CHAPTER V
SUMMARY, CONCLUSIONS AND SUGGESTIONS

5.1 Introduction

The field of education has undergone a significant shift in thinking about the nature of human learning and the conditions that best promote the varied dimensions of human learning. As in psychology, there has been a paradigm shift in designed instruction: from behaviorism to cognitivism and now to constructivism (Cooper, 1993). Certainly one of the most influential views of learning during the last two decades of the 20th century is the perspective known as constructivism. Although by no means an entirely new conceptualization of learner and the process of learner (roots can be traced to John Dewey and progressive educators, to Piaget and Vygotsky and to Jerome Bruner and discovery learning), constructivist perspectives on learning have become increasingly influential in the past twenty years and can be said to represent a paradigm shift in the epistemology of knowledge and theory of learning. The curriculum and evaluation standard for school education, National Curriculum Framework (NCF), prepared by working group of NCERT (2008), does also highlights the importance of introducing constructivist approach in education system. Constructivism is basically a theory -- based on observation and scientific study -- about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences.

Cognitive psychologist, Vygotsky (1986), shared many of Piaget's assumptions about how children learn, but he placed more emphasis on the social context of learning. In Vygotsky's theories both teachers and children play very important roles in learning. There is a great deal of overlap between cognitive constructivism and Vygotsky's social constructivist theory. However, Vygotsky's constructivist theory, which is often called socio-constructivism, has much more room for an active, involved teacher. Incorporating influences traditionally associated with sociology and anthropology, socio-constructivism emphasizes the impact of collaboration, and negotiation on thinking and learning. Especially relevant in this
respect are the communication processes occurring in situations where at least two persons try to solve a problem. The social world of a learner includes the people that directly affect that person, including teachers, friends, students, administrators, and participants in all forms of activities. Teaching strategies using social constructivism as a referent include teaching in contexts that might be personally meaningful to students, negotiating taken-as-shared meanings with students, class discussion, small-group collaboration, and valuing meaningful activity over correct answers. This takes into account the social nature of both the local processes in collaborative learning and in the discussion of wider social collaboration in a given subject, such as science. Socio-constructivism provides an explanation for how learning can be fostered effectively through interactive pedagogical practices. It emphasizes that learning takes place in a social environment and views learners as “active constructors of their own learning environment” (Mitchell & Myles, 1998).

Another fundamental concept in social constructivism is the idea of scaffolding. In its literal sense, scaffolding is a support structure that is erected around a building under construction. In the metaphorical sense used by Vygotsky (1978), scaffolding refers to the support provided by others—parents, peers, teachers or reference sources such as dictionaries which enables students to perform increasingly well. Hammond and Gibbons (2001) interpret scaffolding as high challenge, high support. In other words, teachers need to set up tasks which challenge students to perform beyond their current capacity. To enable students to achieve these tasks, teachers also need to provide support measures which make it possible for students to perform at this new level. If the task is not challenging enough, students will be bored and possibly become unmotivated; however, if there is not enough support, students will be frustrated and may give up. Thus, scaffolding enables students to achieve great leaps forward in their learning. The concept of scaffolding is also linked with what Vygotsky calls the learner’s Zone of Proximal Development (ZPD). By this he is referring to the range of tasks and activities which the student can achieve with scaffolding, but which may be beyond his current abilities if he is unassisted.

In the present study Achievement, Scientific Creativity and Responsible Environmental Behaviour were taken as dependent variables.
Achievement means the extent to which a learner is profiting from instruction in a given area of learning (Crow & Crow, 1956). In other words, achievement is reflected by the extent to which skill or knowledge has been acquired by a person from the training imparted to him. It is the outcome of general and specific learning experiences. The construct of “science achievement,” although deceptively simple and elusive, represents a great challenge. The construct of science achievement can be interpreted according to the conceptual framework. The success or failure of a student is measured in terms academic achievement. It is common observation that success in the academic field serves as an emotional tonic and any damage done to a child in the home or neighborhood may be partially repaired by the success in the school. High achievement in school builds self-esteem, self confidence and strengthens self-efficacy that leads to better adjustment with the groups.

From a scientific point of view, the products of creative thought (sometimes referred to as divergent thought) are usually considered to have both originality and appropriateness. Scientific creativity is creativity through the media of science. It can be considered to help achieve new and original steps in performing the targets of science. According to scientific studies, creativity takes a complementary role in many scientific processes. The individuals who use creativity can make their science education functional, and therefore, the scientific information can be the basis for producing a valuable product instead of just amassing information. Therefore, for students to gain the creative thinking skills that they will need as adults, at each stage of their education, beginning in elementary school, must be one of the most important purposes of science education (Koray, 2003). From a constructivist perspective, generating explanations and testing them are creative processes.

As humanity’s behavioural patterns can either lead to environmental degradation or contribute towards Sustainable Development. It is essential to determine how people perceive and relate to the environment in order to identify behavioural patterns. The ultimate aim of education is shaping human behavior. Societies throughout the world establish educational systems in order to develop citizens who will behave in desirable and responsible ways. In addition to fundamental ecological knowledge and environmental sensitivity, an environmentally literate individual is also able to identify issues, and possesses the skills necessary to
address those issues. A person does not derive these skills from nature study, but acquires these skills through applied training in education strategies related to real issues they have identified. Every learner must be made to participate in the learning process. Positive changes in beliefs, attitude, values and ultimate behaviour are a long term process, which require continuous reinforcement. The teacher must therefore, use his/her creativity in whatever methods and techniques that he/she prefers so as to help promote and sustain the positive change. Constructivist learning as opposed to transmission allows students to feel part of the education process: learning to take responsibility for themselves and their actions.

Intelligence was selected as a classifying variable in the present study. It is a capacity of an individual to understand the environment and the resourcefulness to cope with its challenges of environment. Intelligent behavior consists of purposively adopting to, selecting and shaping one’s environment and that both culture and personality play significant roles in such behavior (Sternberg, 1985).

5.2 Significance of the Study

One important human response to the wonder and awe of nature from the earliest time has been to observe the physical and biological environment carefully, look for any meaningful patterns and relations, make and use new tools to interact with nature, and build conceptual models to understand world. Thus, human endeavors have led to modern science. The attainment of independence marked a change in National Science Policy. The various commissions and committees appointed by government of India have given the stress on importance of science teaching and the advanced research in science education. As given by Indian Education Commission (1964-66), "The basic approach and philosophy underlying the reconstruction of education adopted by in this report tests our deep conviction that the progress, welfare and security of the nation depends critically on a rapid, planned and sustained growth in the quality and extent of education, and research in science and technology." Today, we cannot think of world without knowledge of science. Science is a dynamic, expanding body of knowledge, covering ever-new demands of experience. Good science education is true to child, true to life and true to science. At the primary stage, the child should be engaged in learning principles of science.
through familiar experience. Group activities, discussions with peers and teachers, in the schools are important components of pedagogy. The pedagogical process, centered on teaching through Socio-Constructivist approach, sets out to build in students more scientific notions. Also through the Socio-Constructivist approach the students learn with the assistance of each other.

As one interacts with others and shares ideas a new level of understanding is reached and more advanced knowledge is sought. As courses get more difficult when students advance through college: they ultimately have to rely on others for full comprehension of the material. Socio-constructivism emphasize the construction of an agreed upon socially constructed reality. Learning takes place through interactions with environment viz. nature, things and people, both through actions and through language. Much of our school learning is still individual based (although not individualized). The teacher is seen as transmitting 'knowledge' to children and organizing experiences in order to help learners. But interaction with teachers and with peers can open up many more rich learning possibilities. Learning in the company of others is a process of interacting with each other and also through the learning task at hand.

Creative thinking is necessary to search for solutions to all kinds of problems that are encountered in daily life and to make new products. The individuals who use creativity can make their science education functional, and therefore, the scientific information can be the basis for producing a valuable product instead of just amassing information. Therefore, for students to gain scientific creativity, they need understanding of scientific concepts as adults and at each stage of their education, beginning from primary school (Koray, 2003). Science educators recognized the importance of creativity in science education, and started to work on methods and techniques which can improve creativity. However there are not many studies highlighting improvement in creativity and supporting certain methods for teaching Science, and the studies have generally used the cognitive aspects to determine the scientific creativity of students.

It has been recognized that cause of environmental problems is human behaviour. In order to solve environmental problems, it is necessary, beside the
technical and scientific solution that everybody adopts a different behaviour towards environment. Developing responsible environmental behaviour becomes one of the prominent tasks of science education. Environmental Educators agree that respect for the environment, the teaching of values as related to the environment and encouraging Responsible Environmental Behaviour should be the integral parts of any Education curriculum. Actually involving students in their communities and in solving local environmental problems encourages them to become more active at global level.

Knowledge alone cannot influence the protection of environment. Action is intimately related to how people value their knowledge and how much they feel they can control surroundings and what happens within those surroundings (Hines, Hungerford & Tomera, 1987). Ecological crisis is really a crisis of maladaptive behaviour and not a technological problem (Newhouse, 1990). In order for education to be effective, it needs to help to shift behaviour to be more environmentally mindful. It is important for the teacher to actively pursue methods that bring about behaviour change or positive behaviour development in learners. Behaviour change or positive behaviour development are personal endeavours, selection of methods therefore should aim at making the education learner-centred.

Further, down the years, there has been a massive expansion of the education system in India and qualitative improvements are visible too. We live in a fast moving technological society where the explosion of knowledge around us is a streak reality. Educational curricula and teaching methods are changing. One component of the current redevelopment of all subject area curricula is the change in the focus of instruction from the transmission curricula to transactional curricula. Teachers can no longer merely function as dispensers of information because there is far too much information to impart, and it is changing quickly as it is created. Education is in the midst of a paradigm shift from an information processing explanation of learning to a constructivist approach of learning. According to cognitive scientists, learning is a mental process and can occur only by giving meaning to knowledge which is reaching the mind. For this reason, it is very important to provide students with learning environments in which students construct their concepts by interacting with each other and also through the learning task in hand. This new approach requires teachers to act as a researcher in class environment and to actively participate in process of development and implementation of teaching programs.
Giving due thought to all these views, the investigator decided to study the effect of Socio-constructivist approach of teaching on achievement, scientific creativity and responsible environmental behavior on elementary school students.

5.3 Statement of the Problem

EFFECT OF SOCIO-CONSTRUCTIVIST APPROACH OF TEACHING ON ACHIEVEMENT, SCIENTIFIC CREATIVITY AND RESPONSIBLE ENVIRONMENTAL BEHAVIOUR OF CLASS VII SCIENCE STUDENTS

5.4 Objectives of the Study

1(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Achievement in Science.

1(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Achievement in Science.

1(c). To find if there is any interaction effect between teaching approaches and intelligence on the variable of Achievement in Science of class VII students.

2(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Scientific Creativity.

2(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Scientific Creativity.

2(c). To find if there is any interaction between teaching approaches and intelligence on the variable of Scientific Creativity of class VII students.

2.1(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Fluency viz. dimension I of Scientific Creativity.

2.1(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Fluency viz. dimension I of Scientific Creativity.
2.1(c). To find if there is any interaction between teaching approaches and intelligence on Fluency viz. dimension I of Scientific Creativity of class VII students.

2.2(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Flexibility viz. dimension II of Scientific Creativity.

2.2(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Flexibility viz. dimension II of Scientific Creativity.

2.2(c). To find if there is any interaction between teaching approaches and intelligence on Flexibility viz. dimension II of Scientific Creativity of class VII students.

2.3(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on originality viz. dimension III of Scientific Creativity.

2.3(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on originality viz. dimension III of Scientific Creativity.

2.3(c). To find if there is any interaction between teaching approaches and intelligence on originality viz. dimension III of Scientific Creativity of class VII students.

3(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Responsible Environmental Behaviour.

3(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Responsible Environmental Behaviour.

3(c). To find if there is any interaction between teaching approaches and intelligence on the variable of Responsible Environmental Behaviour of class VII students.
3.1(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Knowledge of Ecological concepts viz. dimension I of Responsible Environmental Behaviour.

3.1(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Knowledge of Ecological concepts viz. dimension I of Responsible Environmental Behaviour.

3.1(c). To find if there is any interaction between teaching approaches and intelligence on Knowledge of Ecological concepts viz. dimension I of Responsible Environmental Behaviour of class VII students.

3.2(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Knowledge of Environmental issues and Problems viz. dimension II of Responsible Environmental Behaviour.

3.2(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Knowledge of Environmental issues and Problems viz. dimension II of Responsible Environmental Behaviour.

3.2(c). To find if there is any interaction between teaching approaches and intelligence on Knowledge of Environmental issues and Problems viz. dimension II of Responsible Environmental Behaviour of class VII students.

3.3(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Appropriate decision making viz. dimension III of Responsible Environmental Behaviour.

3.3(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Appropriate decision making viz. dimension III of Responsible Environmental Behaviour.

3.3(c). To find if there is any interaction between teaching approaches and intelligence on Appropriate decision making viz. dimension III of Responsible Environmental Behaviour of class VII students.
3.4(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Beliefs and values related to environment viz. dimension IV of Responsible Environmental Behaviour.

3.4(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Beliefs and values related to environment viz. dimension IV of Responsible Environmental Behaviour.

3.4(c). To find if there is any interaction between teaching approaches and intelligence on Beliefs and values related to environment viz. dimension IV of Responsible Environmental Behaviour of class VII students.

3.5(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Personal Responsibility viz. dimension V of Responsible Environmental Behaviour.

3.5(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Personal Responsibility viz. dimension V of Responsible Environmental Behaviour.

3.5(c). To find if there is any interaction between teaching approaches and intelligence on Personal Responsibility viz. dimension V of Responsible Environmental Behaviour of class VII students.

3.6(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Intention to Act viz. dimension VI of Responsible Environmental Behaviour.

3.6(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Intention to Act viz. dimension VI of Responsible Environmental Behaviour.

3.6(c). To find if there is any interaction between teaching approaches and intelligence on Intention to Act viz. dimension VI of Responsible Environmental Behaviour of class VII students.
3.7(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Locus of Control viz. dimension VII of Responsible Environmental Behaviour.

3.7(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Locus of Control viz. dimension VII of Responsible Environmental Behaviour.

3.7(c). To find if there is any interaction between teaching approaches and intelligence on Locus of Control viz. dimension VII of Responsible Environmental Behaviour of class VII students.

3.8(a). To study whether groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach differ in mean gain scores on Environmental Sensitivity viz. dimension VIII of Responsible Environmental Behaviour.

3.8(b). To study whether class VII students with high, average and low intelligence differ in mean gain scores on Environmental Sensitivity viz. dimension VIII of Responsible Environmental Behaviour.

3.8(c). To find if there is any interaction between teaching approaches and intelligence on Environmental Sensitivity viz. dimension VIII of Responsible Environmental Behaviour of class VII students.

5.5 Hypotheses

1(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Achievement in Science.

1(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Achievement in Science.

1(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Achievement in Science.
2(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Scientific Creativity.

2 (b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Scientific Creativity.

2(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Scientific Creativity.

2.1(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Fluency viz. dimension I of Scientific Creativity.

2.1(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Fluency viz. dimension I of Scientific Creativity.

2.1(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Fluency viz. dimension I of Scientific Creativity.

2.2(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Flexibility viz. dimension II of Scientific Creativity.

2.2(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Flexibility viz. dimension II of Scientific Creativity.

2.2(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Flexibility viz. dimension II of Scientific Creativity.

2.3(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on originality viz. dimension III of Scientific Creativity.
2.3(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on originality viz. dimension III of Scientific Creativity.

2.3(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on originality viz. dimension III of Scientific Creativity.

3(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Responsible Environmental Behaviour.

3(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Responsible Environmental Behaviour.

3(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Responsible Environmental Behaviour.

3.1(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Knowledge of Ecological concepts viz. dimension I of Responsible Environmental Behaviour.

3.1(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Knowledge of Ecological concepts viz. dimension I of Responsible Environmental Behaviour.

3.1(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Knowledge of Ecological concepts viz. dimension I of Responsible Environmental Behaviour.

3.2(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Knowledge of Environmental issues and Problems viz. dimension II of Responsible Environmental Behaviour.

3.2(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Knowledge of
Environmental issues and Problems viz. dimension II of Responsible Environmental Behaviour.

3.2(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Knowledge of Environmental issues and Problems viz. dimension II of Responsible Environmental Behaviour.

3.3(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Appropriate decision making viz. dimension III of Responsible Environmental Behaviour.

3.3(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Appropriate decision making viz. dimension III of Responsible Environmental Behaviour.

3.3(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Appropriate decision making viz. dimension III of Responsible Environmental Behaviour.

3.4(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Beliefs and values related to environment viz. dimension IV of Responsible Environmental Behaviour.

3.4(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Beliefs and values related to environment viz. dimension IV of Responsible Environmental Behaviour.

3.4(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Beliefs and values related to environment viz. dimension IV of Responsible Environmental Behaviour.

3.5(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Personal Responsibility viz. dimension V of Responsible Environmental Behaviour.
3.5(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Personal Responsibility viz. dimension V of Responsible Environmental Behaviour.

3.5(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Personal Responsibility viz. dimension V of Responsible Environmental Behaviour.

3.6(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Intention to Act viz. dimension VI of Responsible Environmental Behaviour.

3.6(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Intention to Act viz. dimension VI of Responsible Environmental Behaviour.

3.6(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Intention to Act viz. dimension VI of Responsible Environmental Behaviour.

3.7(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Locus of Control viz. dimension VII of Responsible Environmental Behaviour.

3.7(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Locus of Control viz. dimension VII of Responsible Environmental Behaviour.

3.7(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Locus of Control viz. dimension VII of Responsible Environmental Behaviour.

3.8(a). There exists no significant difference between groups of class VII students taught through Socio-Constructivist Approach and Traditional Teaching Approach in mean gain scores on Environmental Sensitivity viz. dimension VIII of Responsible Environmental Behaviour.
3.8(b). There exists no significant difference among high, average and low intelligent groups of class VII students in mean gain scores on Environmental Sensitivity viz. dimension VIII of Responsible Environmental Behaviour.

3.8(c). There exists no significant interaction between teaching approaches and intelligence of class VII students on Environmental Sensitivity viz. dimension VIII of Responsible Environmental Behaviour.

5.6 Delimitations
1. The study was conducted only on Class VII students.
2. The Socio-Constructivist approach based instructional material was developed on some topics of science from the prescribed syllabus of NCERT/CBSE for Class VII.
3. The study was confined to students of Class VII from English medium Government schools of Chandigarh affiliated to CBSE.
4. The study was limited to a sample of 120 students.
5. The present study was delimited with respect to variables of Achievement in science, Scientific Creativity and Responsible Environmental Behaviour as dependent variable, Intelligence as classifying variables.
6. The study was delimited with respect of the tools. The results were guided by the data collected by these tests and interpretations were governed by the theoretical consideration underline these tests.
7. The duration of the treatment was 45 working days.

5.7 Design of the Study

The present study employed an experimental method with pre test – post test design. It employed 2x3 factorial design. The first 2x3 factorial design was computed by ANOVA for the means gain scores on Achievement in Science. Here, instructional treatment and intelligence were the independent variables. Gain on Achievement scores was the dependent variable which was calculated as the differences in post test scores and pre test scores for each subject. The variable of instructional treatment was studied at two levels namely experimental group (A₁) which was taught by Socio-
Constructivist Approach and control group ($A_2$) which was taught by traditional Teaching methods. The variable intelligence was studied at three levels viz High ($I_1$), Average ($I_2$), and Low ($I_3$) levels.

Second, 2x3 factorial designs were employed for analyzing scores on gains in Scientific Creativity. The two independent variables were instructional treatment and intelligence. Instructional treatment was studied at two levels viz. ($A_1$) Socio-Constructivist Approach and ($A_2$) Traditional Teaching Approach. Intelligence was studied at three levels High ($I_1$), Average ($I_2$), and Low ($I_3$) levels.

Finally, 2x3 factorial design was employed for mean gain scores on Responsible Environmental Behavior. The two independent variables were instructional treatment and intelligence. Instructional treatment was studied at two levels viz. Socio-Constructivist Approach and Traditional teaching Approach and intelligence was studied at three levels High, Average, and Low levels.

5.8 Sample

The selection of schools in present study was primarily purposive in nature with respect of medium of instruction; secondly with respects to the willingness of the schools to cooperate and tryout a new approach and thirdly with respect to availability of computers and LCD projectors in the schools. Principals of various representative schools of Chandigarh wherein the medium of instruction was English were approached by the investigator. Principals of two schools namely Government Model Senior Secondary school, sector – 16, Chandigarh and Government Model High School, Sector- 25, Chandigarh showed interest and promised to co-operate. Intelligence test (Coloured Progressive Matrices, 1995) was administered to all 361 students of two schools, and accordingly students were divided into three groups. High Intelligence, Average Intelligence and Low Intelligence. Students whose scores on intelligence test lie at or above the 75th percentile were placed in high intelligence group, students whose scores on intelligence test lie between the 25th and 75th percentile were placed in average intelligence group, and students whose score lie at or below 25th percentile were placed in low intelligence group. After scoring it was found 67 students were in high intelligent group, 73 students were in low intelligent group and 221 were in average intelligent group. Final sample comprised of 120
students which were selected through proportionate stratified random sampling technique where, 24 students with High Intelligence, 24 students with Low Intelligence and 72 students with Average Intelligence were selected randomly from respective groups. Each of three groups of students was randomly allocated to two sub groups i.e. experimental and control group. Thus total six groups were formed. Each group comprised of five students, one of high intelligence, one of low intelligence and three of average intelligence. Selection of these students was done randomly.

5.9 The Tools Used

For the present investigation following tools were used

1) Instructional material for implementing Socio-Constructed Approach (Developed by investigator).
2) Criterion Reference Test in Science (Developed by investigator).
4) Responsible Environmental Behaviour Test (Developed by investigator).

5.10 Procedure

Two main stages were adopted as procedure of experiment

Stage I Selection of the Sample

Stage II Conducting the experiment

Stage I Selection of the Sample

The present study was conducted on VII class students from the Government Model Senior Secondary School, Sector – 16, Chandigarh and Government Model High School, Sector- 25, Chandigarh. After administering the intelligence test to 361 students, they were selected and allocated to 3 groups’ viz. high intelligence, average intelligence and low intelligence as explained under the subheading sample in the present chapter. Each of three groups of students were randomly allocated to two sub groups i.e. experimental and control group. So the final sample comprised of 120 students.
Stage II: Conducting the Experiment

The experiment was conducted in three phases as given below:

Phase I: Administration of Pre test: This phase involved the administration of the following tests to the students of experimental group and control group i.e.

i. Criterion Reference Test
ii. Verbal Test on Scientific Creativity
iii. Responsible Environmental Behaviour Test

Separate response sheets were provided. The answer sheets were scored with the help of scoring key. The scores indicated the previous knowledge possessed by the students, their scientific creativity and responsible behaviour towards environment.

Phase II: Conducting the instructional Programme

To find out the efficacy of instructional treatment, it was executed for about 36 days which included 18 teaching episodes to the experimental group whereas the control group was taught by the conventional method. Same content was taught to both the groups. Students were motivated to learn through the novel method of instruction and were encouraged to participate in the experiment by explaining the objectives. For experimental group each lesson follows the 5-E model where students encounter phenomena experimentally (Engage, Explore) prior to having general rules stated that help them articulate underlying principles (explain). Then the skill and new knowledge are transferred to new situations (Expand) and/or have their understanding enriched through additional experience. Student readiness to make meaning of additional experience is assessed (Evaluation) before the cycle begins again. Students were explained the steps of instructional treatment. Grouping of students was done.

Phase III: Administration of Post Test

After the completion of instructional treatment of 36 days, the subjects were assessed by administrating the following post-tests to students of both the experimental and control groups.

i. Criterion Reference Test
ii. Verbal Test on Scientific Creativity
iii. Responsible Environmental Behaviour Test
5.11 Statistical Techniques Used

- Descriptive statistics such as mean, median, standard deviation, skewness and kurtosis was computed on mean gain scores of Achievement in science (criterion reference test), scientific creativity and responsible environmental behaviour test.
- T-test for finding the significant difference if any in mean scores of group taught through Socio-constructivist Approach and the group taught through Traditional Teaching Approach on the variables of Achievement, Scientific Creativity and Responsible Environmental Behaviour as pre-test given before the treatment. The purpose was to ensure matching of the two groups on these variables.
- Factorial design 2x3 analysis of variance for mean gain scores on achievement in science, Scientific creativity and responsible environmental behavior was employed.

For further investigation t-test was employed wherever F-ratio was found significant. Graphical presentations were done through Bar diagrams.

5.12 Major Findings

The findings of study have been given in four parts viz.

- Findings pertaining to mean gain scores on Achievement in Science.
- Findings pertaining to mean gain scores on Scientific Creativity.
- Findings pertaining to mean gain scores on responsible environmental behaviour.

5.12.1 Findings Pertaining to Mean Gain Scores on Achievement in science

A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on the variable of Achievement in science. Students taught through socio-constructivist approach exhibited better mean gains on achievement in science as compared to those taught through Traditional Teaching Approach.
A significant difference was found among high, average and low intelligent groups of class VII students on the variable of Achievement in science. Further investigations revealed that:

- Students with high intelligence exhibited significantly better mean gain scores on Achievement in Science than students with Average Intelligence.
- Students with high intelligence exhibited significantly better mean gain scores on Achievement in Science than students with Low Intelligence.
- Students with Average intelligence exhibited significantly better mean gain scores on Achievement in Science than students with Low Intelligence.

A significant interaction between Teaching Approaches and level of Intelligence was found on the variable of Achievement in Science. Further investigations revealed that:

- Students with High Intelligence exhibited significantly better mean gains in Achievement in Science than students with Average Intelligence when exposed to Socio-Constructivist Approach.
- Students with High Intelligence exhibited significantly better mean gains in Achievement in Science than students with Low Intelligence when exposed to Socio-Constructivist Approach.
- Students with Average Intelligence exhibited significantly better mean gains in Achievement in Science than students with Low Intelligence when exposed to Socio-Constructivist Approach.
- Students with High Intelligence exhibited significantly better mean gains in Achievement in Science than students with Average Intelligence when exposed to Traditional Teaching Approach.
- Students with High Intelligence exhibited significantly better mean gains in Achievement in Science than students with Low Intelligence when exposed Traditional Teaching Approach.
Students with Average Intelligence exhibited significantly better mean gains in Achievement in Science than students with Low Intelligence when exposed to Traditional Teaching Approach.

Students of high Intelligence taught through Socio-Constructivist Approach exhibited significantly better mean gains in Achievement in Science than their counterparts taught through Traditional Teaching Approach.

Students of Average Intelligence taught through Socio-Constructivist Approach exhibited significantly better mean gains in Achievement in Science than their counterparts taught through Traditional Teaching Approach.

Students of Low Intelligence taught through Socio-Constructivist Approach exhibited significantly better mean gains in Achievement in Science than their counterparts taught through Traditional Teaching Approach.

Students of High Intelligence taught through Socio-Constructivist Approach exhibited significantly better mean gains in Achievement in Science than students of Low Intelligence taught through Traditional Teaching Approach.

Students of High intelligence taught through Socio-Constructivist Approach exhibited significantly better mean gains in Achievement in Science than students of Average intelligence taught through Traditional Teaching Approach.

Students of Average intelligence taught through Socio-Constructivist Approach exhibited significantly better mean gains in Achievement in Science than students of Low intelligence taught through Traditional Teaching Approach.

Students of Average Intelligence exposed to Socio-Constructivist Approach and students of high Intelligence exposed to Traditional
Teaching Approach did not differ significantly on the variable of Achievement in Science.

- High intelligence group taught through Traditional Teaching Approach had exhibited significantly better mean gains in Achievement in Science than low intelligence group taught through Socio-Constructivist Approach.

- Low Intelligence group exposed to Socio-Constructivist Approach and Average Intelligence group exposed to Traditional Teaching Approach did not differ significantly on the variable of Achievement in Science.

5.12.2 Findings Pertaining to Mean Gain Scores on Scientific Creativity and its Dimensions

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on the variable of Scientific Creativity. Students taught through socio-constructivist approach exhibited better mean gains on Scientific Creativity as compared to those taught through Traditional Teaching Approach.

- A significant difference was found among high, average and low intelligent groups of class VII students on the variable of Scientific Creativity. Further investigations revealed that:
  - Students with High and Average Intelligence did not differ significantly on the variable of Scientific Creativity.
  - Students with high intelligence exhibited significantly better mean gain scores on the variable of Scientific Creativity than students with Low Intelligence.
  - Students with Average and Low Intelligence did not differ significantly on the variable of Scientific Creativity.

- A significant interaction between Teaching Approaches and level of Intelligence was found on the variable of Scientific Creativity. Further investigations revealed that:
- Students with High Intelligence had developed significantly more Scientific Creativity than students with Average Intelligence when exposed to Socio-Constructivist Approach.
- Students with High Intelligence exhibited significantly better mean gains in Scientific Creativity than students with Low Intelligence when exposed to Socio-Constructivist Approach.
- Students with Average Intelligence had developed significantly better Scientific Creativity than students with Low Intelligence when exposed to Socio-Constructivist Approach.
- Students with High Intelligence had developed significantly better Scientific Creativity than students with Average Intelligence when exposed to Traditional Teaching Approach.
- Students with High Intelligence had developed significantly better Scientific Creativity than students with Low Intelligence when exposed to Traditional Teaching Approach.
- Group of Students with Average Intelligence and Low Intelligence did not differ significantly on the variable of Scientific Creativity when exposed to Traditional Teaching Approach.
- Students of high Intelligence taught through Socio-Constructivist Approach had developed significantly more Scientific Creativity than their counterparts taught through Traditional Teaching Approach.
- Students of Average Intelligence taught through Socio-Constructivist Approach had developed significantly better Scientific Creativity than their counterparts taught through Traditional Teaching Approach.
- Students of Low Intelligence taught through Socio-Constructivist Approach had developed significantly more Scientific Creativity than their counterparts taught through Traditional Teaching Approach.
- Students of High Intelligence taught through Socio-Constructivist Approach had developed significantly more Scientific Creativity than
students of Low Intelligence taught through Traditional Teaching Approach.

- Students of High intelligence taught through Socio-Constructivist Approach had developed significantly more Scientific Creativity than students of Average intelligence taught through Traditional Teaching Approach.

- Students of Average intelligence taught through Socio-Constructivist Approach had developed significantly more Scientific Creativity than students of Low intelligence taught through Traditional Teaching Approach.

- Students of Average Intelligence exposed to Socio-Constructivist Approach and students of high Intelligence exposed to Traditional Teaching Approach did not differ significantly on the variable of Scientific Creativity.

- Low intelligence group of students taught through Socio-Constructivist Approach had developed significantly more Scientific Creativity than High intelligence group of students taught through Traditional Teaching Approach.

- Low Intelligence group of students exposed to Socio-Constructivist Approach had developed significantly more Scientific Creativity than Average Intelligence group of students exposed to Traditional Teaching Approach.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on the Fluency viz. dimension I of Scientific Creativity. Students taught through Socio-Constructivist approach exhibited better mean gains on Fluency viz. Dimension I of Scientific Creativity as compared to those taught through Traditional Teaching Approach.

- A significant difference was found among high, average and low intelligent groups of class VII students on the Fluency viz. Dimension I of Scientific Creativity. Further investigations revealed that:
• Students with High and Average Intelligence did not differ significantly on Fluency viz. dimension I of Scientific Creativity.

• Students with high intelligence exhibited significantly better mean gain scores on Fluency viz. dimension I of Scientific Creativity than students with Low Intelligence.

• Students with Average intelligence exhibited significantly better mean gain scores on Fluency viz. dimension I of Scientific Creativity than students with Low Intelligence.

A significant interaction between Teaching Approaches and level of Intelligence was found on the Fluency viz. Dimension I of Scientific Creativity. Further investigations revealed that:

• Students with High Intelligence had developed significantly more Fluency viz. Dimension I of Scientific Creativity than students with Average Intelligence when exposed to Socio-Constructivist Approach.

• Students with High Intelligence had developed significantly more Fluency viz. Dimension I of scientific creativity than students with Low Intelligence when exposed to Socio-Constructivist Approach.

• Students with Average Intelligence had developed significantly more Fluency viz. Dimension I of scientific creativity than students with Low Intelligence when exposed to Socio-Constructivist Approach.

• Students with High Intelligence had developed significantly more Fluency viz. Dimension I of Scientific Creativity than students with Average Intelligence when exposed to traditional Teaching Approach.

• Students of High Intelligence and Low Intelligence when taught with Traditional Teaching Approach did not differ significantly on Fluency viz. Dimension I of Scientific Creativity.

• Students of Average Intelligence and Low Intelligence when taught with Traditional Teaching Approach did not differ significantly on Fluency viz. Dimension I of Scientific Creativity.
• Students of high Intelligence taught through Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1 of Scientific Creativity than their counterparts taught through Traditional Teaching Approach.

• Students of Average Intelligence taught through Socio-Constructivist Approach had developed significantly better Fluency viz. Dimension 1 of Scientific Creativity than their counterparts taught through Traditional Teaching Approach.

• Students of Low Intelligence taught through Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1 of Scientific Creativity than their counterparts taught through Traditional Teaching Approach.

• Students of High Intelligence taught through Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1 of Scientific Creativity than students of Low Intelligence taught through Traditional Teaching Approach.

• Students of High intelligence taught through Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1 of Scientific Creativity than students of Average intelligence taught through Traditional Teaching Approach.

• Students of Average intelligence taught through Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1 of Scientific Creativity than students of Low intelligence taught through Traditional Teaching Approach.

• Students of Average Intelligence exposed to Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1 of Scientific Creativity than students of high Intelligence exposed to Traditional Teaching Approach.

• Low intelligence group of students taught through Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension 1
of Scientific Creativity than High intelligence group of students taught through Traditional Teaching Approach.

- Low Intelligence group of students exposed to Socio-Constructivist Approach had developed significantly more Fluency viz. Dimension I of Scientific Creativity than Average Intelligence group of students exposed to Traditional Teaching Approach.

A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on the Flexibility viz. dimension II of Scientific Creativity. Students taught through Socio-Constructivist approach exhibited better mean gains on Flexibility viz. Dimension II of Scientific Creativity as compared to those taught through Traditional Teaching Approach.

A significant difference was found among high, average and low intelligent groups of class VII students on Flexibility viz. Dimension II of Scientific Creativity. Further investigations revealed that:

- Students with High and Average Intelligence did not differ significantly on Flexibility viz. dimension II of Scientific Creativity.
- Students with high intelligence exhibited significantly better mean gain scores on Flexibility viz. dimension II of Scientific Creativity than students with Low Intelligence.
- Students with Average and Low Intelligence did not differ significantly on Flexibility viz. dimension II of Scientific Creativity.

No significant interaction was found between Teaching Approaches and level of Intelligence was on Flexibility viz. Dimension II of Scientific Creativity.

A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on the Originality viz. dimension III of Scientific Creativity. Students taught through Socio-Constructivist approach exhibited better mean gains on Originality viz. Dimension III of Scientific Creativity as compared to those taught through Traditional Teaching Approach.
No significant difference was found among high, average and low intelligent groups of class VII students on Originality viz. Dimension III of Scientific Creativity.

No significant interaction was found between Teaching Approaches and level of Intelligence on Originality viz. Dimension III of Scientific Creativity.

5.12.3 Findings Pertaining to Mean Gain Scores on Responsible Environmental Behaviour and its Dimensions

A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on the variable of Responsible Environmental Behaviour. Students taught through Socio-Constructivist approach exhibited better mean gains on Responsible Environmental Behaviour as compared to those taught through Traditional Teaching Approach.

A significant difference was found among high, average and low intelligent groups of class VII students on the variable of Responsible Environmental Behaviour. Further investigations revealed that:

- Students with High and Average Intelligence did not differ significantly on the variable of Responsible Environmental Behaviour.

- Students with high intelligence exhibited significantly better mean gain scores on the variable of Responsible Environmental Behaviour than students with Low Intelligence.

- Students with Average and Low Intelligence did not differ significantly on the variable of Responsible Environmental Behaviour.

No significant interaction was found between Teaching Approaches and level of Intelligence on the variable of Responsible Environmental Behaviour.

A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on knowledge of ecological concepts viz. Dimension I of responsible environmental behaviour.
A significant difference was found among high, average and low intelligent groups of class VII students on knowledge of ecological concepts viz. Dimension I of responsible environmental behaviour. Further investigations revealed that:

- Students with High and Average Intelligence did not differ significantly on Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behaviour.

- Students with high intelligence exhibited significantly better mean gain scores on Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior than students with Low Intelligence.

- Students with average intelligence exhibited significantly better mean gain scores on Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior than students with Low intelligence.

A significant interaction between Teaching Approaches and level of Intelligence was found on knowledge of ecological concepts viz. Dimension I of Responsible Environmental Behaviour. Further investigations revealed that:

- Students with High Intelligence and Average Intelligence did not differ significantly on Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior when exposed to Socio-Constructivist Approach.

- Students with High Intelligence exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior than students with Low Intelligence when exposed to Socio-Constructivist Approach.

- Students with Average Intelligence exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior than students with Low Intelligence when exposed to Socio-Constructivist Approach.
Students with High Intelligence and Average Intelligence did not differ significantly on Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior when exposed to traditional Teaching Approach.

Students of High Intelligence exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior than students of Low Intelligence when taught with Traditional Teaching Approach.

Students of Average Intelligence and Low Intelligence when taught with Traditional Teaching Approach did not differ significantly on Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behavior.

Students of high Intelligence taught through Socio-Constructivist Approach had exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behaviour than their counterparts taught through Traditional Teaching Approach.

Students of Average Intelligence taught through Socio-Constructivist Approach had exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behaviour than their counterparts taught through Traditional Teaching Approach.

Students of Low Intelligence taught through Socio-Constructivist Approach had exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behaviour than their counterparts taught through Traditional Teaching Approach.

Students of High Intelligence taught through Socio-Constructivist Approach had exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental
Behavior than students of Low Intelligence taught through Traditional Teaching Approach.

- Students of High intelligence taught through Socio-Constructivist Approach had exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behaviour than students of Average intelligence taught through Traditional Teaching Approach.

- Students of Average intelligence taught through Socio-Constructivist Approach had exhibited significantly better mean gains in Knowledge of Ecological Concepts viz. dimension I of Responsible Environmental Behaviour than students of Low intelligence taught through Traditional Teaching Approach.

- Low intelligence group of students taught through Socio-Constructivist Approach and High Intelligence group of students taught through Traditional Teaching Approach did not differ significantly on dimension I viz. Knowledge of Ecological Concepts of Responsible Environmental Behavior.

- Low Intelligence group of students exposed to Socio-Constructivist Approach and Average Intelligence group of students exposed to Traditional Teaching Approach did not differ significantly on dimension I viz. Knowledge of Ecological Concepts of Responsible Environmental Behaviour.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Knowledge of Environmental issues and Problems viz. Dimension II of Responsible Environmental Behaviour. Students taught through Socio-Constructivist approach exhibited better mean gains on Responsible Environmental Behaviour as compared to those taught through Traditional Teaching Approach.

- A significant difference was found among high, average and low intelligent groups of class VII students on Knowledge of Environmental Issues and
Problems viz. Dimension II of Responsible Environmental Behaviour. Further investigations revealed that:

- Students with High and Average Intelligence did not differ significantly on Knowledge of Environmental issues and Problems viz. Dimension II of Responsible Environmental Behaviour.

- Students with high intelligence exhibited significantly better mean gain scores on Knowledge of Environmental issues and Problems viz. Dimension II of Responsible Environmental Behavior than students with Low Intelligence.

- Students with average intelligence exhibited significantly better mean gain scores on Knowledge of Environmental issues and Problems viz. Dimension II of Responsible Environmental Behavior than students with Low intelligence.

- No significant interaction was found between Teaching Approaches and level of Intelligence on Knowledge of Environmental issues and Problems viz. Dimension II of Responsible Environmental Behaviour.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Appropriate Decision Making viz. dimension III of Responsible environmental behaviour.

- A significant difference was found among high, average and low intelligent groups of class VII students on Appropriate Decision Making viz. dimension III of Responsible environmental behaviour. Further investigations revealed that:

  - Students with High and Average Intelligence did not differ significantly on Appropriate Decision Making viz. dimension III of Responsible Environmental Behaviour.

  - Students with high intelligence exhibited significantly better mean gain scores on Appropriate Decision Making viz. dimension III of Responsible Environmental Behavior than students with Low Intelligence.
• Students with average intelligence exhibited significantly better mean gain scores on Appropriate Decision Making viz. dimension III of Responsible Environmental Behavior than students with Low intelligence.

A significant interaction was found between Teaching Approaches and level of Intelligence on Appropriate Decision Making viz. dimension III of Responsible Environmental Behaviour. Further investigations revealed that:

• Students with High Intelligence and Average Intelligence did not differ significantly on Appropriate Decision Making viz. dimension III of Responsible Environmental Behavior when exposed to Socio-Constructivist Approach.

• Students with High Intelligence had developed significantly more Appropriate Decision Making capacity viz. dimension III of Responsible Environmental Behavior than students with Low Intelligence when exposed to Socio-Constructivist Approach.

• Students with Average Intelligence had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behavior than students with Low Intelligence when exposed to Socio-Constructivist Approach.

• Students with High Intelligence had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behavior than students with Average Intelligence when exposed to traditional Teaching Approach.

• Students of High Intelligence had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behavior than students of Low Intelligence when taught with Traditional Teaching Approach.

• Students of Average Intelligence and Low Intelligence when taught with Traditional Teaching Approach did not differ significantly on Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behavior.
• Students of high Intelligence taught through Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behaviour than their counterparts taught through Traditional Teaching Approach.

• Students of Average Intelligence taught through Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behaviour than their counterparts taught through Traditional Teaching Approach.

• Students of Low Intelligence taught through Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behaviour than their counterparts taught through Traditional Teaching Approach.

• Students of High Intelligence taught through Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behavior than students of Low Intelligence taught through Traditional Teaching Approach.

• Students of High intelligence taught through Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behaviour than students of Average intelligence taught through Traditional Teaching Approach.

• Students of Average intelligence taught through Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behaviour than students of Low intelligence taught through Traditional Teaching Approach.

• Low intelligence group of students taught through Socio-Constructivist Approach and High Intelligence group of students taught through
Traditional Teaching Approach did not differ significantly on Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behavior.

- Low Intelligence group of students exposed to Socio-Constructivist Approach had developed significantly better Appropriate Decision Making Capacity viz. dimension III of Responsible Environmental Behaviour than Average Intelligence group of students exposed to Traditional Teaching Approach.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Beliefs and Values Related to Environment viz. dimension IV of Responsible environmental behavior. Students taught through Socio-Constructivist approach exhibited better mean gains on Beliefs and Values Related to Environment viz. dimension IV Responsible environmental behavior as compared to those taught through Traditional Teaching Approach.

- No significant difference was found among high, average and low intelligent groups of class VII students on Beliefs and Values Related to Environment viz. dimension IV of Responsible environmental behavior.

- No significant interaction was found between Teaching Approaches and level of Intelligence on Beliefs and Values Related to Environment viz. dimension IV of Responsible environmental behavior.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Personal Responsibility viz. dimension V of Responsible environmental behaviour. Students taught through Socio-Constructivist approach exhibited better mean gains on Personal Responsibility viz. dimension V of Responsible environmental behavior as compared to those taught through Traditional Teaching Approach.

- No significant difference was found among high, average and low intelligent groups of class VII students on Personal Responsibility viz. dimension V of Responsible environmental behaviour.
- No significant interaction was found between Teaching Approaches and level of Intelligence on Personal Responsibility viz. dimension V of Responsible environmental behaviour.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Intention to Act viz. dimension VI of Responsible environmental behaviour. Students taught through Socio-Constructivist approach exhibited better mean gains on Intention to Act viz. dimension VI of Responsible environmental behavior as compared to those taught through Traditional Teaching Approach.

- No significant difference was found among high, average and low intelligent groups of class VII students on Intention to Act viz. dimension VI of Responsible environmental behaviour.

- No significant interaction was found between Teaching Approaches and level of Intelligence on Intention to Act viz. dimension VI of Responsible environmental behaviour.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Locus of Control viz. dimension VII of Responsible environmental behaviour. Students taught through Socio-Constructivist approach exhibited better mean gains on Locus of Control viz. dimension VII of Responsible environmental behavior as compared to those taught through Traditional Teaching Approach.

- No significant difference was found among high, average and low intelligent groups of class VII students on Locus of Control viz. dimension VII of Responsible environmental behaviour.

- No significant interaction was found between Teaching Approaches and level of Intelligence on Locus of Control viz. dimension VII of Responsible environmental behaviour.

- A significant difference was found between groups taught through Socio-Constructivist Approach and Traditional Teaching Approach in the mean gain scores on Environmental Sensitivity viz. dimension VIII of Responsible environmental behaviour. Students taught through Socio-Constructivist
approach exhibited better mean gains on Environmental Sensitivity viz. dimension VIII of Responsible environmental behavior as compared to those taught through Traditional Teaching Approach.

- No significant difference was found among high, average and low intelligent groups of class VII students on Environmental Sensitivity viz. dimension VIII of Responsible environmental behaviour.
- No significant interaction was found between Teaching Approaches and level of Intelligence on Environmental Sensitivity viz. dimension VIII of Responsible environmental behaviour.

5.13 Educational Implications of the Research

Educational implications are based on the findings of the research and also emerged from the experiences of the researcher during the process of teaching through Socio-constructivist Approach. The results of the present investigation indicate that teaching students through Socio-constructivist Approach enhance their Achievement in Science, Scientific Creativity and Responsible Environmental Behavior. The curriculum and evaluation standard for school education, National Curriculum Framework (NCF), prepared by working group of NCERT (2008), does also highlight the importance of introducing constructivist approach in education system. This ‘Child-Centered Pedagogy’ gives primacy to children’s experiences, their voices, and their active participation where learning take place through interactions with the environment around, nature, things and people, both through actions and through language especially to the primary classes because children have an innate, genetically predisposed tendency to explore and bond with the natural world and they must be given developmentally appropriate opportunities to learn about the natural world. Further, interaction with teachers and with peers opens up many more rich possibilities. On the basis of findings of the study following educational implications may be laid down:

- As students taught through Socio-constructivist Approach yielded significantly more gain scores on Achievement in Science, Scientific Creativity and Responsible Environmental Behavior with their respective dimensions as compared to those taught through Traditional Teaching Approach. This is an encouraging result for the proponents of Socio-constructivist Approach. So, this finding lays emphasis on the use of Socio-
Socio-constructivist Approach as a method of teaching science/Ecology. Teacher should teach ecology part of science through socio-constructivist Approach by incorporating activities relevant to respective topics. Further this finding has implication for principals/administrators to allocate funds and appropriate changes in the time-table, so that the teachers may not face difficulties in adopting socio-constructivist Approach of teaching.

✓ Socio-constructivism provides an explanation for how learning can be fostered effectively through interactive pedagogical practices. Through Socio-constructivist Approach learning takes place in a social environment where learners are active constructors of their own learning environment.

✓ Socio-constructivist theory advocates that students master new approaches of learning through interacting with others. Young children are active learners. Their best learning occurs with hands-on, interactive play and self-discovery rather than by mercly imparting factual.

✓ Students should be encouraged to use active techniques (experiments, real-world problem solving) to create more knowledge, to reflect on and give expression to their process of understanding. The teacher has to make effort to understand the students' preexisting conceptions and guide the activities to build on them.

✓ Teaching strategies using social constructivism as a referent include teaching in contexts that might be personally meaningful to students, negotiating taken-as-shared meanings with students, class discussion, small-group collaboration, and valuing meaningful activity over correct answers.

✓ Young children have a natural curiosity that requires direct sensory experience rather than conceptual generalization. To be effective in engaging children according to their developmental abilities and ways of learning, their hands-on sensory experiences need to be immersive and open-ended rather than structured and scripted.

✓ Children’s experiences during early childhood should nurture the conception of the child as a part of nature. It is during early childhood when children’s experiences give form to the values, attitudes, and basic orientation toward the world that they will carry with them throughout.
Some field trips should also be provided so that participants can experience severe environmental problems or degradation in their local community.

A large percentage of the population lives in poverty, with few options to choose environmentally appropriate lifestyles. Others are in position to make environmentally sensitive decisions but do not do so, partly because of lack of awareness. So, we need to make people aware about environment through education.

Acquisition of good collaborative skills is linked with academic success, happiness in school, as well as a more emotionally stable adult life.

According to research, attaining social interaction early in a child's school career plays an important role in later academic and vocational success.

Some students fail to show even basic understanding of certain concepts necessary for meaningful learning when taught by traditional teaching method. Socio-Constructivism takes care of student’s prior knowledge and hence benefits them.

Socio-Constructivism provides opportunity to the students for independent learning. So, it is useful to the students.

The capability of the students varies. So, teacher should provide the task and environment according to student’s ability.

Teacher should question and insist the students to explain the answer they give and encourage students to reflect on their answers.

Since Science is a unified subject of different branches socio-constructivism provides integrated approach through which the aim of education, which is preparation for adult life, may be achieved to a greater extent.

The teacher education institutions must incorporate socio-constructivism in the training programme for the pre-service and in-service teachers.

A teacher should structure the learning experience just enough to make sure that the students get clear guidance and parameters within which to achieve the learning objectives, yet the learning experience should be open and free enough to allow for the learners to discover, enjoy, interact and arrive at their own, socially verified version of truth.
To fully engage and challenge the learner, the task and learning environment should reflect the complexity of the environment in which the learner should be able to function at the end of learning. Learners must not only have ownership of the learning or problem-solving process, but of the problem itself.

Beyond the use of rewards and punishments, socio-constructivists contend that the motivations possessed by individuals will greatly affect their abilities and capacities to learn as well as what it is that they learn. The most basic motivation for learning is an individual's desire (need) to make sense of the world.

The purpose of Socio-Constructivist learning is for an individual to construct his or her own meaning, not just memorize the "right" answers and regurgitate someone else's meaning.

Participation in group activity allows students to generalize and transfer their knowledge of classroom learning and builds a strong foundation for communicating ideas orally. Group work increases student motivation, collaborative skills, and the ability to solve problem. Increasing student's opportunity to work with one another and discuss their ideas increases their ability to support their thinking, develop reasoning skills, and to argue their opinions persuasively and respectfully.

Constructivist learning theory tells us that we learn in a multiple ways through a variety of tools, resources, experiences, and contexts. The more opportunities we have, and the more actively engaged we are, the richer our understanding. Good teachers have always used experience as a valuable instructional tool; that is why we arrange field trips and hands-on projects.

Every person is surrounded by an infinite variety of images, ideas, information, and other stimuli that provide raw material for thought and understanding. If new information matches the learner's existing understanding, it is easily assimilated.

Social interaction introduces multiple perspectives through reflection, collaboration, negotiation, and shared meaning. In many situations, learning is
enhanced by verbal representation of thoughts—it helps to speak about an idea, to clarify procedures, or float a theory to an audience.

Knowledge, meaning, and understanding of the world can be addressed in the classroom from both the view of individual learner and the collective view of the entire class. Learners look for meaning and try to find regularity and order in the events of the world even in the absence of full or complete information.

Students should appreciate that science is an activity that involves creativity and imagination as much as many other human activities, and that some scientific ideas are enormous intellectual achievements. Scientists, as much as any other profession, are passionate and involved humans whose work relies on inspiration and imagination.

Science knowledge is created from the human imaginations and logical reasoning. This creation is based on observation and inferences of the natural world.

Socio-constructivism views each learner as a unique individual with unique needs and backgrounds. The learner is also seen as complex and multidimensional. Social constructivism not only acknowledges the uniqueness and complexity of the learner, but actually encourages, utilizes and rewards it as an integral part of the learning process.

Teachers should be able to plan and realize collaborative socio-constructivist learning environments, based on research-based frameworks. They should be able to scaffold the constructions process of viable knowledge through radical constructions among the learners.

For the constructivists, language is a synthetic tool that enables individuals to make connections beyond what has been learned in the past because in the formulation of words, sentences, and paragraphs, learners must organize their thoughts into communicable ideas, a process that often results in knowledge.

Constructivists believe that knowledge has a social component—individuals’ interactions with their environment are critical and must not be discounted. Our learning is intimately associated with our connection with other human beings, our teachers, our peers, and our family. Conversations, interaction with others and collaborations are an integral aspect of learning.
Social constructivists view learning as a social process. It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces. Meaningful learning occurs when individuals are engaged in social activities.

Learning involves the learner’s engaging with the world and extracting meaning from his/her experiences. The process of learning takes place when individuals attempt to make sense of the world around them.

The cognitive development of a child is not just driven by internal processes rather it is by active adaptation to its social world. Processes that occur between the child and others become the basis for processes that take place within the child. Dialogue, interaction and argument become internalized to form the basis for reflection, logical reasoning and the formation of new concepts.

In science, creativity and rationality always work together. Scientific creativity never works without rationality and strict empirical testing.

Teachers must have different perspectives on the nature of science, treating their classroom practice of science as an established body of knowledge and techniques requiring minimal justification. Improving teaching, therefore, requires teachers to reconsider their roles, use of discourse, conception of learning goals and the nature of classroom activities.

5.14 Suggestions for Further Research

A research work is meant for developing new dimensions and forwarding innovative steps in related field of work. Keeping the enormity of the comprehensiveness in the area of Socio-Constructivist teaching approach, the researcher by virtue of her experience in the field of study humbly offers the following suggestions for further research that could be taken by the perspective researchers.

- The present study focused on elementary school pupils. It can be repeated with different levels of education like at Secondary Level, College Level or University Level.
• Only eight dimensions of Responsible Environmental Behaviour were used to assess the Responsible behaviour of students towards Environment. These are: Knowledge of Ecological Concepts, Knowledge of Environmental issues and Problems, Appropriate decision making, Beliefs and values related to environment, Personal Responsibility, Intention to Act, Locus of Control and Environmental sensitivity. More researches can be carried out by including more dimensions or other related dimensions on the related field.

• Research may be conducted to study the effect of Socio-Constructivist Approach of teaching science on other important variables such as social skills, scientific temper, problem solving, self-efficacy, self-esteem, self-awareness, leadership and motivation.

• Other psychological variables like scientific temper, social skills, self esteem, motivation, home environment can be added in research endeavor which may possibly correlate the achievement, scientific creativity and Responsible Environmental Behaviour.

• The present study was experimental study and was confined to students only. Some descriptive studies and research projects may be undertaken to study the Scientific Creativity and Responsible Environmental Behaviour of Teachers, Doctors, Lawyers and Engineers also.

• The present study may be replicated on a large population for greater validation of results.

• A comparative study may be designed to compare the effect of Socio-Constructivist approach on private school students and government school students; urban school students and rural school students.

• Other recommendations for future research include a Socio-Cultural-Constructivist approach, to combine and examine the cultural impacts on students from various cultures.