V SUMMARY AND CONCLUSION

5.1. INTRODUCTION

This century will be facing continued global population growth, technical advancement, and subsequent burdens on the natural world due to consumer demands. A citizenry capable of understanding the complexity of environmental issues, and involving themselves in voluntary participation to improve environmental quality is the need of the hour. Effective environmental education alone can produce such a generation. This investigation was aimed at identifying appropriate strategies of environmental education at secondary school level to maximise learning outcomes and produce an enlightened and active citizenry. The design of the study, main findings, recommendations for enhancing the learning process of environmental education, and suggestions for further research studies are discussed in this chapter.

5.2. DESIGN OF THE STUDY

Pupils from standard VIII of Tamil Nadu State Board schools were taught with three types of instructional materials prepared by the investigator and also with fourth conventional method. The independent variables taken into account were attribute variables (type of school, locality, gender and medium of instruction) and treatment variables (activity, multimedia, visual aids and conventional strategies). Pre test, treatment and post test sequence was followed. Tools to measure achievement and attitude were employed.

Comparison between initial (pre – test) and final (post – test) scores was computed with the help of paired t – test and significant differences found between the two scores. In order to find out if there was significant differences in the initial scores, t – test was employed for attribute variables and ANOVA for treatment variables. Then ANOCOVA (interaction analysis) technique was applied on the final scores, the influence of the covariate (initial score) was removed and adjusted means of final scores were obtained. Scheffe’s F – test was employed on adjusted means of final scores to find out pairs of groups which had significant differences.
The above sequence of analysis was done on the total achievement scores, split up achievement scores in the four content areas - noosphere, biosphere, pollution and natural resources and the attitude scores.

5.3. SUMMARY OF THE FINDINGS

i. The comparative analysis on the initial and final achievement scores revealed that all the four strategies employed had greatly influenced the performance of the pupils.

ii. The analysis of adjusted mean scores final in achievement showed that pupils from government schools, rural areas, boys and those with Tamil as medium of instruction were greatly influenced by activity strategy followed by the sequence of multimedia, visual aids and conventional strategy while their counterparts were also greatly influenced by activity strategy but followed by visual aids, multimedia and conventional strategy sequence.

iii. Comparison between initial and final noosphere scores identified that the conventional activity and multimedia strategies employed had greatly influenced the final achievement of the pupils but visual aids could exert significant influence only on government schools, urban schools and pupils with English as the medium of instruction. The impact of visual aids strategy was not significant on private schools, rural students, boys, girls and students with Tamil as medium of instruction.

iv. In the analysis of adjusted final mean scores in noosphere, it was evident that only government schools were greatly influenced by multimedia strategy followed by activity, conventional and visual aids strategies. On the other hand activity strategy had the greatest influence on private, urban and rural schools, boys, girls and pupils from both Tamil and English medium followed by multimedia, conventional and visual aids strategies in sequence.

v. The comparison between initial and final scores showed that all the four strategies employed had greatly influenced the final achievement of pupils in biosphere area.
vi. Application of ANOCOVA technique followed by Scheffe’s F test on adjusted means of biosphere scores-final indicated that pupils from government and private schools, from urban and rural locality, boys, girls and those with Tamil as medium of instruction were highly influenced by activity strategy followed by visual aids, and conventional and multimedia strategy in sequence. Pupils with English as medium of instruction, also exhibited the highest influence of activity method but followed by visual aids, multimedia and conventional strategy in sequence.

vii. The comparison between initial and final pollution scores showed that all the four strategies had significantly high influence on the performance of pupils in pollution area of environmental education.

viii. The analysis of pollution scores employing ANOCOVA technique followed by Scheffe’s F test on adjusted means of pollution score-final reveal that on private, rural and Tamil medium pupils alone activity method had the highest impact followed by multimedia, visual aids and conventional methods, whereas for all other groups namely government, urban, boys, girls, and English medium pupils multimedia strategy was the most effective one followed by activity, visual aids and conventional strategies in learning about pollution.

ix. The comparative analysis between initial and final natural resources scores indicated that pupils treated with all the four strategies exhibited highly significant performance in final scores.

x. The analysis of adjusted means of natural resources score-final showed that the order of effectiveness of strategies was activity, visual aids, conventional, and multimedia strategy for pupils of all categories namely government, private, urban and rural schools, boys, girls and pupils from both Tamil and English medium.

xi. The comparative analysis between initial and final attitude scores showed that all the four strategies employed had greatly influenced the attitude towards environmental issues.

xii. Analysis of the adjusted mean scores of attitude-final by attribute and treatment variables revealed that for government, private and rural schools, girls and Tamil medium pupils activity strategy had
produced the highest impact followed by visual aids, multimedia and conventional strategy in sequence, and pupils from urban schools, boys and those with English as medium of instruction also find activity strategy highly effective but followed by visual aids, conventional and multimedia strategy.

A comparison of the above findings led to the conclusion that activity strategy was the first choice for learning about noosphere, biosphere and natural resources. The second choice for the above areas would be visual aids strategy. This finding might be attributed to the fact that the concept dealt under these topics are either in their neighbourhood like solid waste, sewage disposal, population explosion, ecosystems, water, and energy or about the issues they had come across in their life through television, news papers or during visits to nearby places. Activities and visual aids helped pupils in recollecting their personal experiences and view the same in different perspectives.

For learning about pollution multimedia was found to be the best choice according to the findings of this investigation which might be attributed to the reason that issues like the effects of air, water and soil pollution, global warming, ozone depletion, and biological magnification are beyond their daily life experiences and hence photographs and video clippings used in the multimedia helped them in visualizing those concepts. The second choice for learning about pollution was activity strategy.

These findings are in tune with the suggestions made by Pandya, M and Ragunathan, M (1999) that environmental education should ideally utilize diverse learning situations and a broad array of approaches.

From the comparison of overall performance of the pupils it was identified that activity strategy had greatly influenced both achievement and attitude level of the pupils in the learning process of environmental education.
5.4 RECOMMENDATIONS

As Martin (1982) puts it, the environmental movement was looking to environmental education to develop new modes of behaviour which would ultimately lead to new modes of human action so that science and technology could be used in the light of a new concept of mankind and his relationship to the world in which he lived.

Marcinkowski (2010) sketched the contemporary challenges like expansion of professional development opportunities growing in different directions, clarity of dynamic relationship between environmental education and education for sustainable development and that of climate change continue to mount. In addressing these challenges, we must continue to seek out and affirm the best of what was traditional and innovative as well as effective and adaptive within this field. In view of the above challenges and expectations the following recommendations are given:

5.4.1. CURRICULAR CHANGES

Gordon (1995) and Jackson (2001) had sketched an alternative new or ecological science paradigm because the basic assumptions underlying the current science paradigm were contradicted by the solutions to environmental problems that appear to be required. Education department should conduct periodical diagnosis of educational problems, and make changes in the curriculum. Incentives may be given to those teachers who attempt for innovation in teaching. The existing scheme of NCERT identifying talents in teachers needs to be popularised and strengthened at state level. The present study revealed that environmental knowledge as well as attitude improved significantly as a result of activity method for most of the areas of environmental education while multimedia methodology was effective for the study of pollution. If these findings are made known to practising teachers they can follow the same and also improve upon it to cater to the needs of their immediate environment.
5.4.2 CHANGES IN TEXT BOOK

Since a good textbook provides not only the contents but also determines the method of teaching, and in view of present educational scenario which is dominated by text book, it is essential that suitable changes should be made in the text books. As revealed in the study attitudinal change and achievement has direct correlation with the type of instruction. Hence text books should include plenty of activities to create interest in environmental education, develop a sense appreciation for environment, technical skills and scientific knowledge, train them in analysing their environment and develop the capacity for problem solving. Therefore text book writers must be oriented about the findings of studies related to environmental education so that they can incorporate the same at all levels of school education.

Revised textbooks from Tamil Nadu Textbook Society for standard six published in the year 2010 have incorporated Environmental Education concepts in Science, Tamil and English. The Science textbook deals with the classification of organisms in an innovative way associating organisms with their habitat and provides scope for keen observation and recording of what they observe around them. The lesson on our environment has plenty of pictures and offers scope for relevant activities.

The topic titled Our Environment deals with solid wastes, sewage and pollution. The concepts have been introduced in a thought-provoking manner followed by suitable activities, discussion sessions, think-and-answer type of evaluation and a fact-file. There is plenty of scope for developing a positive environmental attitude and behaviour among the students.

In the English textbook meant for standard six, an attempt has been made to open the doors to the world of nature through the letter written by Chief Seathl, the leader of a tribe from the north of America to the president of USA explaining why he could not sell his land. It is one of the most important letters ever written about natural resources and the need to teach our children that whatever happens to the earth will happen to all creatures that live on the earth. The beauty of the night had been evoked through a poem written by William Blake. A supplementary unit related to a Japanese folktale about
cranes has been included. Poetry-writing and story strips have been included in a creative manner. There is also a functional enrichment activity and a project. A strong framework has been built through learning about the beauty of the natural world and our fellow species through various relationships that man builds with them.

The Tamil textbook includes a lesson on birds, a supplementary reader on snakes and a life-skill development on a visit to the zoo. Colourful photographs of birds and innovative methods would certainly help to learn more about birds and bird sanctuaries of Tamil Nadu. The lessons on snakes and the zoo help to develop the right attitude towards animals and inspire the students to learn more about animals. The innovations taken up for the standard six textbooks signal a healthy start and could be extended to textbooks for other classes to ensure greater awareness on various facets of environment.

5.4.3 TAKING ADVANTAGE OF ICT

Focus Group on Habitat and Learning suggests that we use media as tools to augment the knowledge base on India's environment by getting students involved in generating knowledge. This calls for developing software to support EE project work of students through communicating proper methodologies of data collection, help validate identification of plant and animal species or of soil and rock types, and organise databases capable of accepting data from many sources.

5.4.4 THE SCHOOL HABITAT

The school must be a demonstration of the environmental values that the education system tries to convey. Whether the context is that of drinking water and sanitation facilities, paper, energy use, garbage management, composting, or greening, the school needs to exemplify good practices and needs to communicate these, through demonstration, not only to the students but also the community, (Focus Group on Habitat and Learning, 2005) and (Gislason, 2009). Teachers' Handbooks, reference books, proper Teaching Aids and separate Theory and Project rooms should be provided (Benitha Raphael, 2008), in schools.
5.4.5 PROJECTS, ACTIVITIES AND GENERATION OF KNOWLEDGE

As stated by Focus Group on Habitat and Learning, projects and activities must be the backbone of any scheme aimed at the effective implementation of EE in schools. In order to inculcate the desirable skills and competencies, it will be imperative to develop a basket of activities and projects that may vary in range in respect of their difficulty levels, coverage of skills and parameters of environment, as also the feasibility of carrying them out within the limitations of teacher competency, available resources and time.

Right now there is no proper agency or program at micro level to generate data or to monitor the status of environment. Gadgil suggests that it is important to generate new information. This can be used as a long term way of creating a good database on India’s environment. This suggestion was accepted as a part of NCERT curriculum framework in 2005. Subsequently it was put before the Central Advisory Board on Education, which also endorsed it, so in a sense, a formal attempt is being made to use student activities in the area of environment to generate knowledge resources.

5.4.6 ASSESSMENT AND EXAMINATIONS

It may be worthwhile to evolve a variety of assessment strategies for a given type of activity, and refine them through trying them out on a pilot basis to arrive at practical and feasible modes of assessment, as suggested by Focus Group on Habitat and Learning (2005). Evaluation system and examination should include oral, project as well as written examination, (Benitha Raphael, 2008).

5.4.7 TRAINING THE HEADS OF INSTITUTIONS

Administrative heads of schools must be motivated for implementing the findings of the study. The state education department through State Council of Educational Research and training may organise orientation courses to the head masters and principals of schools in order to familiarise them with many innovative educational strategies.
5.4.8 IN – SERVICE TRAINING TO SCHOOL TEACHERS

Extension service departments attached to colleges of education, and universities and also academic staff colleges need to give priority to organise in - service programs for school teachers. Teachers have positive attitude towards usage of multimedia but have poor operating capacity, (Kumar, 1998), (Mehra, 2007), and (Rajasekar, 2008). This program would enable the teachers to update themselves with the innovative strategies, multimedia usage and the latest research findings.

5.4.9 REVAMPING TEACHER EDUCATION CURRICULUM

Ravindranath (1996) visualises the role of District Institutes of Education and Training (DIET) in planning, organising and implementing a comprehensive program of environmental education at the district level. He further cautions that the salutary efforts made by different agencies will not be sustained unless these are accompanied by appropriate curricula and teacher training.

Education for sustainable development calls for a shift from “teaching” to “learning” (Sarabai 2005), from transmission to transaction or even transformation. In this context, the role of teacher educator becomes one of creating one of appropriate learning opportunities through environmental education for teacher trainees (Ravindranath,2007) to actively engage in enquiry, exploration, questioning, and critical thinking in making informed choices and decisions on environmental and developmental matters, which they can subsequently adopt in their school teaching.

The results of this study and similar studies carried on in India and abroad may be discussed with teacher educators and experts so that appropriate changes can be made in the teacher education curriculum. Multimedia teaching and activity based teaching must be made compulsory so that student teachers develop right attitude and skill in these innovative technologies before they take up teaching profession.
5.4.10 CREATING AWARENESS AMONG PARENTS ABOUT INNOVATIVE METHODS

The role of parents in the learning process is very important. Most of the parents have no idea about the methods of teaching followed in schools and they are result oriented. Institutions must organise programs to create awareness about innovative techniques which would be of great help to them in guiding their children. Parent Teacher Associations can play a vital role in this regard.

5.5 SUGGESTIONS FOR FURTHER RESEARCH

Potter (2010) suggests that now may be the time to consider new environmental education legislation that is more systemic in nature and that provides substantive increases in funding for national level grants, educator training, and research initiatives. The author also suggests broadening the scope of strategic level conversations to include sectors beyond the education community.

Short (2010) points out that to date, nearly all researches on environmental education have focused on educational outcomes. Evaluations of impacts to environmental quality linked to actions resulting from environmental education efforts will be necessary if this discipline is to remain relevant in the world facing a century of great challenge in protecting environmental integrity while meeting the needs of our growing and increasingly consumptive population.

Rickenson (2001) is of the opinion that future researches should shed light on students’ educational experiences and preferences and about the learning process in environmental education.

Researches to understand the emotional engagement in prompting pro-environmental behaviour is the need of the day. Maiteny (2002) reiterates the need to record experiences that have prompted individuals to reduce environmental impact of their life styles through attitudinal change and find out how these experiences relate to their wider beliefs, meanings and convictions.
The question of what shapes pro-environmental behaviour is such a complex issue that it cannot be visualised through a single framework or a diagram and hence, Kallmuss (2002) outlines the need to analyse the demographic factors, external factors (e.g. institutional, economic, social and cultural) and internal factors (motivation, pro-environmental knowledge, awareness, values, attitudes, emotion, locus of control, responsibilities and priorities) that have been found to have some influence, positive or negative on pro-environmental behaviour.

**Suggested Topics are**

- Comparative study of preferences of teachers and students towards the use of activity, multimedia and visual aids strategies in environmental education.
- Analysis of learning environmental education through outdoor activities.
- Study on development of creative skills, scientific attitude, achievement, motivation, stewardship through activity method in environmental education.
- A study on environmentalists: What experiences in teen-age shaped their pro-environmental behaviour?
- Learning environmental education: The role of non-governmental organizations in the city.
- Study on the role of projects in shaping environmental attitude among school pupils.
- Effectiveness of nature camps in creating positive environmental attitude among school students.
- Films on the life of various organisms: How do they shape environmental education among students?
- Effectiveness of case study in learning environmental education at school level.
- Motivational effect of television channels namely Animal Planet, National Geographic etc., on students and adults.
5.6. CONCLUSION

*Man has tried his suicide*
*With bigotry and hate*
*But in the end he’ll kill himself*
*With nothing but his waste*
*What will happen when*
*The farm land turns to dust*
*When only rich receive the food*
*And nothing’s left for us*

— Robert McGuinn, *The Trees are all Gone*.

When one looks at the efforts taken by different agencies over a period of four decades, environmental education has matured greatly and has gained a strong and meaningful structure as a critically important subject at all levels.

Recognizing the wealth, generosity and importance of nature since time immemorial, the Indian depth of spiritual knowledge has enabled us to create pious, serene and noble atmosphere around ourselves and live in peace and harmony with nature. The psyche of Indian people finds solace with reverence to Nature. The philosophy of life is reflected in our national song, Vande Matram, sung in honour of our mother land.

Let us follow the strategy stated by the National Focus Group on Habitat and Learning (2005). The new paradigm of education, embodying the spirit of science, of democracy, and of caring for the environment, would emphasise a number of key elements:

- Learning rather than teaching;
- Building capacity for critical thinking and problem solving;
- Locale specificity in the context of a global vision;
- Multidisciplinary approach;
- Multi-sourced and accessed, rather than top-down, controlled and orchestrated in nature;
- Participatory with broad involvements of peers and other community members;
- Lifelong and continuous in character;
- Sensitivity to diversity, equity and gender;
- Knowledge generation;
- Empowerment, rather than indoctrination.

As Hungerhord (2010) states, one is given to hope, for the sake of the nation, the world, and the learners within, that environmental education grows at pace that is keeping with the many crucial problems issues facing humanity.