CHAPTER VI

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SUMMARY AND CONCLUSIONS

6.1.0 The study in retrospect

This concluding chapter presents the study in retrospect, the major findings, conclusions and suggestions, the implications of the study and a few suggestions for further research in the area.

It is of paramount importance to create a kind of love and concern for nature in young minds so that they grow up with an awareness that would lead to action. This calls for an environment oriented bioscience education programme with live examples for better understanding of our ecosystem making use of the most valuable infrastructure provided by the botanic gardens of our country. The potential of botanic gardens as an effective tool for environmental education is well recognized. What remains less potent is the knowledge of how to use the botanical infrastructure (living models) to increase children’s environmental awareness. Therefore the study is entitled as “The Environmental Education Potential of Botanic Gardens”. The potential of the botanic gardens and how this should be instrumentalized for inducing environmental / ecological education among secondary school children is the major focus of the present investigation. Botanic gardens have a unique role to play in environmental education and they are as potent as an effective tool for imparting ecological / environmental education focusing towards an integrated sustainable development. However, empirical studies to establish this
potential are very few. The major aim of the present study is to find out how botanic garden can be made use of as an institutional establishment for making the pupils identify and understand the different types of plants which are the key elements of biodiversity. This thesis reports the results of the study conducted among the secondary school students making use of the botanical infrastructure (living models) available in Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram. The potential of botanic gardens as an outdoor learning centre is mainly determined by the content they emphasize and the kind of activities they present. This study also helps to find out whether the field visit through the botanic garden helps to reinforce and strengthen the knowledge and understanding gained from the classroom teaching.

6.1.1. Objectives of the Study

The scope of the study envisages the following objectives:

1. To identify the structure and potential of Botanic gardens for environmental education.

2. To find out the role of Botanic gardens in environmental education.

3. To study the scope of school syllabus in Botany for environmental education.

4. To find out the effect of field visit to a Botanic garden on the skill of the secondary school students in identifying different types of plants, categorising them according to their use and economic importance.
5. To find out the effect of field visit to a Botanic garden in improving students’ knowledge and understanding of the varieties of plants and their conservation within an environmental education framework.

6. To identify the role of Botanic gardens to supplement the knowledge and understanding of the students gained from classroom teaching.

7. To prepare an integrated ecological/environmental education Model Action Plan for secondary school students in Kerala on the basis of the findings of this research.

6.1.2 Methodology in brief

Research Design

The potential of botanic gardens as an outdoor learning centre is mainly determined by the content they emphasize and the kind of activities they present. Hence data collection consisted of a combination of theoretical and empirical methods. Content analysis and experimental study which are the most exact and difficult of all methods and most important from the strictly scientific point of view are the major techniques of research employed in the present study.

Structural Analysis of Botanic Gardens

In terms of the theoretical methods, a historical investigation of the scientific evidence for environmental education in botanic gardens of selected countries was undertaken. This was combined with a structural analysis of national level botanic gardens. On the basis of the first objective of the present study there is a prerequisite to identify the present status of plants and plant systems in these gardens.
To identify the dominating sector, the availability of plant systems is examined first by analyzing the available secondary data. Several books in the areas of the plant diversity and conservation aspects of botanic gardens were critically analysed. Though the above analysis succeeded in establishing the nature and working of botanic gardens, more details were not available with the above data. When the earlier analysis was able to ascertain the general infrastructure facilities of each botanic garden, the analysis of the second set of parameters provided a more clear picture of how a botanic garden can improve the activity pattern of the secondary school students, who constitute the major target group of this study.

**Content Analysis of the Textbook in Biology**

As a pre-requisite the content of the biology textbooks from Upper primary to Secondary classes was analysed in order to select different types of plants which are culturally, socially and economically important. The analysis of such a comprehensive data system helped to identify the names and economic importance of the plants which were included in the text. The plants mentioned were checked for their local relevance as well as their availability in TBGRI. This is done with a view to understanding the extent of the occurrence of the explanation of plants in the biology textbooks and as a basic supporting evidence for the experiment. This is to find out how far these plants can be identified and documented according to their economic importance by the students in a pre-demonstration and post-demonstration scenarios. The main objective of this analysis is to find out the role of botanic garden to supplement the knowledge and understanding gained from classroom teaching or in otherwards to find out whether botanic garden can be used as an extended laboratory of the school.
Experimental Design

The major aim of the study is to determine the potential of botanic gardens for the environmental education. Therefore with a view to ascertain the environmental education potential of botanic gardens, an empirical study was undertaken. This empirical study aims at evolving experimental designs and methodologies for the effective implementation of environmental education making use of the botanical infrastructure facility in Tropical Botanic Garden and Research Institute.

The experiment is based on the principle that field study is more important than classroom teaching. The assumption is that students can themselves discover facts and principles through direct experience without formal teaching. The importance of learning outdoors has in recent years got prominence as one of the most effective strategies in the teaching/learning process. Hence one of our approaches selected was to conduct a plant identification programme. Identifying and documenting the categories of plants is an important facet of the environmental education.

The design selected was able to accommodate the testing of the effectiveness of field study - a new instructional strategy. In the present study the effect of the strategy was tested experimentally by a pre-test-post-test design. The independent variable is the teaching strategy - field visit, and scores obtained on the test or the students’ performance is the dependent variable.

The observations from the plant identification programme led to, a second experiment. It was done with a view to ascertain the knowledge and understanding ability of the students about the utility of the different plant systems especially
medicinal plants. As this design being a very important parameter which determines the understanding level of students in pre- and post-demonstration scenario, is methodologically very important. The same achievement test was used for pre- and post-testing.

**Model Action Plan**

Model action plan is the outcome of the analysis of the potentials of botanic gardens in relation to the curricular and conservation aspects. It is developed on the basis of the findings under study and is presented as a separate section in the chapter of Analysis, as a major contribution of this research endeavour.

**The Sample for the Study**

The target population from which the sample was drawn for the study was the entire population of IXth standard students of Thiruvananthapuram district. The subjects for the study consisted of representative samples. They consisted of the students studying in standard IX in selected schools and the selection was made by the schools themselves and was not subjected to the whims or bias (if any) of the experimenter. The experiment was done in two stages and they are independent by themselves. The two experiments were different both in the case of sample and tools. This was to prove the efficacy of demonstration in the sense that how a particular group of students reflects back on the performance in an independent situation.

In the plant identification experiment the sample consisted of 50 students of standard IX from a rural school. This can be considered as an incidental sampling because the selection was made by the school itself. But this sample
takes account of various strata or criteria like occupational and educational levels of parents, marks obtained in the terminal examination, etc. Students were of varying academic abilities. Since we are using single group design, the incidental sampling is sufficient for the plant identification experiment.

In the second experiment samples were collected in such a way to distinguish and identity the difference and variations among the rural-urban children in understanding plants and their economic importance. Keeping this view in mind students studying in urban and rural areas were selected equally for the experiment. This categorization will help to understand and design curriculum and related concept and content accordingly. Sample for the second experiment is a small population \((N=60)\) of the IXth standard students of Thiruvananthapuram district.

6.2.0 Major Findings

6.2.1 Analyses of the Potentials of major Botanic Gardens

The first step of this attempt was to analyse the pre-existing situation in botanic gardens for environmental education. From an educational perceptive there were two main assets; first the plant wealth of the garden, which includes, native and exotic, common, rare and endangered species. Secondly the educational service, catering for students of all age groups as well as the general public.

The aim of this education component is to teach the community especially students to observe, love and protect their environment and the successive stages in the educational process are necessary to respect nature and bring about a responsible attitude to conserve nature. All botanic gardens are admirably suited to this and plants in the garden are the best teachers with all their infinite variety.
From the analysis of the present scenario of botanic gardens in the world, it is very evident that those gardens have long been associated with education. The first gardens founded in Europe were created specifically as gardens for the cultivation of medicinal plants, for the use in the teaching of medicine at the ancient city universities and later ones were established for the teaching of botany as a separate science. Many gardens are still closely associated with universities and have a very strong formal education component in their structure. The higher education role has, in many gardens been complemented by a more popular public education component and this has been actively pursued at places such as Kew (UK) and Missouri (USA).

There are some gardens where the education component is simply a passive and generally unplanned – for side effect of showing a wide spectrum of plant life to the general public. Each botanic garden is unique and has a vital role to play in environmental education. They are important centres close to nature and to learn about plant.

**Resources and facilities in a botanic garden for environmental education**

1. **Garden Collections**: Collections in botanic gardens are reserves of biodiversity. Considering the sheer diversity of plants in a botanic garden - native, common, rare, endangered, endemic and exotic plants, the scope for education is endless. Thus botanic gardens are ideal places to teach people about
   - the richness of the plant kingdom
   - the morphology of these plants with their adaptations
   - the importance of plants in our lives.
- the use of plants economically, culturally and aesthetically.
- the threat to plants from all sides.
- the need to conserve these plants.

2. **Education Staff**: Environmental education programmes can be successfully conducted only with the help of an education officer supported by his / her assistants. Knowledge of the standard and the previous experience of the target group is very essential. The education officers need to integrate themselves fully into the staff structure of the garden. Educators themselves need training to plan, organize and implement different types of programmes for different target groups. From this analysis it is very evident that most botanic gardens have education officers.

3. **Support**: It is important for other members of staff to support the education officer(s) in whatever way they can. There needs to be good communication within the garden about the role each member of staff can play in education and the education officer have to play a central co-ordinating role as far as the outreach programmes are concerned.

4. **Education Materials**: Even though plants are the major attraction of the garden other teaching materials like posters, panels, slides video clippings, education packs, books etc. can be used for outreach programmes. Garden collections like herbarium, museum etc. can also be used as education materials.

5. **Budget**: The garden must allocate a budget to education and the education officer must be responsible for managing the budget. The money can be used for transportation of students, for their food and accommodation.
Moreover the kind of programmes to undertake also depends upon the money available.

6. **Visitors:** The success of an educational activity in the botanical garden depends on the visitors. Education officer has to identify the target group for the programme. The main target group for most gardens include

- Schools: (primary and secondary)
- Colleges and Universities: plant science / botany, ayurveda.
- Teachers: both in-service and pre-service.
- Youth clubs and General public.

It is impossible to target all these groups. Each garden has to set priorities according to the message they want to get across and the facilities that are available.

7. **Developing Programmes:** Living collections serve as a support in the development of the educational programmes. The collections and the expertise of the staff are ideal in enabling to conduct a variety of activities that aim to make the public, aware of the importance of protecting our plant heritage. With appropriate labels, displays and other interpretive information materials, the botanic gardens can sensitise and motivate people to protect biodiversity and instill a sense of care and concern over the protection of the environment.

There are numerous teaching methods that botanic gardens can use in developing educational programmes and an enormous variety of programmes can
be developed inside and outside a garden. The usual method is receiving groups of children with their teachers in the garden – simply a passive and generally unplanned way of showing a wide spectrum of plant life. Many botanic gardens have developed comprehensive environmental education programmes and in this programme a more popular public education component can be actively pursued through the following programmes.

- Nature trial
- Guided tours
- Interactive exhibitions
- Field excursions
- Demonstration of collections
- Practical horticulture and arboriculture
- Botany courses
- Quiz and essay competitions
- Drama
- Simulated games
- Interpretive signs and posters.
- Outreach programmes
- Preparing education packs
- Teaching teachers (Teacher training)

More specific programmes can be conducted in addition to the daily work undertaken at the botanic garden, such as guided tours and attending to the general visitors. Certain programmes can be arranged for one or two days where specific areas can be covered.
These areas are:

- Know the medicinal plants and their therapeutic values
- Know the common plants and their uses
- Know the aquatic plants and their use and adaptations
- Know the orchids
- Know the rare plants and their extinction
- Know the common trees in the arboretum
- Plant adaptations - A walk through the garden
- Training in horticulture.
- A Workshop on wild edibles
- A Study of plants across the curriculum.

6.2.2 Role of Botanic Gardens in Environmental Education

From this analytical results it is very evident that botanic gardens have long been associated with education and each garden is unique and so will have particular programmes for conservation. But very recently gardens are turning their attention to the general public – aim is to provide first hand knowledge about the local, rare, endangered, endemic, exotic and the medicinal plants, their habitats, therapeutic values and cultivation, for effective conservation for future. The field visit has great potential to sensitise and increase environmental knowledge and awareness and to educate people about the urgent need to conserve plants. The diversity within the plant kingdom provides a shop window for conservation education.

All botanical gardens hold large collection of living plants. According to the mission statement of each garden the staff implements the education programme. The role of botanic gardens as evident from the analysis is given below.
Learning Centre

Some of our gardens are floundering without a serious role, debased to parks and pleasure gardens. The visitors take particular pleasure in observing the most beautiful flowers, some of the more unusual plants within the peaceful and beautiful surrounding of the garden.

Botanic gardens can be designed as a learning centre by the content they emphasize, the major objectives the developer has in mind, the kind of activities they present and the type of instructional media. Botanic gardens can set up and implement environmental education programmes within the framework of their infrastructure facilities. Learning becomes more meaningful and challenging when each student competes only with himself or herself. Each visitor in the garden becomes a student who explores, estimates, experiments, and questions through learning centre activities. Visitors develop a skill of observation even if the visit is planned or for a fun.

In an environmental education programme the principle is, get the children out of the classroom in to the botanic garden and let them experience and study the diversity of life directly. Botanic gardens play a perfect complementary role in supplementing and enriching the formal system of education. They are a major catalyst or act as a facilitator in learning about the flora of the world.

Botanic gardens contain plants from all over the world. Properly planned field study can provide the opportunity to be close to the wide spectrum of plants, observing its diversity, similarity and variations. As they see more species, species
diversity and the importance of biodiversity will become more meaningful concepts. For example students can understand that colocassia and anthurium belong to the same family. The difference between species can be analysed and discussed. The visit will help the students to find a variety of different plants, how these plants are adapted to the environment. Botanic gardens thus became the centres of natural aesthetic beauty and taxonomic studies and education.

Conservation Centre

Throughout the world wild plants and their habitat are under increasing threat. Botanic gardens are a repository of endemic, rare and endangered species of plants all over the world. They will be growing a fraction of native flora. Highest priority is given to those plants thought to be endangered or of known economic potential either for horticulture, medicine or wild relatives of agricultural crops. It is realised that botanic gardens have an obvious and vital role to play in conserving plants. In the present era of dwindling living plant resources, botanic gardens are the last resort because they can augment maximum resources towards the conservation of plant diversity. This cannot be achieved sustainably without proper education, creating general awareness among students and the general public. When such a conservation centre is in operation as part of the botanic garden it could become an effective conservation education facility for the students and general public.

6.2.3. Content analysis of the Biology Textbooks

The important findings emerged from the content analysis of the Biology Textbooks are presented below.
1. Even though plants are available and used across a wide spectrum, educationists have included in the syllabus only a cursory screening of one in ten or an intensive screening of one in a hundred or thousand.

2. Taxonomic studies (information) were not pursued, in any of the standards, nor the distribution, physiology and morphology of each plant.

3. Almost all the plants are locally available except certain exotic plants like foxglove, redwood tree etc. Even though cereals like wheat, millet, sorghum etc. are not cultivated in our State, the coms are available and the students are familiar with it. Therefore, it can be concluded that basically the examples given in the text are consistent with the ecosystem endowments of Kerala.

4. Along with the botanical/morphological features of each plant, its economic (including medicinal importance) and its sustainable utilization could also be mentioned in order to make the students aware that the plant system is not only the foundation of ecosystem but also that of economic system and hence man’s holistic development and welfare. Conservation of medicinal plants is to be addressed in a comprehensive way in order to strengthen the resource base of our traditional systems of medicine. It would have been better if the elements of ayurvedic medicines were also included in the curriculum within an environmental education framework from primary level onwards.

5. Curriculum is not designed to emphasize the practical implications of present knowledge giving learners a large amount of concrete experiences in activities, which is designed to improve environmental quality and qualities of life simultaneously. Curriculum should give more attention with such
intensity for the conservation and utilization of our plant resources, including the importance and preservation of biodiversity and sustainable development.

6. Almost all the plants except foxglove, red wood tree and jute are available in the Botanic garden with all their diversities and varieties. The allied species with all their variants represents the unique nature of a botanic garden. Therefore, Botanic garden can be considered as an extended laboratory of the school where students can understand and identify the different types of plants across the curriculum-within a cause effect relationship. The results achieved through this research attempt shows that botanic garden could play a perfect complementary role with school curriculum.

A closer analysis of the biology textbooks from standard V to X convinced the investigator that on the whole there are some lapses in the coverage and treatment on some of the aspects concerned with plant systems. It is found that some of the essential aspects of conservation and sustainable utilization have not been included in these texts. The lapses thus identified are presented below, grouped under certain common heads.

1. **Biodiversity**
   - Plant Classification
   - Plant Adaptations
   - Sacred Groves
   - Rare and Endangered Plants
   - Useful but Deadly
   - Protection, promotion and economic importance of bio-diversity
2. Economic Importance

(a) Plants as Edibles
   (i) Cerials
   (ii) Fruit plants
   (iii) Leafy vegetables
   (iv) Herbs for cooking

(b) Plants for Health
   (i) Folk Cures
   (ii) Plants used in Modern medicine
   (iii) Plants used in Ayurveda and other Indian systems of medicine

(c) Plants as Industrial raw material
   (i) Trees
   (ii) Ornamentals
   (iii) Aromatic Plants.
   (iv) Herbs as Repellants against insects
   (v) Fiber yielding Plants

3. Conservation

(i) Role of Forest
(ii) Growing Native trees
(iii) Growing Avenue trees
(iv) Propagation Methods
(v) Habitat conservation
(vi) Extinction of species
(vii) Sustainable Utilisation
(viii) Biodiversity Conservation
4. **Activities**

(i) Practicing Propagation Methods  
(ii) Field Visit  
(iii) Awareness Programmes  
(iv) Maintenance of School Garden  
(v) Plant Identification Competition  
(vi) Gardening competition

6.2.4. **Major Findings of the Experimental Study**

The experimental evidence leads to the following findings.

1. From the analysis it is apparent that a field visit through a botanic garden increases the students' skill in identifying common and rare plants in their surroundings. The more the exposure to nature, the more the awareness.

2. In the general plant identification programme more students were able to know the plants by their names but their application and economic utility were not clearly understood. Even though our medicinal plants have much therapeutic application, the local people as well as the students are not aware of it, as they are depending on allopathic medicines for their common ailments.

3. This type of study helped the students to learn the common medicinal plants in their natural setting and to identify the common and rare ones in their immediate environment. This study, therefore, stresses the need to extend teaching and learning activities into the immediate environment (natural / built) of the pupils beyond the classroom.
4. Pre-test results show that students have very limited awareness of their environment. They are unable to identify the plants around them with their names, values and significance in the lives of human beings.

5. Students get an opportunity to know the botanic, scientific and ecological aspects and dimensions of many plants. Again botanic garden plays a catalytic role in imparting this botanical information among the public.

6. Another finding from the investigator’s observation is that any ecosystem element which is involved in an entertainment interaction phenomenon especially in a magico-religious framework makes more imprint in children when compared to a normal interaction scenario.

7. Pre-test results of the identification of spices show that there is a lacuna in formal teaching because formal teaching experience is almost divorced from the environment. Therefore botanic garden infrastructure systems could adequately be useful for pedagogic supplement.

8. The results of the analysis of the students’ achievement scores in the pretest reveal the lack of knowledge of the students about the cultural, environmental and botanical aspects of the plant systems.

9. Post-test results show that a purposeful botanic garden visit increases students’ awareness about the local and scientific names, economic importance including the uses and structural variations of different species of plants. Moreover they get knowledge and understanding about

   (i) plants which are medicinal

   (ii) plants which are culturally important

   (iii) plants mentioned in the biology textbooks
(iv) rare and endangered plants
(v) structure variations in plants
(vi) conservation aspects
(vii) habitat and the need for its protection

Therefore, botanic infrastructure available in TBGRI is sufficiently adequate to play a very effective role in providing botanical and medicinal knowledge and information to the students.

10. The comparison between pre-test and post-test of the two experiments reveals the following results

(i) There is significant difference between pre-test and post-test scores of students in the skill in identification of plants.

(ii) There is significant difference between pre-test and post-test in the identification of medicinal plants.

(iii) There is significant difference between pre-test and post-test of the achievement test on total sample.

(iv) There is significant difference between the rural and urban students as far as the achievement post-test is concerned. The difference is in favour of the urban group.

(v) Another interesting observation is that there is no significant difference between the rural and urban students in achievement pretest.

The mean scores of the students in the findings (i)-(iv) show that the visit to the garden by the students had a significant advantage to them in identifying plants including rare and medicinal plants and also in their achievement in Botany.
The experimental results conspicuously reveal that post-demonstration target group manifested a better understanding of environment compared to pre-demonstration scenario. This result, therefore, gives the indication that botanical infrastructure available in a botanic garden could function as an effective tool in propagating botanical and ecological/environmental education in the school children.

6.3.0 Conclusions and Suggestions

The major conclusions arrived at in the present study are:

6.3.1. Analysis of the infrastructure in Botanic Gardens-

Botanic gardens can be considered as a Learning Resource Centre with live examples. It is an Exploratory centre to facilitate the free flow of qualitative and quantitative information on all types of plants including economic plants. Moreover it is a Learning laboratory that provides a framework for training in horticulture and tissue culture. Thus botanic gardens can be considered as the Second biggest classroom in nature. Success depends on the unique combination of facilities, opportunities, expertise and the link with other gardens. Moreover modern botanic gardens have a role in society with new and extremely important elements in it. These include the “ex situ” maintenance of rare and endangered species, “in vitro” cultivation, field gene banks research on reproductive biology. Thus education is a major part of the gardens’ programme and ranges from classes of young children to Ph.D researchers in botanical and related sciences.
6.3.2 Analysis of the Biology textbooks

The documented collection of plants that is represented in the biology textbooks of standard V to X do not represent a cross section of our plant wealth. Kerala's renowned natural plant wealth has never been included in the curriculum especially within the framework of Kerala's unique biodiversity status with a view to make the students environmentally literate. There are thousands and thousands of species of animals and plants, which have not been sufficiently studied, sometimes not even identified which could be of great potential values for future generations. Without study we cannot be sure about its utility. Therefore, we can't consider the textbook as a benchmark material for any future study on the vegetation status of Kerala. The whole purpose of introducing the subject to the students should be to encourage young minds to develop love and respect for plants of their neighbourhood and to inculcate in them an interest and curiosity about the plants they come across in their daily life. From this analysis it is very clear that formal schooling is not a solution for the universalization of environmental / ecological education in India. To increase understanding of biodiversity, representative and viable samples of ecosystem, populations and species must be included in the school curriculum. Economic importance, sustainable development and environmental education aspects of different groups like fruit trees, medicinal plants, bamboos, ornamentals etc. are to be explained within the frame work of its ecological economic inter linkage and relationships. How each of these items sustain our ecological system and as a result how we can formulate a stable ecological base for economic development? Such questions will create awareness among the students to protect the entire system. Sustainable use of biodiversity requires the application of both traditional and modern knowledge of biodiversity and biological resources.
In short in an environmental approach the study of the curricular materials should sow the seeds from which an affinity for plants would sprout resulting not only in the conservation of existing greenery but also in making substantial addition to it.

Thus, Botanic garden educators and the school teachers could build’ the second biggest classroom’ in nature. These new circumstances, thus define a new role for the Botanic garden as a unique place for environmental education.

6.3.3 Analysis of the experimental results

This experiment in a holistic scenario encompasses comprehensive aspects of students’ cognitive, affective and behavior development. This type of experiments can make learning about their environment practical and meaningful potentially having long term impacts on students’ attitude towards environment and also in shaping their future life. The results of these experiments reflect the students’ experiences in their home, school and community as this will get them pondering about every day habits and occurrences in an environmental dimension This type of programmes will help them to acquaint with the local plants and this will create an interest in them to identify more plants and to know more about uses and economic values.

As explained in the analysis, this experimental investigation reveals that a visit to botanic garden significantly affects environmental awareness of the school children. Nature trail through garden provides a living lesson on ecology. School children are able to experience the plants at first hand, so even a short visit to
the garden gives them some insight into the conditions necessary for these plants to flourish. Students can experience in portraying the shapes and textures of unfamiliar exotic plants. This experience must help to promote awareness as well as appreciation of plants on a large scale. It creates an awareness of a totally new world of nature to which they had not previously been exposed. It is felt that by participating in this study, the students gain a more complete picture of the life of their own, as well as the lives of other organisms and the part that any living thing including man, must play as a living community.

Therefore, it could be firmly concluded that the results obtained through the present investigation helped to establish (to a great extent) that field visit could be instrumentalised as a living technology system, which has got significant potential to impart science and ecological education focusing towards an integrated sustainable development process. This type of programme will help the students to acquaint themselves with the local flora and will create an interest in them to identify more plants and to know more about their economic importance for sustainable utilisation and harvesting (exploitation). Moreover, such activities play a fundamental role in the field of conservation (especially bio-diversity conservation) by motivating the students and creating interest in nature and its protection. Further these efforts can also have catalytic educational and development effects/benefits.

It may, therefore, be concluded that the infrastructure provided by the botanic gardens not only helps to instill in the children an environmentally compatible behavioural pattern but could also inculcate in them the skill and aptitude necessary for instrumentalising them as the responsible citizen who could play a vital role in
initiating total sustainable development in the future. It is the investigator’s firm belief that the seeds we sow in the creative minds now will grow, over a period of time in to gigantic trees, under whose shade thousands of people will find comfort and solace. More over they will feel that this earth is to keep up and not to exploit.

6.4.0 Implication of the study

Environmental education in botanic gardens is still a relatively young subject. Considerable research effort is needed in order to develop techniques to deal with the complex ecological relationships relevant to most environmental programmes.

The present study was conducted with an over all purpose of identifying the potential of botanic gardens for environmental education. The study was therefore designed on a triple phased attempt of analysing the infrastructure facilities of a particular botanic garden, reviewing the content of the biology text books and studying experimentally the effect of the field visit through a botanic garden with emphasis on the awareness of the local plants as well as rare and endangered medicinal plants.

The results of the present study have a wide implication for the improvement of learning biological sciences in the secondary schools. Based on those results a few suggestions for improvement of learning are presented.

(i) A visit to parks, zoos, etc. will make the students aware of the vast diversity that exists within the plant and animal kingdom and to appreciate the interdependence and importance to the planet.
(ii) Small gardens can be developed in the school itself with the active involvement of the students in the process of planting and protecting the different types of plants in their locality.

(iii) Eco camps can be formulated in schools and colleges to provide an opportunity to gain practical and firsthand knowledge of the problems of the environment and the ways in which they can be tackled.

(iv) Action plans are to be evolved to sensitize youth on the importance of conservation through the technique of learning by doing, by afforestation, social forestry, floristic and faunistic surveys and other research projects. There should also have a school and college liaison cell in all the botanic gardens.

(iv) Training can be given in various nursery techniques about the different propagation methods of economically important plants in collaboration with botanic gardens.

(v) Environment education programme in a holistic way encompasses comprehensive aspects of student's cognitive, affective behavior development. Therefore such programmes may be initiated by governmental and nongovernmental organizations.

(vi) The importance of conservation can be emphasized through exhibits depicting the flora and fauna showing their ecological relationships.

(vii) Afforestation programmes like raising school nurseries, planting trees on either side of the road, etc. can pay special attention to protect, preserve and maintain the natural wealth.
(viii) Training and educational programmes organised by botanic gardens for the students at various levels and public for the sustainable utilization of plant resources will be elaborated and emphasis will be placed on how environmental improvement and conservation is achieved through education.

(ix) Teachers from primary and high schools can be invited to participate in a series of workshops that intend to address the challenges and to continue towards building a culture of environmental awareness, knowledge and action.

(x) Botanic gardens can organize annual flower shows during December and January. Organisation and participation in the science exhibitions at various occasions may also be the prime activities of the garden. Plant identification competitions can be conducted in botanic gardens to identify more plants.

(xi) Debates and essay competitions can be conducted about the ways in which living collections in the garden could be more effectively used for a sustainable future.

(xii) Elements of the ayurvedic medicines are to be included in the school curriculum from primary level onwards. In each standard at least 5 medicinal plants can be included in the syllabus, there by we can sow the seeds of conservation in the minds of children.
6.5.0. Suggestions for further research

Although a large sample would be needed for drawing more definite conclusions the study illustrated the fact that the environmental education programmes in botanic gardens can play a relevant role in increasing consciousness about the environment. Such programmes are seen to have a strong potential for developing the nation’s ability to deal with biodiversity conservation especially those, which may have strong national implications.

Techniques and elements that have been developed for this programme can be applied to other field of botany making some modifications according to objectives. This study has the added value of being an exemplar of lesson planning which would be extended to any field from forest to city park.

On the basis of the findings of this research a study can be conducted to design an integrated ecological / environmental education plan for secondary school students in Kerala.

A study can be conducted to develop environmental education materials for different sections of society.

Research can be conducted to develop appropriate technology for promoting environmental education among children, youths, women and decision makers.

Surveys can be conducted to analyse the present attitude of people towards the environment.

Studies can be conducted for the development of curriculum in environmental education at different levels; pre-school to university level.
Production of professional material on environment for wide dissemination among the public through media can be undertaken.

Development of environmental awareness programmes for different sections of society is a useful attempt of study.

Case studies can be planned for the solution about the environmental problems of a locality.

A survey of the topics related to environmental education of schools that are scattered in various subjects, not only in the Natural science, but also in the Physical science, Social science, Geography, Economics and Literature can be conducted.

As a path finding application of this research effort, an example of a model curriculum, focusing the contemporary relevance of plant systems for sustainable development can be developed for the curriculum makers to study its scope and plausibility.