CHAPTER 7
CONCLUSION AND RECOMMENDATIONS

7. CHAPTER PREVIEW

This chapter is divided into nine subheadings. These subheadings focused on Student assessments on EESD, Environmental Outcomes, Social Outcomes, Economic Outcomes, Implications, Content Analysis, Stakeholder Analysis, and recommendations.

7.1 Student assessments on EESD

There was a significant statistical difference between the pre and post tests on the student’s environmental knowledge, behaviour, attitude, and skills. The students who have been educated by active EESD teaching strategies have gained more environmental knowledge, attitudes, behaviour and skills than the students who have been educated by the traditional teaching methods. The present study has proven that students who participated in active EESD program have more environmental knowledge and are more environmentally active than the control group. This is in agreement with that of the findings of several earlier workers (Gang, 1989; Sinclair, 1990; Marzano, 1997; Manjengwa, 1998; Ellis, D’Silva, 2010). The present study demonstrated that students learn more quickly in outdoor settings compared to classrooms, retain skills longer and appreciate the experience to a greater extent. This is similar to the findings of several workers (Tanner, 2001; Tsevreni, 2011; Cuthbertson, et.al, 2003). The present study has indicated that field-based education positively impact ecological attitudes and behaviour. This is in agreement with findings of several earlier workers (Cobb, 1977; Dresner & Gill, 1994; Moore & Wong, 1997; Dettmann-Easler and Pease, 1999 Crane, 2001).

The local environment such as lakes, ponds, local residential areas, vermicompost units and botanical gardens were used as ideal field sites for the implementation of the active EESD module. Students should be encouraged to be involved by expressing and communicating their experiences, ideas and emotions about their immediate environment and their everyday life (Barratt Hacking, Barratt, and Scott, 2007). However, student’s involvement can take place at different levels, along a broad spectrum of opportunities: from local issues to regional, national and international policies (Simovska and Jensen, 2009).

The direct experiences provided to experimental group students in the present study has significantly improved their skills (t = 9.16, p <0.05) in identifying various environmental issues at local level. Kellert’s (2002) model of the impact of different types of nature experiences (direct, indirect and sensational) on various modes of learning (cognitive, affective and evaluative) is found useful for addressing issues regarding context and learning outcomes in the present study. The theoretical and empirical work of Fazio and Zanna (1978, 1981) Millar and Millar (1996) also provide insights into the
influence of direct experiences on attitude, development and behaviour. For example, their findings suggest that indirect experiences lead to more cognitively based attitudes while direct experiences produce more affectively based attitudes.

Skills are important determinants of water conservation. Students were provided with various skills in identifying environmental issues that have improved their skills to understand and solve local environmental problems. Corral-Verdugo (2002) found that student’s abilities for saving water were indicators of conservation competency, a factor directly influencing water-conservation behaviour. Middlestadt, et al.(2001) indicated that providing high school students with specific ‘behavioural knowledge ‘regarding how to save water can lead to water conservation behaviour. These results indicate that providing individuals with specific skills about how to protect the drinking water is a necessary and important step in leading their behaviour towards a conservation goal. In the present study also, the implementation of EESD has led to protection of drinking water in schools and their neighbourhoods.

A discussion on environmental, social and economic outcomes of the implementation of EESD in selected schools is presented in this chapter.

7.1.2 Knowledge

EESD encompasses environment, economics, and society. Therefore, people need basic knowledge from the natural sciences, social sciences, and humanities to understand the principles of sustainable development. Active EESD teaching learning approach can achieve sustainable development provided it covers the above topics.

7.1.3 Skills

EESD must go beyond teaching about environmental issues. EESD must give students attitudes, behaviour, knowledge and practical skills that will enable them to continue learning after they leave school, to facilitate sustainable lifestyles. The following list demonstrates the types of skills students will need. The skills fall into one or more of the three realms of sustainable development - environmental, economic, and social and may be grouped into the following categories (Mc Claren, 1989);

- The ability to communicate effectively (both orally and in writing)
- The ability to think about systems (both natural and social sciences)
- The ability to think in time - to forecast, to think ahead, and to plan
- The ability to think critically about value issues.
- The ability to separate number, quantity, quality, and value.
- The capacity to move from awareness to knowledge to action.
- The ability to work cooperatively with other people.
• The capacity to use these processes: knowing, inquiring, acting, judging, imagining,
    Connecting, valuing, and choosing.
• The capacity to develop an aesthetic response to the environment.

EESD is an ongoing process. It should be approached as a series of small steps and expectations should be kept as realistic as possible. A strong understanding of what sustainability involves within the context of school and wider community is essential as it has been emphasised by several earlier workers.

Sustainability is not a short term goal; it takes a long time to achieve. Thus, EESD needs to be embedded in the school action and curriculum plans to ensure it continues even when there are staff changes.

7.2 Sustainability of EESD program

7.2.1 Environmental Outcomes

Through the water conservation education and training program, tap water and rain water harvesting set up have been built in selected schools in Puducherry and Cuddalore with the help of local NGO Foundation for Ecological research Advocacy and learning (FERAL, Puducherry based NGO) to conserve water. The mulching of the trees, gardens and herbs have reduced the loss of water from evaporation in selected schools in Puducherry and Cuddalore. Recycling of manure from the flora available in school, have improved soil quality in the school gardens. Native tree saplings (Plates 13, 14, and 15), medicinal plants and nectar plants comprising of 12 species have been planted with the help of Forest Department, Government of Puducherry that has attracted 46 butterflies species, small nectar birds, and insects. Local earthworm species (Lampito mauritii) were used in the vermi-compost. This reduced the dumping of bio-degradable organic wastes in the campus leading to foul smell along with associated health problems and has the additional benefit of using the worm castings for bio-fertilizer in vegetable gardens and medicinal gardens within the school campuses. Such organic farming practices, if adopted on a wider scale can indirectly reduce the emission of green house gases (as the chemical fertilizer inputs that need fossil fuels for their production), besides sequestering carbon in the soil (Lehmen et.al., 2006).
Plate 13 Students are setting up medicinal garden at Sri Valliammal Hr. Sec School, Cuddalore

Plate 14 Maintenance of medicinal garden by students after looking three months at sri Valliammal Hr. Sec. School
Plate 15 Students are setting up of vegetable garden at C.S.S school, Puducherry

Plate 16 Students are planting tree saplings at their residents

Though there are a number of indicators that may be used to quantify the impacts of EESD on the school campuses and a neighbourhoods, due to the short term nature of the present study only a few indicators were chosen and studied.
7.2.2 Social Outcomes

Present EESD program has facilitated strong student and community interactions that have facilitated (Plates 18, 19, 20, and 21):

- sharing their ideas and findings on water, biodiversity and solid waste assessment with local community
- preparing speeches and presentations delivered with other students and community level
- showing leadership within the local community and school
- networking with students and teachers from other schools
- being involved in school events to celebrate special days such as water day, ozone day and wild life week celebrations.

Plate 18 Students are interacting with local community about their water test findings at Puducherry
Plate 19 Students are interacting with local community about their water test findings

Plate 20 Students are playing drama about wildlife conservation at Puducherry
Plate 21 Students are presenting their finding about campus biodiversity with other students in J.N.V school, Puducherry

7.2.3 Economic Outcomes

It was estimated that due to the improved rainfall harvesting strategies the selected schools were able to save tap water to a considerable extent during 2009 to 2010 (42,600 L for Puducherry schools and 28,000 L for Cuddalore schools) The waste paper generated from the selected school were converted to several useful goods such as pen-holder, caps, paper bags and small tubs which are used for students as alternatives to plastic materials. A reduction in paper use will again provide significant savings for the school.

Setting up of vegetable garden has contributed part of cooking needs in schools. Besides, the native vegetable seeds (Solanum melongena, Hibiscus esculentis, Cucurbita maxima, Solanum lycopersicum, and Dolichos lablab) have been distributed to students to extend gardens at household level. Nearly 50 students have setup vegetable gardens at their residences due to the EESD program both from Cuddalore and Puducherry. Planting nectar plants within the school premises attracted more butterfly species and other insects that also contributed to the biodiversity wealth of school gardens. Microbial and vermicompost unit in school campuses as part of the EESD program facilitated the production of bio fertilizer to green gardens in schools.

Two communities such as Navarkulam Village near Puducherry (located closer to Makkal Thalaivar Vasudeva Subya Government High school, Puducherry) and Sigarathope village in Cuddalore (located closer to Valliammal Vidyalaya Matric Higher Secondary school, Cuddalore) were selected for community awareness program by students. As a consequence of the EESD program the two communities started (6 months after the students interaction with the communities) sustainable solid waste management system (Plate 21) through which the women’s self help group (SHG) produce compost
and vermi-compost. The compost are distributed to each household in order to maintain the backyards and also selling it for other villagers by which they are earning Rs 200 per month per household. Through this system around 2 tons of wastes are being turned into compost and vermi-compost both in Cuddalore and Puducherry during 2009-2010.

Plate 22 A member of the women SHG setting up compost pit at household level through service learning education, Navarkulam village.

Plate 23 Medicinal garden providing medicinal values to the students in V.V school, Cuddalore.
Plate 24 Conservation of endangered species (*Couroupita guianensis*) in J.N.V school, Puducherry.

Plate 25 Flower garden attracted many butterflies in M.T.V school, Puducherry.

7.3 Teachers’ perception on EE

It should be remembered that the main aim of environmental education is to develop environmentally responsible individuals who are informed and skilled enough to act for the environment. The comprehensive environmental education pre-service and in-service programs for teachers should be designed (Ko and Lee, 2003).
Each school should be required to employ a minimum number of teachers trained for environmental education. If more teachers understand the urgent need to act for the environment, promotion of environmental education among teachers will be far easier.

For more effective teaching, teachers should be able to better communicate environmental values and perspectives related to EE rather than just relying on textbooks and executing merely a teacher-proof science curriculum.

These findings suggest that teachers involved in environmental education for school students need to be more knowledgeable in attaining the goals and objectives of EE and the required innovative curriculum guidelines in science, social studies, and languages and environmental studies subjects to encourage greater incorporation of EE in classrooms. Although National missions have guidelines on EE in Puducherry and Cuddalore (Tamil Nadu) at schools levels where there are no state or district guidelines specifically for EE, environmentally concerned teachers, parents, and communities should stress for the implementation of effective EE standards. This makes real sense if we conclude that teachers will plan for and implement environmental curricula using required standards.

7.4 Content Analysis

The comparative analysis of ten Science and Social science curricula analysed from Tamil Nadu science and social science text books with regard to components of environmental literacy revealed that all the components are not considered equally. While the components pertaining to environmental knowledge and some practical skills are highly emphasized, the other components such as behavioural and attitudinal changes towards environmental protection and understanding about the local environment and environmental service learning as well as experiential learning are partially or even largely ignored.

One of the important objectives of environmental education for students is to help them develop the abilities and capacities needed for community participation, service, and action (National missions for environmental education 2000). However, the findings of the study indicate that in Tamil Nadu state and Puducherry U.T, this aim of environmental education may not be easily realized because the action component of environmental literacy is given little attention and is even ignored in the curricula. Since curriculum development and revision processes are never ended, the science/social science curricula can be provided with continuous feedback through research findings. In this regard, the findings of this study may be a detailed source of information for the revision of state/national curricula, particularly on the integration of all the components of environmental literacy sufficiently. The value and action components require a new approach to teaching, incorporating inquiry methods and field studies, ensuring the
integration of knowledge, emotion and action, i.e., heads, hearts and hands. This means that revision of curricula and text-books is not enough. Teachers’ guides and teachers’ qualification should also be updated in order to create stimulating learning environments (Sonowal, 2009). All these facts point to the urgent need for a paradigm shift in the approach towards the contents and delivery of environmental education -the importance of environmental education for sustainable development.

7.5 Stakeholder Analysis

7.5.1 Relevance of Environmental Education

In responding to questions (Appendix 5) which asked the respondent to describe why the students should learn EESD at school, the principal J.N.V school held the following view about students passing on knowledge to their parents about disease prevention:

“It is must for every individual as there is a lot of threat to the environment by disturbing natural resources and it is required especially for the survival of humanity in this globe. (Vinayathan, Principal J.N.V Puducherry)”.

It is very essential that students must be know and understand about environment and its complexity and it must be solved at local level.

7.5.2 Curriculum review

The government leaders mentioned that they have been accept that active EESD teaching learning methods in the curriculum and trial of EESD materials e.g. Vinayathan said:

“Yes, the EESD modules which have been used for school students is well planned, organised and well executed. The students learnt a lot about the environment and appreciate nature and natural laws” (Vinayathan, Principal J.N.V Puducherry)

“The active based EESD strategy must be implemented in schools not only to understand the environment but also provide skills to solve the various local environmental issues besides this attitudes and behavioural aspects of environmental education must be effectively provide in schools with sufficient local examples”(Mr. Ramalingam State Co-ordinator EE cell, Puducherry & officer on special duty, EE cell, Puducherry)
7.5.3 Training

The key stakeholders mentioned that they had been working with other related parties in the training of teachers Dr. Krishnan officer on special duty, State training centre, Puducherry said, “We have been working collaboratively on training of teachers. “With renowned NGO’s such as CEE, CSE, NGC, and CSS.

EE is one of the important subjects to be taught at school level; it is incorporated in school text books are very less coverage. We are in collaboration with MoEF and other related parties are now running workshop for teachers on how to implement/develop EESD in schools. (Mr. Ramalingam State Co-ordinator EE cell, Puducherry)

7.5.4 Projects

The key stakeholders also mentioned that they had been involved with other people in different activities and projects related to EESD e.g.

We had been working with GLOBE project; it’s related to monitoring of climatological data such as rainfall pattern, temperature and humidity collected by students in every school in Puducherry. CLEAN India project for understand the various local environmental issues and GIS project for hands-on-training for geographical and remote sensing programmes (Mr. Ramalingam State Co-ordinator EE cell).

7.5.5 Relevance of working together

In explaining the advantages of working together, the government leaders mentioned that it has been and could be a means of joint effort, e.g.

For example we have been working with other stakeholders to facilitate workshop for teachers. And in the preparation of EESD strategy it has been a joint effort between the Ministry for Environment, Ministry of Education and other stakeholders such as CPR foundation, CEE Ahmedabad and CSE. (Mr. Ramalingam State Co-ordinator EE cell, Puducherry).

Through joint effort the government leaders explained that they had a plan for capacity building, professional development of teachers and other related activities that would help in the development of EESD in Puducherry.
7.5.6 Perceived challenges

When asked what were the perceived challenges and their suggestions for ways the collaborative system could be maintained, the government stakeholders mentioned coordination, leadership, responsibility and an active role.

“Empowering and motivating teachers is essential and sought their co-operation to actively implementing the program besides these skills must be provided through intensive training program to make them to understand the local environmental issues. In Puducherry there are around 375 schools having NGC club each club provided Rs. 2500 for conducting for environmental awareness program, this amount is not at all sufficient for effectively conduct the EESD awareness program in addition to this issue the lack of manpower to monitor and development these NGC clubs in Puducherry also the lack of empowered teachers in terms of adequate knowledge on environmental issues and skilled are insufficient for effectively implementing the EESD program in Puducherry” (Dr. Krishnan Officer on Special Duty, State Training Centre, Department of Education, Puducherry)

7.5.7 Communication

The government leaders pointed out the importance of communication between schools and parents, e.g. Mr. Ramalingam State Co-ordinator EE cell, “If the students learn something at school it should also be known at home otherwise it would be difficult to be accepted at home.” This seems to be important the parents have different expectations of their children to the expectations of the school, and that EESD is an area which has not been familiar to parents, means it is relevant for parents to be informed and get involved with the schools EESD programs.

7.5.8 Stakeholders’ views on collaboration

The interview conducted from the key stakeholders indicated that coordination can enhance or inhibit collaboration activities. They suggested that through coordination of skills, experiences, expertises, funding and resources from different organisations can work jointly for provide effective implementation of EESD in Puducherry and Cuddalore region.

7.5.9 Stakeholders’ views on their involvement with EE activities

The stakeholders in Government educational institutions/departments indicated a range of ways in which they had been playing a part in the development of EE in schools. Only a few of the respondents thought that the teachers should facilitate learning while employing active EESD strategy other than the traditional lecturing method, and that the students should be involved in the learning process as active learners. The respondents
did not consider that students can make a change as they thought the school students are too young for decision-making and for their work to be taken into consideration. However, it showed that the feasibility for the implementation of EESD in schools could be expected when consideration is given to teachers’ attitudes, knowledge, behaviour and skills. Therefore, teachers’ support in terms of encouragement, recognition, intensive training, adequate resources, expertise, and sufficient funds were thought of as having fundamental importance. However, teachers are challenged that their teaching styles should be in line with the objectives of EE and EESD that they should work with others for exchange of views and resources, support their training, and be accountable for their work.

The school leaders in the administration position were considered as the key players and that they should give teachers a supportive atmosphere; encourage learning, good behaviour and environmentally friendly activities at school; and work with other stakeholders to support teaching of EE and training of teachers. The survey also indicated that for effective implementation of EESD in schools, government roles in professional development of teachers, provision of resources, and funds for school projects should reach the majority. It is suggested that the parents should help students to change their behaviour, and improve their learning; they should visit schools and talk to students, encourage environmentally friendly activities at home, and provide other support in terms of funds for books, school projects and field trips. The EE agencies were thought to play a major role in expertise, tools and practical suggestions as well as in training, funding and resources. The stakeholders thus considered EESD as a vehicle for enhancing school relationships with other stakeholders.

It can be seen that the stakeholders involvement in activities related to EESD were limited to activity based environmental education such as cleanliness, planting trees, gardening, compost unit, and water conservation. However, there was an understanding among the stakeholders in this study of the advantages from those activities, which might help to address some key problems facing the region e.g. garbage, biodiversity loss, water/air and soil pollution that will more effectively facilitate the teaching/learning process.

7.6 Recommendations

Introduction and implementation of environmental education as an independent subject would require to formulation of strategies, logistics and comprehensive support systems at different levels- both within the school systems as well as outside; Pedagogy need to be based on the needs of children belonging to different age groups, local context, and indigenous perception of environment, cultural tradition and multi disciplinary approaches. It has to come out from the confines of the school and involve the participation of parents, family and entire community, formulation of curriculum in other
subject areas to avoid unnecessary duplication and increase in curriculum load, evaluation of effective cognitive domains like values, attitudinal changes etc. Evaluation methods have to be formulated to include group evaluation and significant modification in the curriculum and syllabus for both pre service teacher education programs.

The text books on environmental science should not only provide space for physical and natural environment, but also for the social environment as family, school, neighbourhood, and community are domains of a child’s life. The text book content need not be all inclusive. The stress should be an interesting and meaningful treatment of selected themes rather than superficial and information laden treatment of a multitudes of topics, so that it does not burden the child. The curriculum and teaching learning process should lead to internalization and help in attitude formation. The curriculum for environmental literacy in middle school level must include local natural habitats/resources such as lakes, ponds, forests, wildlife and environmental issues as an example. Service learning in order to understand local environmental problems and involve in local environmental protection programs must be a part of environmental literacy in school education.

Improving the educational outlook for environmental learning is the goal of all environmental educators, and they need to take an active role in making teachers aware of the complexities of environment and its problems to the society. Environmental educators can also support student learning about environment by providing teachers and publishers with additional local environmental issues as an example relevant to science topics, and engaging problem solving and service learning opportunities.

Teachers should take their students into the natural environments and expand their use of field practices to arouse students’ curiosity toward the environment and help students grasp how classroom learning can be applied in practice. There is a need for the systematic inclusion of environmental education in school curriculum from very immediate environmental elements to national and global environmental issues as the child grows.

Investigation, experimentation and analysis through discussion should be the way of imparting EE in schools. This may be quite easy if locale-specific examples are included precisely. EE should be aimed at developing a child’s perception with values about its surrounding environment. While locale-specific courses are taught in EE, it must not ignore other concerns covered in regular textbooks. Thus, while a separate course on locale-specific EE is imparted, the infusion technique will do further justice to the course.

Cooperation among local governmental organizations, nongovernmental organisations (NGOs) and schools is essential in order to develop sustainable environmental projects (water conservation, biodiversity conservation, air pollution, waste management, recycling, re-using) in which all stakeholders will have to take active roles to protect and conserve the natural environment. Besides, educational and
developmental policymakers, researchers and practitioners need to establish a stronger links so that the findings of EESD research can be reflected in the policy-making process and practice at the field level. Policy makers need to reconsider the existing studies together with all of their limitations and provide further opportunities for large scale planning/implementation of EESD strategies. Unless the three parties go into stronger cooperation, large scale studies will continue to remain as an individual effort, like an oasis in the desert.