CHAPTER – V

SUMMARY AND CONCLUSIONS

5.1 INTRODUCTION

Education is generally acknowledged as one of the crucial allies of the developmental process. ‘No nation can rise above the quality of its education system’. Education is a powerful tool to transfer and percolation of knowledge. The educators should meet the fast changing demands and expectations of the society from time to time. The expanding knowledge of science and technology which accompanied by fast growing environmental problems has set in motion, the updating of educational curricula to meet the new changes and preparing the environmental conscious citizen. Since no education system can rise above the quality of its teacher, the challenge of teacher education appears to be the most daunting challenge facing the education system in general. Educating the people, particularly the youth about the environment and its related aspects helps to link the learning process with daily life experiences, thus making it more meaningful.

One of the greatest problems facing the earth at present is the impact of humans on the environment. Experts argue that the environmental problems caused by human development, such as global warming, the destruction of rainforests and threats to bio-diversity, have reached an unprecedented scale and complexity in world history. Since 1992 World Environmental Conference in Rio de Janeiro, a succession of international environmental conferences have acknowledged that the threat to the Earth’s ecosystems are global problems that
need to be viewed and solved cooperatively by many people from a range of cultural backgrounds.

The Asian Environmental Outlook Report (ADB, 2001) underscored that because of the environmental degradation, people’s health and livelihoods, the survival of species and ecosystem services that are the basis for long term economic development are at risk. It also mentions that Asia will find it difficult to achieve long term sustainable economic growth unless countries in the region play attentive to solving the enormous environmental problems. UNEP’s Global Environment Outlook Report (2000) blames the intense poverty of the marginalized group and excessive consumption by a few as two major causes of environmental degradation.

Recent international meetings emphasized the task of crucial importance, that of handling on to future generations, a world capable of promoting the natural life enhances the beauty and life sustaining resources they will need. World education and environmental specialists have repeatedly pointed out that a solution to environmental crisis will require an environmental awareness and its proper understanding which should be deeply rooted in the education system at all levels of school education (Shobeiri, et al., 2007). This calls for the environmental education and training of each successive generation in order to ensure widespread environmental literacy that includes the elementary knowledge related to environment and its conservation, skills and motivation essential for people to participate in the solution, anticipation of environmental problems and to make their own contribution to suitable development.
Environmental Education is not a new concept. It has been defined in many ways by various people and has been implemented in the school syllabi of many countries for years, though with mixed success. There are various reasons why implementation has not met with more success; for example, there is no consensus of views regarding the nature and purpose of environmental education. It was also realized that existing environmental education programmes have to be revised and new ones developed that are more holistic and learner centred. This is because on the more recent definitions of environmental education see it as “… a holistic, lifelong process of becoming aware of, appreciating, valuing and contributing to the creation and development of the kind of environment that is healthy and sustainable” (Little, 1998, p.103). It was also realized that environmental education programmes should not only address awareness of environmental issues, but should be geared toward changing learners’ perceptions and attitudes towards their environmental and lead them to engage in more environmentally responsible behaviour. In order to do this, learners also need to be equipped with the necessary skills (action strategies) to address environmental issues.

Environmental problems are not the problems of developing countries like India, but it is concerned with the whole globe. It is the need of the hour to make the whole society conscious about the ecosystem and ecological balance. Education is a powerful medium for change our behaviour. For rising the awareness level of the populace, it is very essential to start from the grass root level. This indicates the need for environmental education at all levels of education. When students learn about the functioning of eco-system and about
environmental action strategies that contribute to their maintenance they develop more environmentally responsible behaviour.

A number of new objectives and guiding principles for developing EE at all levels in both formal and non-formal levels were formulated at the Tbilisi Conference (UNESCO, 1977). These are as follows: i) acquires an awareness of and sensitivity to the total environment and its allied problems, ii) Gain a variety of experiences and acquire a basic understanding of the environment and its associated problems, iii) Acquire a set of values and feelings of concern for the environment and motivation for active participation in environmental improvement and protection, iv) Acquire skills for identifying and solving environmental problems, v) evaluate environmental measures and education programmes in terms of ecological, economic, social, aesthetic and educational factors, provide an opportunity to be actively involved at all level in working towards the resolution of environmental problems (Sharma, 2004, p.532). On the other hand different developing countries have taken massive steps for environmental education. In India, environmental education (EE) has found a place in diverse disciplines. Supreme Court of India has directed the U.G.C., New Delhi to implement compulsory courses of all branches of higher education (Rao, 2010).

5.2 THE ROLE AND AIMS OF ENVIRONMENTAL EDUCATION

Most of the initiatives described above express support for the introduction of world-wide environmental education. However, considerable differences arise, when the precise form of this education should take is considered, and debate continues on the most successful way to approach environmental education in
A key issue is the relative importance of three aspects of environmental education: knowledge, attitudes and behaviour, illustrated by the three aims for environmental education devised by the Tbilisi conference in 1977. The relationship between these three aspects is reflected in the traditional division of environmental education into education about the environment; education from or in the environment and education for the environment (Huckle, 1990; Fien, 1992; Palmer & Neal, 1994; Tilbury, 1995). These three strands each emphasized different aims and teaching methods, which are briefly outlined below.

1. **Education about the environment** – Students develop knowledge and understanding about the content and processes of the environment (Centre for Environmental Education, 1995). Objectives are largely cognitive, the main aim being to a mass information. Education about the environment has been criticized for its failure to examine the social causes of environmental issues or look at sustainable alternatives. Pupils are not encouraged to understand the cultural, political and economic systems which inter-relate with environmental issues, and therefore lack the depth of understanding needed to enable them to take action with regard to environmental problems (Huckle, 1990). Education about the environment is seen as objective and value-free. The discussion of personal viewpoints is not encouraged.

2. **Education from (or in) the environment** – Students are taught by using the environment as a learning resource, either as a medium for discovery or as a source of teaching material. A wide variety of activities are encompassed, including outdoor education, field trips and use of the school grounds to teach
about the environment. Objectives are equally varied, involving cognitive and affective aims such as learning important concepts, improving fieldwork skills, or nurturing a sense of involvement in the environment. It has also been criticized however, and has been described by John Huckle as “naive experimental encounters with nature” (Huckle, 1981).

3. Education for the environment (or for sustainable development) – Students are explicitly encouraged to develop and express their own attitudes towards environmental issues, and make informed decisions concerning the links between human activity and the environment. Objectives go beyond the acquisition of knowledge and skills: pupils are encouraged to develop an informed concern for the environment and to take action to improve or preserve some aspect of the local environment. Education for the environment aims to assist students in developing the skills which allow them to participate fully in a democratic society (Fien, 1992; Sterling, 1993; Tilbury, 1995).

Thus, there is a clear gradation from the largely knowledge-based “education about the environment”, through the knowledge and attitude development of “education from/in the environment”, to “education for the environment” which involves knowledge, attitudes and behavioural outcomes. Majority of the researches highlighted the major concerns about dealing with environmental issues, most of the time controversial. They include: 1) Concern that teaching controversial environmental issues is too great a challenge for schools or for teachers, 2) Concern that environmentally-sound attitudes are not agreed upon, 3) Concern that developing attitudes might take place at the expense
of knowledge and 4) Concern that developing attitudes might take precedence over independent thought.

According to Hungerford and Volk (1990) the ultimate aim of education is to shape the human behaviour. Educational systems have therefore been established on a global scale to develop citizens who will behave in a desirable way. Environmental Education has been identified as an educational method for promoting environmentally responsible behaviour in learners and has subsequently been implemented in the curricula of schools throughout the world. The guidelines defined in the Tbilisi Intergovernmental Conference, 1977 for effective environmental education programmes that may lead to behavioural changed on the part of the learners, allow us to define an environmentally responsible person as someone who has an awareness, sensitivity, understanding and concern for the environment and its problems as well as the necessary skills to identify and solve environmental problems and who actively engages in working toward a resolution of environmental problems at all levels (Hungerford & Volk, 1990). Teaching environmentally responsible behaviour therefore goes beyond basic education in its traditional sense and involves the teaching of knowledge about environmental issues, promoting of pro-environmental attitudes and the teaching of the necessary skills for positive action in society.

Environmental curriculum developers should prepare curricula that stimulates “the learning of concepts, provides for the attainment of problem solving skills, allows for the modification of benefits and values and provides for training in and opportunities to apply appropriate citizenship behaviours which will result in a population lifestyle that balances the quality of life with the quality
of the environment” (Clacherty, 1993, p. 6). The curriculum development process involves more than the preparation of materials. According to Clacherty (1993, p.10), it also involves “decision making concerning goals and objectives; subject matter to achieve the goals and objectives; and methods of teaching and evaluation of the achievement of goals and objectives”. Environmental curriculum developers should strive for transfer in selecting methods, formats and styles.

There exists a major assumption that, knowledge about the environment and environmental problems will lead to environmental awareness and pro-environmental attitudes which in turn will lead to environmentally responsible behaviour. According to research done by scientists such as Hines et al., (1986/87), factors such as an intention to act, prior knowledge of the problem at hand, and a desire to act are more likely to lead to actual action on the part of the individual. Most of the environmental education programmes however, do not take the factors which predict the environmental responsible behaviour into consideration and are still designed to provide knowledge (information) about the environment and increase environmental awareness. The lack of emphasis on objectives that focus on helping learners actually solve environmental problems and develop problem solving skills, is an existing contradiction to most of the guidelines evolved in national and international committees.

It is imperative that EE programmes move beyond the mere knowledge production and awareness raising and include ways of increasing the intention and desire of learners to act environmentally responsible ways as well as to equip them with necessary skills and problem solving abilities to actively engage in
environmentally responsible behaviour (Hungerford and Volk, 1990). This raised
the need for a new model for instruction.

5.3 SIGNIFICANCE OF EXPERIENCE AND EXPERIENTIAL
LEARNING

Using experience in a teaching and learning setting is not new; in fact,
almost everything we learn is based on some kind of experience. The key hallmark
of whether an experience is educational or not is based on how the experience is
used to promote further development or learning.

The term ‘experience’ is associated with the raw knowledge or skills
gained from life by personal (initial) contact with facts and events. Experience
implies that there is recognition (at an affective level) that ‘something’ has been
gained as a result of personal contact, and the subsequent reflection that moves
experience to experiential learning forms the basis of developing a consciousness
or understanding of ideas, neither of which may in turn be understood as a theory.

Kant elevated the status of practical experience as opposed to the cognitive
worldview (theoretical knowledge) held by Plato and Aristotle. Kant also
acknowledged the importance of reflecting on experience to develop a theoretical
perspective. Practical knowledge was not reduced to implementing theory, but was
viewed as a critical link in generating and establishing a theoretical position. The
relationship between prior knowledge and current experience was, therefore,
dependent on personal interpretation. Thus, the term ‘experience’ requires detailed
analysis and the link between ‘experience’ and the contemporary view of
experiential education needs to be explored.
John Dewey made the point that if experience involved being affected by something (i.e. “Suffering or undergoing the consequences”) then it embraced the concept of thinking about our actions. If our actions shift and become a change in behaviour, then Dewey believed that true learning had occurred. However, it is the connection of what Dewey calls the passive and active elements of experience that determines the true value of an experience. Therefore, he argued that the activity by itself “does not constitute experience” (1966, p. 139).

Dewey’s philosophy of learning is similar to the ideas of Kant. His approach to learning is based on the idea that all learning is grounded in experience, which, for the purpose of this thesis, is interpreted as being ‘affected by an event’. Dewey (1966) believed that a small amount of experience was worth a huge amount of theory, “because it is only in experience that any theory has vital and verifiable significance” (p.144).

Dewey further clarified the term ‘experience’ by describing two related aspects of all experience which he called primary and secondary experience. According to Dewey (1926, p.23), an initial, primary experience is essentially “non-cognitive”. Indeed Dewey saw it as “gross, macroscopic and crude” (p.7).

However, secondary or reflective experience involves an exploration of what happened during the primary experience. Therefore, the reflective experience transforms the basic and rough nature of primary experience into a more sophisticated form, one that is “precise, microscopic and refined” (p.7).

The concept of primary experience is grounded in an event that happens to a particular person. Thus, personal experiences are not someone else’s experience but something that an individual must “significantly identify with, seriously
interact with” or “form a personal relationship with” (Joplin, 1981, p. 15). The secondary experience is based on an individual’s interpretation of the primary experience. Therefore, the initial experience provides the context for learning, while the secondary experience provides the significance and meaning. Thus, it is the reflective process and quality feedback that turns experience into experiential learning. Consequently, experiential learning “includes both the act of experiencing and what has been experienced” (Bernstein, p.65). However, what has been experienced is limited to the specific context in which it occurs, to the particular people involved and to individual interpretation. According to Usher, Bryant and Johnson (1997) “experience can have many meanings some conflicting and contradictory” (p.105). Hence, no experience is the same for each individual and is open to different interpretations in different contexts and settings. Therefore, “the meaning of experience will vary according to different discursive practices, as will the particular significance given to learning derived from experience” (Usher, Bryant & Johnson, 1997, p.105).

Experience can be limited by how it is presented and then authenticated by the social structures in which it is conceived. Usher, Bryant and Johnston (1997) argue that this identifies a major weakness in considering “how experience itself represents (has meaning) and second, is itself represented (within theories and epistemologies)” (p.101). While ‘raw’ experience is authentic to the learner it is often presented within established social structures. Consequently, these social structures have the power to either limit and control the potential experience or liberate it by providing the freedom to challenge. Therefore, Usher, Bryant and Johnston (1997) suggest that experiential education that is “representing or
discursively producing experience in a very particular way and with a very particular set of significations” (p.102) is notably contestable, political and subject to question.

As a result, experiential learning should be considered not just as a student-centred approach or pedagogical technique. Instead, it needs to be viewed in terms of the socio-cultural and institutional context in which it operates (Usher, Bryant and Johnston 1997). Individual meaning of an experience will always be context specific and will produce different interpretations.

5.4 EXPLORING UNDERSTANDINGS OF EXPERIENTIAL EDUCATION

The concept of experiential education has been developed to provide a philosophical basis to understand and make use of experience in the learning process. However, there is still some confusion in relation to the term ‘experience’ within the concept of experiential education. Aldous Huxley states that “experience is not what happened to you; it is what you do with what happens to you” (cited in Luckner & Nadler, 1992, p. 176). This statement recognizes secondary experience but neglects the personal connection, identity and relationship that is grounded in ‘primary’ experience.

Experiential education is described as “an approach which has students actively engaged in exploring questions they find relevant and meaningful, and has them trusting and feeling, as well as thinking” (Chapman, 1992, p.18). Thus, experience is meaningful when new insights are drawn by reflecting on what happened (Beard & Wilson, 2002). It is not meaningful if the aim is to support the “existing status quo” (p.17). Learners must actively interact with a range of “external stimuli” (Beard & Wilson, 2002, p.18) and critically examine these in
light of previous knowledge in order to develop new meanings. Student ownership and interest in the questions they ask is critical for the experience to be meaningful. In this context experiential education is better understood in terms of style (Chapman, 1992) rather than as a theory of learning thus, the techniques can be used in a range of subjects. Reflection is identified as a critical component of experiential education and is the technique used to develop meaning and understanding from experience that leads to new ideas, and new experiences (Heron, 1989, Chapman, McPhee & Proudman, 1992; Luckner & Nadler, 1992; Carver, 1995; Beard & Wilson 2002). Luckner and Nadler (1992, p.3) characterize experiential education as “learning that occurs when individuals engage in some activity, reflect upon the activity critically, derive some useful insights from the analysis, and incorporate the result through a change in understanding and/or behaviour”. It is best described as ‘philosophical orientation’ (Luckner & Nadler), towards learning that is grounded in learner reflection and ownership of learning process.

Experiential education is an approach to learning that sets out to engage learners in self-improvement, social empowerment and transformation through critical practice (Bell, Usher, Bryant & Johnson, 1997). Therefore, it has the potential to become what Simon (1987, p.372) calls a ‘pedagogy of empowerment” because it is “aimed at enabling” through co-operation and collaboration. Environmental Education as defined in a UNESCO document (1987, p. 2) describes a model of action “in which individuals and the community gain awareness of their environment and acquire the knowledge, values, skills, experiences and also the determination which will enable them to act –
individually and collectively – to solve present and future environmental problems.” By the use of the phrase “enable them to act,” the UNESCO definition suggests a model in which there is a direct relationship between awareness, knowledge, values, skills, and determination and the ability of individuals to act on environmental problems. This defined relationship, outlining the role of specific precursors of environmentally responsible behaviour, is also supported by a broad range of environment-behaviour research.

The Brundtland Report (1987) argued “that the world’s teachers have the crucial role to play in helping bring about the extensive social changes needed for sustainable development” (p.8). Fien and Tilbury (1996) also acknowledge that a similar message was included in the World Conservation Strategy for the 1990s by ICUN, UNEP and WWF (1991) and also in the Agenda 21 report from the Rio Earth Summit in 1992.


Consequently, teacher education has come to be seen as “potentially the greatest source of educational change” (UNESCO, 1976) for developing environmental literacy. Thus, the UNESCO-UNEP International Environmental Education Programme expressed a concern that “the priority of priorities” was the preparation of teachers to facilitate effective environmental education programmes (UNESCO-UNEP, 1990, p.1).
Both pre-service and in-service teacher education has been identified as important in providing the skills, knowledge and practical expertise to help teachers meet the requirements of the environmentally educated teacher (Fien & Tilbury 1996). The competencies of the environmentally educated teacher were outlined by Stapp as early as 1975 (Fien & Tilbury 1996). These have been documented in a number of reports since then (UNESCO 1976; UNESCO-UNEP 1976; UNESCO 1978; Stapp, et al., 1980; Halverson 1982; Mishra, et al., 1985; Wilke, Petyon & Hungerford, 1987; Robottom, 1987c). Williams (1988), Chapter 36 of Agenda 21 The Rio Earth Summit 1992 entitled “Promoting Education, public awareness and training” addresses the importance of “pre-service and in-service programmes of teacher training” (UNESCO p.39) provides a mandate for teacher education.

Warren (1988), Law (1993) and Finlay (1996) have modelled the process of experiential learning in classes that were either being exposed to the theory of experiential learning or the “enterprise skills” (Finlay, 1996) required for student-centred learning. Warren introduced her programme to students at Hampshire College “because many students expressed a desire to use experiential learning in their future teaching careers” (1988, p.4). Warren’s experience was based on using experiential learning techniques as ‘a model for teaching experiential education theory’, with the idea being to establish a student-directed classroom in which students were empowered to have ownership of their own learning. In this setting students determined “the syllabus, prioritized topic areas, regulated class members’ commitment, facilitate actual class sessions undertake individual or group inspired projects and engage in on-going evaluation” (Warren, 1988, p.4).
5.5 TEACHER TRAINING IN EE: NEED AND PRIORITIES

The academic and professional training of teachers has a direct and positive bearing on the quality of their performance and consequently on the achievement of students. Specific factors such as the years of teacher training, the teachers’ verbal fluency, subject matter knowledge, having books and materials of knowledge and knowing how to use them, teacher expectations of pupil performance, time spent in classroom preparation and frequent monitoring of student progress are known to effect student achievement. Teacher education can make a difference to student achievement, depending on the type of programme and support that put in place.

A teacher willing to develop a real EE, building knowledge and environment friendly habits in his/her students need:

1. Theoretical and Methodological Frame
2. Awareness/Sensitivity towards environmental related social issues.
3. Reflective Practices
4. Science based Knowledge
5. Commitment

Through EE students should perceive environment as a very complex system, inside which biological, physical, chemical, human events occur. EE should stimulate sensitivity, develop awareness and build suitable attitudes towards environment. Students should be guided in acquiring and re-organizing information should be solicited to form and freely express their own opinion as well as they should have some chances to observe and/or consider and reflect about consequences of the human impact on nature.
At the secondary level, students learn the links between their life styles and components of the environment, they are more capable of explaining the cause and effect relationships, learn to function as a member of a group and begin to understand social responsibility and thus desirous of becoming involved in decision making. The emphasis of EE therefore, is to develop environment friendly persons at an early age so that they bring these habits and model the positive values as they mature and become environment citizens. When they become adult and/or professionals, they can practice and/or influence decision making in their area of work towards sustainable production and environmental protection.

In the proceedings of the Thassaloniki International Conference, UNESCO and Govt. of Greece (1998, Athens), it highlighted that, “only an appropriate, lifelong education can teach respect for the environment and at the same time guide the students in how to survive and develop without jeopardizing the future of their own”. The goal of any teacher education programme or effort thus, should be to develop competencies in environmental education. These competencies take from knowledge, responsible behaviours, sensitivity towards environment and environmental issues and skills, commitment, which are necessary to effectively incorporate the environmental dimensions in educational programme.

A key function of EE in the attainment of sustainability is to develop responsible citizens who have appropriate knowledge and skills. To this end, the challenge for education in general and teacher education in particular is to translate such EE objectives into instruction reality. They include instruction in terms of issue bases and or problem based experiential oriented learning strategies. It is obvious that the objectives focus on environmental behaviour. Most
environmental psychologists and educators have identified in their studies that EE is closely linked to environmental responsible behaviour.

The Environmental Responsible Behaviour model proposed by Hungerford and Volk (1997) has three different levels variables, viz., entry level variables, ownership level variables and empowerment level variables.

**Entry-Level Variables**: Entry-level variables are good predictors of behaviour or ones that appear to be related to responsible citizenship behaviour. These appear to be prerequisite variables or, at the very least variables that would enhance a person’s decision making, once an action is undertaken.

**Ownership Variables**: These variables are those that make environmental issues very personal. The individual “owns” issues, i.e., the issues are extremely important, at a personal level, to him/her. Much of what we know about “ownership” is inferred from a variety of studies. Ownership variables appear to be critical to responsible behaviour.

**Empowerment Variables**: These variables are crucial in the training of environment responsible citizenship in the environmental dimension. These variables give human beings a sense that they can make changes and help resolve important environment issues. “Empowerment” seems to be cornerstone of training in environmental education. Unfortunately, it is a step that is often neglected in educational practices.

### 5.6 NEED AND SIGNIFICANCE OF THE STUDY

EE as a discipline of national and international importance finds its crucial role at the levels of education. Contemporary discourses advocates for the reorientation of EE towards action skills and action competencies of the
individuals. It is hoped that the learners’ interest in EE topics would be encouraged through learning that involves hands-on and minds-on activities. As learners belong to communities, it is assumed that the larger community would eventually benefit from learners’ knowledge, attitude and awareness.

According to Curriculum Framework for Teacher Education (2006, NCERT and NCTE), teachers would have to play the pivotal role in the total transaction of the EE curriculum. Consciousness about environment, conceptual capacity about environmental issues attitudinal transformation and the practical ability to guide students would be principal requirement of EE teachers at all levels of schooling. They are already familiar with certain routine transactional strategies in a formal, year-end examination set up.

Effective integration of EE into school programme is therefore a dynamic step towards improving teaching learning. To make the integration of EE effective, teachers of different subject areas must be conscious of the emphasis of their own disciplines and the knowledge and the skills they want students to acquire at different grades to reduce overlapping or over repeating concepts to the point of being redundant.

“Instructional materials on different environment problems/issues are available, but in limited circulation. Oftentimes, critics question the accuracy and bias of information received by the young people about environmental issues. Given the scarcity of EE related textbooks and support materials, children and the community get information (often sensationalized) from inaccurate sources” (Merle Tan, 2004).
Young learners should learn in depth exercise skills related to inquiry, decision making and problem solving. The learning process must provide them with the experiences that are real and meaningful to them.

Without understanding how knowledge is generated and developed by learners, educators cannot adequately deliberate with them on complex issues, such as the socio-cultural and economic dimensions of environmental issues. During the learning process, mental processes take place on both the part of the deliverer and the receiver. These processes constitute the framework of constructivist theory of learning (Constructivism) that has its main principles that building of knowledge by the learners and thus, their active involvement in the teaching and learning process. Constructivism is a theory that interprets learning processes that are based on the “construction of knowledge” by the learners themselves.

Research has revealed that students following an environmental course or programme based on the principles of Constructivism had the better understanding of the concepts covered by the topics of the course or programme than did students in the traditional teacher centred group. Students’ involvement in their-own cognitive procedure and critical thinking are crucial elements for both EE and Constructivism. Meaningful EE is envisioned as a teaching and learning approach with interdisciplinary, critical thinking, problem solving and decision makes orientations leading to the capacity to transfer beyond the specificity of each and every subject discipline.

Constructivism provides the context for the interpretation of the ways by which students learn and perceive the “new messages and ideas” thus being an
essential means for the educators and not an end in itself. Therefore it is important for educators to be aware of and practice such methods, as they would be very useful and effective in-order to achieve the educational objectives of the lesson, activity etc.

Seeking to educate for environment and sustainable development requires educators to inspire and encourage a commitment to the values of social justice and equity, peace and ecological integrity, democracy and respect to nature, promoting the adoption of new lifestyles and living patterns. Educators should create a realistic hope in which the probability of change and the real desire for change are accompanied by concrete and active participation. In order to attain this, experience based learning strategies will be the comprehensive tool. Experiential Education is that education which is structured in a way that allows the learner to explore the phenomenon under study- to form a direct relationship with the subject matter. As stated earlier in Kolb’s model, it requires that the learners play an active role in the experience and that experience is followed by reflection as the method for processing, understanding and making sense of it. Experiential education, most generally occurs in different kind of programmes that have as their goals as the construction of knowledge, skills and disposition from direct experience.

In India, environmental issues attracted popular attention and it was felt that education has to respond appropriately to this crying need of the hour. It has been felt that, although a fair amount of information about environment is being given through the textbooks, it has not reached to generate a concern that may lead to effective action for conserving and further improving the environment. In such
a field of global concern, it may not be half so important to know as to feel and be motivated to act. Therefore, the further course of study in EE should emphasize the emotional and attitudinal aspects to the learners’ personality along with the cognitive component most of, which is available in different subject textbooks, anyway. Thus it is argued that a value based action oriented course of EE would lead from knowledge to feeling and finally to appropriate action. This alone would bridge the wide gulf between the avowed intent and the actual implementation of the programme that concerns the present and the future of the entire humanity on the earth. This observation gives a strong input to the researcher to undertake this particular study. The process and strategies suggested would help to develop positive attitudes, responsible behaviours, sensitivity, knowledge and performance competencies, social values, and strong concerns for sustainable development and further improvement of the environment among student teachers.

Teaching is not a technical business in general and teaching environmental education in particular. The personal and professional commitment makes any teaching endeavour more meaningful and productive. The nature of the environmental education itself stresses the importance of commitment from the side of the teacher in order to involve him/her self and make students to involve in the environmental related actions.

Teacher education would urgently need an overall review for all strategies of schooling with a sharper focus on the sensitization and awareness building about the environment and the issues related to it and on the acquisition of competencies for organizing the transaction of EE in consonance with the learners’ requirement. Any environmental education work aiming to stimulate
sensitiveness, consciousness and appropriate action or activities requires cooperation of students and development of their criticism.

EE is meaningful if it takes place in real life and is geared towards understanding and solving real life problems. Practical activities and first hand experiences are essential for creating their understandings. But most of the schools neither geared towards this or the teachers. So the teachers have to find out innovative ways to create such opportunities through experiential learning. Thus the present study focuses on the student teachers to equip them with the experiential based training package in EE. In order to confirm the meaningfulness of the package, its effect over the environmental knowledge, responsible behaviour and commitment of the student teachers is being studied after the implementation of the package.

EE as a tool for empowerment, changes the mindset and attitudes and lead towards sustainable development, the researcher do strongly feels that the critical pedagogy and experiential learning strategies in EE which are issue oriented will be a gentle leap towards strengthening the EE initiatives in teacher education.

5.7 STATEMENT OF THE PROBLEM

Educators need to be capacitated to implement active learning with the “environment as a topic”. There are, however, a number of questions in terms of educators’ preparedness to integrate EE into all of the Learning Areas, including the question: Are all educators aware that EE should be integrated into all learning areas? Palmer and Neal (1995) have argued that the successful implementation of EE programmes relates to the educators’ subject knowledge, enthusiasm, awareness and dedication to their tasks. A crucial question is whether educators
teach EE in an integrated approach. For instance, can educators identify environmental topics and relate these to their teaching? One wonders if all educators are aware that they need to design learning programmes that address local environmental issues so that the learners can be in a position to solve global environmental issues. One has to act locally, but think globally because the world has shrunk to such an extent that there are missing bits due to development in technology, that unsuitable activities in one part of the world eventually impacts negatively on other parts of the world. With this background the investigator had decided to conduct a study on the effectiveness of an experience based approach to environmental education on environmental knowledge and environmental responsible behaviour of student teachers at secondary teacher education. Thus the present study entitled as, “A Study on the Effectiveness of an Experience Based Approach to Environmental Education for Secondary Teacher Education”. It was intended to study the effectiveness on the basis of environmental responsible behaviour and the environmental knowledge of the student teachers at the secondary level. The environmental responsible behaviour model suggested by Hungerford and Volk has been adapted with the three level variables was adopted as well as the student teachers’ Environmental Knowledge

5.8 OPERATIONAL DEFINITIONS

Experience: The term ‘experience’ is associated with the raw knowledge or skills gained from life by personal (initial) contact with facts and events. Experience implies that there is recognition (at an affective level) that ‘something’ has been gained as a result of personal contact which forms the basis of developing a consciousness or understanding of ideas, neither of which may in turn be understood as a theory.
In this study it is conceived as the process by which a learner creates meaning from direct experience. It refers to the processes that a learner undergoes. It gives a personal framework for developing and understanding proportional knowledge and practical knowledge.

**Experience Based Approach:** In the present study, it is conceived as the teaching learning experiences realigning to provide experiences to the learners to reflect, brainstorm and generalize/conclude.

**Environmental Education:** It is the process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems and it aims at the knowledge, attitudes, commitment and skills to work individually and collectively towards the current problems and preventing the new ones.

**Environmental Knowledge:** The present study considers the environmental knowledge as the knowledge of basic ecology, knowledge about the environment, environmental issues.

**Environmental Responsible Behaviours:** The present study adopted the model proposed by Hungerford and Volk (1997) for environmental responsible behaviour. The model consists of three different level variables such as entry level, ownership level and empowerment level. The investigator considered environmental responsible behaviour including the knowledge of ecology, environment and environmental issues, knowledge of consequences of behaviours, both positive and negative and knowledge of and skills in using environmental action strategies.
5.9 OBJECTIVES OF THE STUDY

The following objectives were formulated for the present study.

1. To analyze the existing B.Ed. curriculum in Environmental Education prescribed by Calicut University in order to select key contents. To develop an issue based teaching learning strategies by reframing the key content in order to transact through an experience based approach.

2. To develop an experience based approach to Environmental Education to transact with the student teachers at secondary level.

3. To study the effectiveness of experience based approach in EE for the secondary teacher education level on certain student teacher related variables namely:

   3.1 The environmental knowledge

   3.2 The environmental responsible behaviour

5.10 HYPOTHESES OF THE STUDY

Based on the above objectives, the following hypotheses were formulated.

1. There is a significant difference between post-test performance of student teachers belonging to experimental and control groups on environmental knowledge.

2. There is a significant difference in the gain scores of student teachers belonging to experimental and control groups on environmental knowledge.

3. There is a significant difference in the pre-test and post-test performance of student teachers belonging to experimental group on environmental knowledge.
4. There is a significant difference in the post-test performance of student teachers belonging to experimental and control groups in the environmental knowledge when the pre-test performance was taken as covariate.

5. There is a significant difference between post-test performance of student teachers belonging to experimental and control groups on environmental responsible behaviour.

6. There is a significant difference in the gain scores of student teachers belonging to experimental and control groups on environmental responsible behaviour.

7. There is a significant difference in the pre-test and post-test performance of student teachers belonging to experimental group on environmental responsible behaviour.

8. There is a significant difference between post-test performance of student teachers belonging to experimental and control groups on environmental responsible behaviour when the pre-test score was taken as covariate.

9. There is a significant difference between the pre-test and post-test performance of student teachers belonging to experimental and control groups in the environmental responsible behaviour componentwise.

5.11 VARIABLES USED IN THE STUDY

Independent Variable: Experience based approach to Environmental Education

Dependent Variables: Student teachers’

1. Environmental Knowledge

2. Environmental Responsible Behaviour
5.11.1 Independent Variable

An independent variable is the variable that has been manipulated. In this experimental study approach to teaching has been considered as manipulated to find out what kind of effect it can produce on dependent variables. Unlike a true experiment which is done on inanimate objects (independent variable is under the control of investigator) where it is able to measure, but in subjects of Education, measuring of independent variables becomes less accurate. In this study experience based approach to environmental education was taken as independent variable.

5.11.2 Dependent Variables

A dependent variable is the measured or observed variable. By observing the dependent variable the effect of the independent variable can be seen. It is to be tested whether the independent variable critical pedagogical approach in teaching social studies would have an effect on environmental knowledge and environmental responsible behaviour of student teachers. These dependent variables were observed and measured to determine whether the independent variables had any effect.

5.11.3 Intervening Controlled Variables

Control variable is a variable that has the potential to impact the dependent variable as well as the independent variable but its effects are removed or controlled by research design or statistical manipulation. The variables that were controlled for the experiment to get homogeneous groups were: classes chosen for the experimental treatment, contents selected, and features of the training college and size of the sample. For the statistical analysis the pre-test scores were used as covariance to control their effects on the outcome.
5.11.4 Intervening Uncontrolled Variables

Variables that have an unpredictable or unexpected impact on the dependent variable were unable to control. Some of these variables are fatigue, absence of some student teachers during experiment, motivation, anxiety, interest of the students, socio-economic status, family environment, previous exposure to teaching strategies, present teaching in other subjects, physical resources of the students, education of parents, study habits, academic ability in the subjects, teacher competence in a particular treatment, enthusiasm and others. These variables remained uncontrolled during the experiment.

5.11.5 Situational Variables

Situational variables like time, duration of treatment, type of management, subjects to be taught etc., were controlled administratively and through selection of sample and equating the time interval.

5.12 DESIGN OF THE STUDY

The present investigation was carried out to study the effectiveness of experience based approach to environmental education at secondary teacher education. The design adopted in the study was quasi-experimental, which is different from true experimental designs in two ways; Firstly, the participants are not randomly selected from the specific population and secondly, the participants are not randomly assigned to experiment and control groups. Nevertheless, Quasi-experimental designs provide a relatively high degree of experimental control in natural settings and it clearly represent a set-up from pre experimental designs because they enable the researchers to compare the performance of the experimental group with that of a control group. In other words, quasi-
experimental designs enable researchers to move their experimentation out of the laboratory and into a natural setting or context (Martella, 1999). “Often in educational research, it is simply not possible for investigation to undertake true experiments …” (Cohen, 2007, p. 282). Quasi-experimental design is applied to much educational research where the random assignment of schools and classroom is quite impracticable (Kerlinger, 1970).

Non-randomised experimental-control group design was employed for the present study, which is similar to the pre- post-test control group design except for absence of random selection of the participants from a population and the random assignment of participants to groups. This design is similar to the static group comparison design except that both groups are given a pre-test, which can be used to determine whether two groups are equivalent, even though they have not been formed by random assignment. This design is represented by following diagram:

```
Experimental  O   X   O
Control       O   O
```

Here, X represents experimental treatment, O represents the pre-test or post-test measurement of dependent variable and broken line indicates that the experimental and control groups are not randomly formed (Campbell & Stanley, 1963).

Through the analysis of the pre-test data, it could be seen that both experimental and control groups are equal in their pre-test performances.

This design was found to be appropriate in the present study in order to examine the effectiveness of experience based environmental education at the secondary teacher education in the natural setting without disturbing classroom climate by either controlling or manipulating the variables.
5.13 SAMPLING PROCEDURE

The major population of the study consisted of student teachers of Kerala state. The sub population of student teachers who opted for science was under consideration in the present study. Purposive sampling technique also known as judgment sampling was used wherein the unit of sample is selected at the discretion of the researcher, wherein he/she may exercise his/her own judgment based on experience or expert judgment (Kalton, 1983) for including a given student in the sample. Such a sample is arbitrarily selected because there is good evidence that it is a representative of the total population (Kaul, 1984). “Where matching is not possible, the researcher is advised to use samples from the same population or samples that are as alike as possible” (Kerlinger, 1970). The class as a whole in its natural settings was considered for implementing the study. The sample was drawn from the intact group from NSS Training College, Ottapalam, Kerala and from Ideal Training College, Cherpulasserry, Kerala as experimental and control group respectively.

5.14 SAMPLE OF THE STUDY

The intact groups of 62 student teachers in experimental and 60 student teachers in control group were initially taken for the study. Later 2 students from experimental group were eliminated from the sample due to their absence in the pre or post-test. Finally the sample comprised of 120 student teachers including both experimental and control group. The sample included 34 males and 86 females in total.
5.15 INSTRUMENTS USED FOR THE STUDY

Two instruments were used to gather data for this study: (i) Environmental Responsible Behaviour Test, and (ii) Environmental knowledge Test. Both the instruments were designed and standardized by the investigator.

5.15.1 Environmental Knowledge Test

To test the pre and post environmental knowledge of student teachers of experimental and control group an environmental knowledge test was developed by the investigator. The knowledge of ecology, environment and environmental issues were the components of the instrument. Appropriate weightages were given to cognitive process dimensions, content and the types of questions. The assessment was objective based and the test planned included only multiple choice items. The test consisting of 70 questions was given to experts from Environmental Science and Environmental Education background. They scrutinized and studied the items of the test in terms of their sampling individual units and ensuring coverage of cognitive process comprising of Remembering, Understanding, Applying and Analyzing. On the basis of their suggestions, appropriate modifications were made and a total number of 70 items were selected for the Environmental Knowledge test for try out. Twenty questions were deleted from the test as a result of item analysis.

The items, objectives and areas from which the items are selected were given to the experts for scrutiny. As per the feedbacks of the experts, it was found that the test contents cover the significant concepts as well as comprehensive enough in terms of cognitive process dimensions. Thus the content validity of the Content Environment Knowledge Test was established. The data were analyzed
using SPSS (Version 17.0) and the reliability coefficient was found out. The reliability coefficient obtained for the Environment Knowledge Test was 0.789. The value indicates that the test is reliable. The final form of the Environment Knowledge Test consisted of 50 items for a total score of 50.

5.15.2 Environmental Responsible Behaviour (ERB) Test

The researcher adapted Environmental Responsible behaviour model proposed by Hungerford and Volk (1997). According to the model, there are three level such as Entry level, Ownership level and Empowerment level. The researcher had taken the three levels and prepared the test items in a five point Likert scale. Based on the expert opinion as well as the primary try out, the number of items from the item pool condensed to 92. There were 30 items each in entry level and ownership level and 32 items in empowerment level. After the item analysis, there were 62 items in the final form. The reliability coefficient (Cronbach’s Alpha) obtained for the ERB Test was 0.735. The value indicates that the test is reliable.

5.16 PROCEDURAL DETAILS OF THE STUDY

The study was carried out in five phases.

5.16.1 Phase 1: Analysis of Curriculum and Preparation of Issue Based Syllabus

Curriculum on Environmental Education for B.Ed. level at Calicut University was analyzed with a focus on the environmental education syllabus at the secondary school level. It is important that students, teachers and the general public be informed of environmental issues on a deeper level to effectively participate in sound decision making regarding these issues. The investigator had
not gone for one to one reframing of the syllabus content to issue based one, but taken care to integrate as much points as possible with issues, also the scope for student teachers to discover skills, such that the syllabus becomes enriched in a collaborative manner.

5.16.2 Phase 2: Development of the Tools and Experiential Based Transactional Materials

The environmental knowledge components were identified as the basic knowledge in Ecology, Environment and Environmental Issues. The experience based approach to environmental education material contains the objectives, content, scenarios and reflective questions. The present material uses scenarios from environmental issues, which unfolds the discussions and reflections. By presenting the scenarios, the student teachers can brainstorm, discuss and even they can connect their own similar situations/experiences, which leads them for fully improvisational performances. The investigator had given scope for the pedagogical and andragogical experiences. The whole material was divided into two sections, ‘section A’ containing the conceptual part (in order to equip the student teachers with the concepts of environmental education, experiential learning and environmental issues, which direct their involvement in the issue based learning process) and ‘section B’ was containing scenarios of environmental issues. The scenarios were followed by the reflection and action questions. The scenarios presented were in the form of news items, case studies, pictures related to environmental issues. The rationale for selecting the scenario was to initiate the discussion which leads to reflection and conceptualization. After the preparation of the materials, the lesson scripts were designed.
Lesson plans were designed for each selected modules in which the experience based learning approach was applied. There were many formats of a lesson preparation and transaction in the experiential learning approach. Based on the discussion with experts, the researcher arrived at a format for the lesson plan and class room process. The content in the lessons were organized based on the background knowledge and experience of the students following the principles of experiential learning. 16 lesson plans were prepared from the selected modules. Each lesson plan were planned for one hour duration. The activities were extended to even two hours because of the active involvement of the student teachers in the learning process. Each lesson plan contains learning objectives, materials/resources, introduction, exploration, sharing, processing, generalizations/conclusions/application and assessment.

5.16.3 Development of Instruments for Data Collection

Two instruments such as environmental knowledge test and environmental responsible behaviour test were developed and standardized by the investigator. The details were given in the earlier section.

5.16.4 Phase 3: Administration of Pre-tests

The tools were administered as pre-test for measuring Environmental Knowledge and Environmental Responsible Behaviour. The tests were administered to the student teachers belonging to the experimental and control group. After administering the above said tests, they were scored on all the above said variables which served as the pre-test scores of the sample students on the respective criterion measures. Both the tools were administered separately in both the groups to avoid fatigue.
5.16.5 Phase 4: Experimental Treatment

The student teachers of NSS Training College were selected as the experimental group and student teachers from Ideal Training College was taken as control group. The investigator transacted the lessons using experience based approach to environmental education to the student teachers of experimental group. The researcher maintained a diary where the daily observations of classroom interactions were recorded. The classes were taken in the regular periods of the college. Sixteen lesson plans in Environmental Education were prepared for forty instructional hours with the time duration of 1 hour. The experimental treatment lasted for one and half months excluding vacation and all other holidays.

In the control group, the regular teacher educator taught the student teachers and covered the selected units approximately using the same number of periods. The teacher of the control group was consulted regarding the duration required for teaching the selected units, mode of teaching and the assessment that followed in the control group. The teacher educator of control group was known as a competent teacher in the college. The experimenter bias was avoided by involving the regular teacher educator in teaching the control group students.

In the experimental group, the investigator created such an environment in the classroom that the students were able to critically/creatively construct the knowledge related to the given concepts and themes/issue by doing various activities like discussion, group and individual work, brain storming, community participation, cooperative learning etc, in which already known experiences and knowledge played a significant role to transform in to a new one. The student
teachers were exposed to the environmental issues and got opportunities to reflect on the experiences, conclude and recognize action skills. The role of the investigator was to guide and facilitate and critically reflect their learning efforts whenever found necessary.

5.16.6 Phase 5: Administration of Post-tests

Soon after the experiment was completed, students were administered the post-tests for all the dependent variables – Environmental Knowledge test and ERB Test. These tests were administered to both experimental and control group.

5.17 STATISTICAL TECHNIQUES EMPLOYED

Various statistical techniques were used to analyze the data. Descriptive statistics was used to summarize the pre-test scores and post-test scores. They were inspected to determine if the sample showed deviation from normal distribution. Cronbach’s Alpha and Kuder Richardson’s Alpha were used to establish internal reliability of the tool. ‘t’ test and ANCOVA were employed to test the various hypotheses.

5.18 ANALYSIS OF DATA

The data collected were compiled, cleaned and coded and SPSS version 18.0 were used to analyze the data. The effectiveness of an experience based approach to environmental education for secondary teacher education was analyzed with its effectiveness on environmental knowledge and environmental responsible behaviour. It was also studied the difference in the environmental responsible behaviour of student teachers with respect to their level of environmental knowledge.
5.19 MAJOR FINDINGS OF THE STUDY

The major finding of the study has been categorized into 1) findings related to environmental knowledge and ii) Findings related to environmental responsible behaviour.

5.19.1 Findings Related to Environmental Knowledge of Student Teachers

1. There was a significant difference in the post-test performance of student teachers belonging to experiential and control group on environmental knowledge, with a significant ‘t’ value 14.52 (at 0.01 level of significance). The student teachers in the experimental group had a high mean score, 35.87 than that of control group with 27.43.

2. There was a significant different in gain scores of student teachers belonging to experimental and control group on environmental knowledge with a significant t-value 13.34 (at 0.01 level of significance). The student teachers of the experimental group had high gain mean score 11.80 than that of control group with 4.18.

3. There was a significant difference in the pre and post-test performances of student teachers belonging to experimental group on environmental knowledge with a significant t-value 23.86 (at 0.01 level of significance). The student teachers in the experimental group scored high in post-test performance with a mean score 35.87, than that in the pre-test performance with 24.07.

4. There was a significant difference in the post-test performance of student teachers belonging to experimental and control group on environmental knowledge when the pre-test performance was taken as covariate, with a significant F-value 1039.56 (at 0.01 level of significance).
5. The adjusted mean in environmental knowledge of student teachers belonging to experimental group, 35.66 was significant with a t-value 23.59 (at 0.01 level) with that of the control group with a an adjusted mean 27.64.

5.19.2 Findings Related to Environmental Responsible Behaviour

1. There was a significant difference in the post-test performance of student teachers belonging to experimental and control group on environmental responsible behaviour with a significant t-value 28.26 (at 0.01 level). The student teachers of experimental group had a higher mean score, 248.52 than that of control group with 205.57.

2. There was a significant difference in the gain scores of student teachers belonging to experimental and control group on environmental responsible behaviour with a significant t-value 45.46 (at 0.01 level). The student teachers of experimental group had a higher mean score, 64.05, than that of control group with 22.42.

3. There was a significant difference in the pre and post-test performances of student teachers belonging to experimental group on environmental responsible behaviour with a significant t-value 27.26 (at 0.10 level). The experimental group had a high mean environmental responsible behaviour of 248.52 in post-test than that in the pre-test with 184.47.

4. There was a significant difference in the post-test performance of pre service teachers belonging to experimental and control group on environmental responsible behaviour, when the pre-test performance was taken as covariate, with a significant F-value, 838.44 (at 0.01 level).
5. The adjusted mean score, 248.21 of experimental group was significantly higher, with a t-value 26.11 (at 0.01 level), than that adjusted mean score of control group with 205.88.

6. There was a significant difference in the pre and post-test performance of pre-service teachers on environmental responsible behaviour component wise, with a significant t-value of 50.05 for entry level component; with a significant t-value of 71.50 for ownership level component; with a significant t-value of 34.24 for empowerment level component.

5.20 IMPLICATIONS OF THE STUDY

Through the present study it could be found that environmental knowledge and environmental responsible behaviour improved positively through an experience based approach to environmental education. This improvement in the experimental group who was taught environmental education through issue oriented experience based approach indicated the fact that, if opportunities are given to student teachers to analyze environmental issues, reflect, critically analyze and negotiate, their environmental knowledge and environmental responsible behaviour could be improved positively. This implies for the curriculum planners about the need for restructuring the existing B.Ed. curriculum in environmental education.

The existing B.Ed. curriculum in environmental education was for 15 hours duration. During the study the investigator transacted for forty hours, which could bring significant positive changes in the selected dependent variables in the experimental group than the control group. This indicated that, the time allocated is too little in the existing curriculum in order to bring about necessary awareness,
attitudinal and behaviour changes. Since the selected dependent variables are of much importance in the contemporary nature of environmental education, it implies that there is a need for either increase the time allotment or to consider offering environmental education as an optional education paper.

While analyzing the existing B.Ed. curriculum, it could be seen that vital components of educational importance like value education, sex education, physical education were the part of the paper, where environmental education was included. But all these components focused on mere coverage of conceptual knowledge that too, superfluously creating an insight into the concerns which lead to action skills of the student teachers.

The significant mean scores in environmental knowledge and environmental responsible behaviour of student teachers of experimental group than the control group implies the need for using experience based approach in teaching environmental education.

The active participation of student teachers in the issue analysis and devising action strategies during the experimental intervention also stressed the importance of this. Maximizing the opportunities for student teachers to involve in the curricular transaction assures taking ownership by them. This implies the need of strengthening the training programmes for teacher educators in this line. The student teachers need to be addressed using the andragogical principles rather than the pedagogical principles.

The need for restructuring the existing assessment patterns is also an implication of the present study. Continuous observation and a collaborative approach is needed in the assessment strategies. This will strengthen the whole
training programme with action skill development of the student teachers to equip them as a competent environmental education teacher.

5.21 SUGGESTIONS FOR FURTHER RESEARCH

1. Similar study can be undertaken at D.Ed., BSc.Ed. and M.Ed. levels in order to study the effectiveness of an experience based approach to environmental education.

2. The predictors of environmental responsible behaviour can be studied further through experience based approach to environmental education.

3. Similar study can be taken to study the relationship between environmental awareness, environmental attitude and environmental responsible behaviour of student teachers.

4. A survey can be taken to study the environmental responsible behaviour of teacher educators and student teachers.

5. A correlational study can be taken to study the environmental knowledge and environmental responsible behaviour of student teachers.

6. A study can be taken on the effectiveness of experience based approach to environmental education of other subject group student teachers.

5.22 DELIMITATIONS OF THE STUDY

The present study had the following delimitations:

1. The study was confined to Palakkad District.

2. The study was confined to the student teachers who opted science subjects.

3. The three levels of environmental responsible behaviour were taken as composite components.

4. Only two variables such as environmental knowledge and environmental responsible behaviour were studied.