if they have problem with methods
of teaching especially in science education. Therefore, for the fruitful improvement of
education pattern, innovative and effective methods of teaching science should be located
through research and are to be tried out in actual classroom settings.

The amount and the direction of research on teaching styles demonstrate vigorous
changes during the past decades resulting in the development of generic patterns or styles that
have broad utility as well as the possibility of synthesizing specific patterns effective for
particular children in specific setting. In spite of this continuous effort for searching and
implementing innovative methods of teaching, the instructional procedures in science are not
giving maximum expected returns or learning outcomes. This suggests that effectiveness in
educational process depend on the methodologies of teaching and learning; instructional
strategies used; learning situations provided or learning activities organized. More and more
research studies are required to determine the effective methods of teaching. Therefore, it is
high time for teachers to employ more varied formal or informal but effective methods of
teaching, which are supported by research and which can foster learning and evaluation in the
process of teaching. A teacher needs such instructional strategies which are logical,
systematically structured and which provide for their accomplishment with very few limitations. Models of teaching incorporate such strategies.

Models are numerous and they adequately cover the wide range of objectives. Each model has its own goal, theoretical assumption, principle and major concept underlying it. Some models are designed for very specific purposes while others have general applicability. As a consequence, the researcher felt the need for determining the most effective models for teaching environmental concepts in high school classroom settings. It was clearly noted by the researcher that even among the few studies done, comparisons had been made only with one or two models of teaching with each other and with the conventional method of teaching.

Several teaching methods and strategies are being examined here in terms of well-known variables. It is, however, observed that there is a great need for more detailed and in-depth studies in the same area. Research at this stage is still in its infant condition, because research on classroom teaching over the past three or four decades has brought people only marginally closer to an understanding of teaching-learning process. Time is now right to scientifically search for new and alternative strategies that can be easily and effectively employed.

One of the fundamental facts, which every educator should know, is that progress in teaching and learning can be achieved by research, guided by proper philosophy of education. (Best, W John 1978) states that, "research is one method by which one finds the solution to educational problems". Every teacher should recognize the important role that research plays in teaching and learning process. The common assumption that the art of teaching is nothing better than the process of imparting information is gone.

The main aim of teaching is to help the child to respond to his environment in an effective way. A sincere analysis of teaching and research or experimentation in teaching
provides for refinement in teaching or transformation process. The necessity for improving science teaching, for instance, is strongly reflected by lack of changes in teaching methods over many years. Therefore, it is high time to adopt innovative methods of teaching that foster transformation and evaluation in the process of education.

Education in schools has become narrowed down in focus, rigid and more related to textbooks than to the life contexts. Hence, it is time to redefine the objectives of education according to the present and future needs of the individual and society. Any improvement in education should essentially reflect the changes in the process of teaching because the major part of formal education is carried out in the form of classrooms teaching. An attempt through research is required to examine the compatibility of educational practices with procedures and techniques of teaching.

Research on models of teaching has been carried out and validated in western countries. To what extent do they fit into Indian conditions? There is a need to explore the feasibility of these models of teaching for Indian conditions.

There is a generally shared feeling that science teaching in schools has become drab, dry and monotonous. It does not stimulate the thinking and generate the interests of students towards science. Students tend to develop negative attitudes towards learning of science. Such a phenomenon leads to low enrolment in science at higher levels of education leading to a dearth of scientists who can engage in research and development. Creativity in science would be a casualty in future. Hence, interest in science learning should be developed at school level itself by adopting a variety of strategies/methods/models. The conditions under which models function effectively needs to be understood in classroom/school contexts and in real life situations.
Education process does not mean passing on information only but is concerned with developing analytical, critical and problem solving abilities as well as the creativity of an individual. Many research studies in this regard on pupil's performance or achievement in learning are available.

1.9 SIGNIFICANCE OF THE STUDY

Life is, by nature, highly independent. To try to achieve maximum effectiveness through independence is trying to play tennis with a gold club. Being independent and working in a team, gives a person an opportunity to share himself deeply, meaningfully with others and have access to the vast resources and potential of other human beings.

Cooperative learning is an instructional strategy based on the human instinct of cooperation. It is the utilization of the psychological aspects of cooperation and competition for curricular transaction and student learning. The concept of cooperative learning refers to instructional methods and techniques in which students work in small groups and are rewarded in some way for performance as a group. The idea behind the cooperative learning method is that when group rather than individuals are rewarded, students will be motivated to help one another to master academic materials. Cooperative learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating atmosphere of achievement.

A cooperative classroom increasingly emphasizes mediated learning. Mediation can be defined as facilitating, modeling and coaching. Facilitating involves creating rich environment and activities for linking new information to prior knowledge, providing opportunities for cooperative work and problem solving, and offering students a multiplicity of authentic
learning tasks. Coaching involves giving hints or clues, providing feedback, redirecting students’ efforts and helping their use of a strategy. That is to provide them with right amount of help when they need it.

1.10 STATEMENT OF THE PROBLEM

Students are the grass roots of any nation. It is imperative to make them technically sound and professionally confident create the knowledge society. This formidable task of nation building can be achieved only with the help of hybrid learning environments. It is the hour to think of various possibilities of integrating the conventional face to face classroom environment with small groups learning environment. Hence the problem of the present study may be stated as “Effect of Small Groups Learning on Students’ Performance in Science at High School Level”.

1.11 OBJECTIVES OF THE STUDY

The following are the objectives of study

1. To prepare a tool to assess the achievement of High School students in Science.
2. To study the achievement of High school students in science learning through small group learning with respect to their personal variables.
3. To study the Scientific temper of High school student learning through small group learning with respect to their personal variables.
4. To study the Creativity of High school student learning through small group learning with respect to their personal variables.
5. To evaluate the effectiveness of small group learning in science subjects.
6. To find out the relationship between the Achievement and creativity of high school students learning through small group learning.
7. To find out the relationship between the Scientific temper and achievement of high school students learning through small group learning.

8. To find out the relationship between the Creativity and Scientific temper of high school students learning through small group learning.

1.12 OPERATIONAL DEFINITION OF TERMS

Small group Learning Strategy

Cooperative learning means a variety of concepts and techniques for enhancing the value of student-student interaction. It refers to the instructional use of small groups in which students work together to accomplish meaningful school tasks (Mahran, 2000: 35). Furthermore, it is a pedagogical technique that has students work together in small and mixed groups on a structured learning task with the aim of maximizing their own and each other’s learning (Yang, 2005: 45).

Cooperative learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating an atmosphere of achievement and practice.

In the present study taken as Slavin’s STAD (Students Achievement Division), TGT, JIGSAW and EXPERIMENTS methods have been used. The STAD (Slavin, 1978), TGT, JIGSAW and EXPERIMENTS methods have been described earlier in the chapter.

Performance

Performance is defined as something accomplished successfully, especially by means of exertion skill, practice or perseverance. It is the accomplishment of proficiency of
performance in a given skill or body of knowledge as measured by a standardized test. In educational fields, performance (academic) refers to mastery on a learning material or a task. Academic performance means the student’s level of educational performance. The performance level can be stated in terms of criterion referenced skill statements, norm referenced measurements such as grade or age level, are curriculum based assessment measures (Lerner, 1989 p. 62).

In the present study, performance has been viewed as mastery on the specified learning material (lessons from Science subject) characterized by student’s scores on Science Achievement Test. The test development and the description of the test have been provided in class 8th standard students, as measured by the tool developed by investigator.

1.13 DELIMITATIONS OF THE STUDY

Keeping in view the limited time and resources, the present study was delimited as under

1. The investigator has studied the scientific temper, creativity and achievement of students learning science at High school level.
2. Since the study is an experimental study, the investigation is restricted to experimental and control group.
3. The size of the sample selected is limited.
4. The medium of instruction is restricted to English.
5. Only schools under the Tamil Nadu Secondary Board of Education (TNSEB) were selected for the study.
6. The investigation will be restricted to Virudhunagar district of Tamilnadu only.
7. Out of various schools in Virudhunagar district, only two co-educational school was selected for the study.
8. Only 109 students of class 8\textsuperscript{th} were selected for the study.

9. Out of several methods of cooperative learning four methods (STAD, JIGSAW-II, TGT, EXPERIMENT) were selected for the present investigation.

10. Only four lessons were selected from class 8\textsuperscript{th} Science book (Tamil nadu text book).

1.14 CHAPTER SCHEME

The first chapter explains the meaning of small groups learning strategy, need and significance of the problem and delimitations of the study.

1. Chapter II presents the theoretical back drop to the study.

2. Chapter III attempts to provide a review of related literature and insight gained by the investigator.

3. Chapter IV deals with research paradigm, selection of samples, construction of tools, reliability and validity of the tools.

4. Analysis and interpretation of data are explained in Chapter V.

5. Chapter VI gives the summary of findings, educational implications of the study and the conclusion.

1.15 CONCLUSION

The present study is related to the development of small groups learning modules by integrating the freely available resources and the class room input of the teacher. An attempt is also made to investigate the effect of the modules on scientific temper, creativity, achievement in science at High school level.