

**IMPACT OF ENVIRONMENTAL EDUCATION AMONG THE
HIGHER EDUCATION STUDENTS OF COIMBATORE DISTRICT**

**Thesis submitted to the Bharathiar University, Coimbatore
for the award of Degree of
DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL SCIENCES**

**By
CHANDRAN R
(Reg. No. 2011R838)**

**Supervised by
Dr. P. A. AZEEZ
Senior Principal Scientist - I**



**ENVIRONMENTAL IMPACT ASSESSMENT DIVISION
SÁLIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY
COIMBATORE – 641 108, TAMIL NADU, INDIA**

NOVEMBER 2017

Certificate

CERTIFICATE

This is to certify that the thesis, entitled “**IMPACT OF ENVIRONMENTAL EDUCATION AMONG THE HIGHER EDUCATION STUDENTS OF COIMBATORE DISTRICT**”, submitted to Bharathiar University, in partial fulfillment of the requirements for the award of the Degree of **DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL SCIENCES** is a record of original work done by **CHANDRAN R** during July 2011 to November 2017 of his research in the Environmental Impact Assessment Division at Sálim Ali Centre for Ornithology and Natural History (SACON), Anaikatty, Coimbatore 641108, Tamil Nadu, India under my supervision and guidance and the thesis has not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship or any other similar title of any candidate of any University.

Head of the Division

Signature of the Supervisor

**Head of the Institution
(Director)**

Declaration

DECLARATION

I, **CHANDRAN R** hereby declare that the thesis entitled “**IMPACT OF ENVIRONMENTAL EDUCATION AMONG THE HIGHER EDUCATION STUDENTS OF COIMBATORE DISTRICT**”, submitted to the Bharathiar University in partial fulfillment Degree of **DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL SCIENCES** is a record of original work done by me during July 2011 to November 2017 under the research supervision and Guidance of **Dr. P.A. AZEEZ**, Senior Principal Scientist-1, Environmental Impact Assessment Division at Sálím Ali Centre for Ornithology and Natural History (SACON), Anaikatty, Coimbatore - 641108, Tamil Nadu, India and it has not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship or any other similar title of any candidate of any University.

Signature of the Candidate

*Certificate of Genuineness
of the Publication*

CERTIFICATE OF GENUINENESS OF THE PUBLICATION

This is to certify that Ph.D. candidate **Mr. CHANDRAN R** working under my supervision has published a research article in the standard refereed journal named **Journal of Educational Research and Extension** with Vol. No. **53 (4)** Page Nos. **14-22** and year of publication **2016** published by **Sri Ramakrishna Mission Vidyalaya College of Education (Autonomous)**. The contents of the publication incorporate part of the results presented in his thesis.

Director

Research Supervisor

CERTIFICATE OF GENUINENESS OF THE PUBLICATION

This is to certify that Ph.D. candidate **Mr. CHANDRAN R** working under my supervision has published a research article in the standard refereed journal named **Economic & Political weekly** with Vol. No. **51 (48)** Page Nos. **58-65** and year of publication **2016** published by **A Sameeksha Trust Publication**. The contents of the publication incorporate part of the results presented in his thesis.

Director

Research Supervisor

CERTIFICATE OF GENUINENESS OF THE PUBLICATION

This is to certify that Ph.D. candidate **Mr. CHANDRAN R** working under my supervision has published a research article in the standard refereed journal named **Current Science** with Vol. No. **109 (1)** Page Nos. **171-176** and year of publication **2015** published by **Current Science Association**. The contents of the publication incorporate part of the results presented in his thesis.

Director

Research Supervisor

CERTIFICATE OF GENUINENESS OF THE PUBLICATION

This is to certify that Ph.D. candidate **Mr. CHANDRAN R** working under my supervision has published a research article in the standard refereed journal named **Periyar University Journal of Psychology** with Vol. No. **1 (2)** Page Nos. **64-67** and year of publication **2013** published by **Department of Psychology, Periyar University**. The contents of the publication incorporate part of the results presented in his thesis.

Director

Research Supervisor

Certificate of Plagiarism Check




பாரதியார் பல்கலைக்கழகம்
BHARATHIAR UNIVERSITY
COIMBATORE - 641 046, TAMILNADU, INDIA.

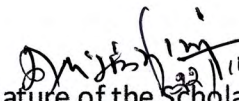
State University | Re-accredited with "A" Grade by NAAC | Ranked 14th among Indian Universities by MHRD-NIRF


CERTIFICATE OF PLAGIARISM CHECK


1	Name of the Research Scholar	CHANDRAN . R
2	Course of study	M.Phil., / Ph.D.,
3	Title of the Thesis / Dissertation	"IMPACT OF ENVIRONMENTAL EDUCATION AMONG THE HIGHER EDUCATION STUDENTS OF COIMBATORE DISTRICT"
4	Name of the Supervisor	Dr. P.A. AZEEZ
5	Department / Institution/ Research Centre	SALIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY, COIMBATORE.
6	Acceptable Maximum Limit	30 %
7	% of Similarity of content Identified	01 %
8	Software Used	URKUND
9	Date of verification	22 / 11 / 2017

Report on plagiarism check, items with % of similarity is attached


Signature of the Supervisor
Dr. P.A. AZEEZ
வரிசுத ப்ரவான வேஜானிக./Senior Principal Scientist-I
சாலிம் அலி பகிவிஜான எவ் ப்ரகூதி விஜான கேந்ர
Salim Ali Centre for Ornithology and Natural History
ஆனாகட்டி, கோயம்புடூர் - 641 108
Anaikatty (Post), Coimbatore - 641 108


Signature of the Scholar
22/11/2017


R&D Director (BU) / Head of the Department
Dr. P.A. AZEEZ
வரிசுத ப்ரவான வேஜானிக./Senior Principal Scientist-I
சாலிம் அலி பகிவிஜான எவ் ப்ரகூதி விஜான கேந்ர
Salim Ali Centre for Ornithology and Natural History
ஆனாகட்டி, கோயம்புடூர் - 641 108
Anaikatty (Post), Coimbatore - 641 108


University Librarian (BU)
University Librarian
Anghar Anna Central Library
Bharathiar University
Coimbatore - 641 046.

Research Coordinator (BU)

Urkund Analysis Result

Analysed Document: Chandran. R.docx (D32788521)
Submitted: 11/23/2017 10:04:00 AM
Submitted By: bulib_librarian@yahoo.co.in
Significance: 1 %

Sources included in the report:

Thesis-Asta Budvytyte.doc (D4044784)
Thesis.docx (D18473630)
Mathurajothi-thesis.docx (D26926558)
yogita's thesis for urkund.docx (D20877304)
<http://oopen.org/search?identifier=574829>

Instances where selected sources appear:

16



University Librarian
Arignar Anna Central Library
Sree Siddhagar University
Coimbatore - 541 046.

Acknowledgement

ACKNOWLEDGEMENT

I would like to thank the following people for the help and support they gave towards the completion of this thesis.

It is my honour, pleasure and privilege to express my utmost gratitude to my research supervisor **Dr. P.A. Azeez**, Senior Principal Scientist-I and former Director, Sálím Ali Centre for Ornithology and Natural History (SACON), for his extreme patience, understanding and, most importantly, encouragement throughout the whole doctoral program.

I sincerely thank **Dr. K. Sankar**, Director, SACON, Coimbatore, for providing all the necessary supports during the thesis writing period.

I also express gratitude to **Dr. P. Balasubramanian**, Senior Principal Scientist and Research Co-coordinator, Landscape Ecology Division, SACON, for his encouragement and support during the completion period of this study.

Words will not suffice to thank **Dr. Sylvia Christine Almeida**, **Dr. Ernesto Lasso De Lavega** and **Dr. Gebre Tafere**, for their suggestions and help made during the research tool construction and review of literature collection.

My heartfelt thanks to **Rameshkumar**, **Samsoor Ali** and **Shanthakumar**, Ph.D. Scholars, SACON, for their help, support and motivation throughout the research period.

I profusely thank all the staff of SACON and Sri Ramakrishna Mission Vidyalaya College of Education, for their kind help and co-operation throughout my study period.

This study was made possible by the JRF fellowship awarded by the University Grants Commission (UGC), Government of India for providing me with timely financial support.

Also I acknowledge the great help I received from college correspondents, principals, faculties and students of the various colleges, I studied who spent their time completing survey and proving me with information for my thesis report.

This thesis is the result of my childhood friends who were always there when I really needed and spending their precious time with me and gave their valuable suggestions.

My work would not have been possible without the kind support and help of many other individuals not mentioned here. Once again I would like to express my sincere thanks to all of them.

I would like to express my gratitude towards my family for the encouragement which helped me in completion of this thesis. My beloved and supportive wife, ***Deepthi*** who is always by my side when times I needed her most and helped me a lot in making this study.

Lastly, this thesis is dedicated to my child, ***Akshad Deeran***. It is hoped that through this work, one day, you may understand why I was not with you during some of the important days of your lives.

Chandran R

Contents

TABLE OF CONTENTS

Title	Page No.
ACKNOWLEDGEMENT	
LIST OF TABLES	
LIST OF FIGURES	
CHAPTER-I (INTRODUCTION)	
1.1 Background of the study	2
1.2 Statement of the problem	4
1.3 Significance of the study	4
1.4 Research questions	6
1.5 Definitions of key terms	7
1.6 Scope of the study	8
1.7 Limitations of the Study	9
CHAPTER-II (REVIEW OF LITERATURE)	
2.1 Environmental concerns and challenges (global to local)	10
2.2 EE – Important milestones (global to local)	25
2.3 Studies on awareness, attitudes, knowledge and practice of EE	37
2.4 Sources of information on environmental issues and EE	41
2.5 Constraints to effective implementation of EE	42
2.6 EE Studies in India	44
CHAPTER-III (METHODOLOGY)	
3.1 Brief Description of the Study Area	49
3.2 Objectives of the study	51
3.3 Hypotheses of the study	51

	Title	Page No.
3.4	Methodology	51
3.5	Methods of Data Collection	
3.5.1	Sampling	52
3.5.2	Instrument	57
	3.5.2.1 Structure - Students' Instrument	58
	3.5.2.2 Structure –Teacher's Instrument	60
3.5.3	Data Collection	65
3.6	Statistical Analysis	65
CHAPTER-IV (RESULTS AND DISCUSSION)		
4.1	Rate of Return of completed questionnaires / instruments	66
4.2	Research Questions	
4.2.1	Students' Environmental Awareness (EA)	66
4.2.2	Students' Environmental Attitudes (EAtt.)	72
4.2.3	Students' Environmental Knowledge (EK)	80
4.2.4	Students' self-efficacy (SE)	86
4.2.5	Students' Attitude towards Social responsibility (SR)	93
4.2.6	Students' Environmental Actions	98
4.2.7	Students' Awareness-Knowledge-Attitude-Self-efficacy-Actions linkage	104
4.2.8	Teachers' Awareness about Environmental Issues and Environmental Education	105
4.2.9	Teachers' perception of local (Coimbatore) environmental conditions	110
4.2.10	Teachers' Level of concern about local environmental issues	114
4.2.11	Teachers' Overall Environmental Awareness	119

	Title	Page No.
4.2.12	Teachers' Environmental Attitudes	122
4.2.13	Teachers' Attitudes towards Environmental Education	128
4.2.14	Teachers' Actual Practice of Environmental Education	135
4.2.15	Teachers' Awareness-Attitude-Practice linkage	140
4.2.16	Teachers' Information Sources on Environmental Issues and EE	142
4.2.17	Students' Feelings about their Competence to Learn Environmental Education	144
4.2.18	Teachers' Feelings about their Competence to Teach Environmental Education	146
4.2.19	Learning Environmental Education: Opportunities and constrains for students	148
4.2.20	Teaching Environmental Education: Opportunities and Constraints	151
4.2.21	Single most important common and environmental issues for Tamil Nadu government	157
 CHAPTER-V (CONCLUSIONS AND RECOMMENDATIONS)		
5.1	Conclusions	162
5.2	Recommendations	164
	References	167
	Appendices	
	Publications	

List of Tables

LIST OF TABLES

Table No.	Title	Page No.
CHAPTER-II (REVIEW OF LITERATURE)		
1	Regional share of global consumption and population	18
2	Chronology of landmark developments in EE	26
3	Chronology of key developments in EE in India	36
CHAPTER-III (METHODOLOGY)		
1	Schools for general education, students and teachers in Coimbatore	50
2	Colleges for general education, students and teachers in Coimbatore	50
3	Number of samples in each college	52
4	Demographic Characteristics of the student participants	55
5	Demographic Characteristics of the Teacher participants	56
6	Student Survey Questionnaire – Tool (Instrument structure)	59
7	Teacher Survey Questionnaire– Tool (Instrument structure)	64
CHAPTER-IV (RESULTS AND DISCUSSION)		
1	Details about questionnaires distributed and returned for the Study	66
2	Percentage distributions of the respondents’ overall Environmental awareness (EA)	67
3	Scores of Environmental Awareness (EA) among students	68
4	Independent Sample “t”- test for EA Scores by Gender, Parents literacy, Residence location and Nativity.	69
5	One-way ANOVA on EA Scores	70
6	Frequency distributions of the Respondents for NEP Scale	75
7	Percentage Responses of pro and anti NEP Scale	75
8	Mean and SD of Environmental Attitude Scores	76
9	Independent Sample “t”- test for Environmental Attitude Scores by Gender, Parents literacy, Residence location and Nativity	77
10	One-way ANOVA for Environmental Attitude Scores	78

Table No.	Title	Page No.
11	Frequency and Percentage Distributions of the responses indicating the Respondents' Environmental knowledge	81
12	Mean Scores and SD of Environmental Knowledge Scores	82
13	Independent Sample "t"- test for Environmental Knowledge Scores by Gender, Parents literacy, Residence location and Nativity	84
14	One-way ANOVA for Environmental Knowledge Scores	84
15	Frequency and Percentage distributions of the respondents' self-efficacy statements	88
16	Mean Scores and SD of Self-efficacy Scores	89
17	Independent Sample "t"- test for self-efficacy Scores by Gender, Parents literacy, Residence location and Nativity	90
18	One-way ANOVA for Self-efficacy Scores	91
19	Frequency and Percentage distributions of the respondents' Social Responsibility (SR) statements	94
20	Mean Scores and SD of Social responsibility Scores	95
21	Independent Sample "t"- test for social responsibility Scores by Gender, Parents literacy, Residence location and Nativity	96
22	One-way ANOVA for Social responsibility Scores	97
23	Responses to actions taken on behalf of Environmental issues by all participating student groups	99
24	Mean Scores and SD of Environmental actions Scores	100
25	Independent Sample "t"- test for Environmental actions Scores by Gender, Parents literacy, Residence location and Nativity	101
26	One-way ANOVA for Environmental Actions Scores	102
27	Pearson's Product Moment Correlation-Students	104
28	Percentage of Teachers Giving Correct Responses	106
29	Mean Scores and SD of Teachers' Awareness about Environmental Issues and Environmental Education	107
30	Independent Sample "t"- test for Teachers' Awareness about Environmental Issues and Environmental Education Scores	108

Table No.	Title	Page No.
31	One-way ANOVA for Teachers' Awareness about Environmental Issues and Environmental Education Scores	109
32	Frequency and Percentage Distributions of the Respondents' perception of local environmental conditions statements	110
33	Mean Scores and SD of Teachers' perception of local Environmental Issues	112
34	Independent Sample "t"- test for Teachers' perception of local Environmental Issues	113
35	One-way ANOVA for Teachers' perception of local Environmental Issues/Conditions scores	114
36	Frequency and Percentage distributions of the respondents for level of concern about local environmental issues statements	115
37	Mean Scores and SD of Teachers' level of concern about local environmental issues	116
38	Independent Sample "t"- test for Teachers' level of concern about local environmental issues scores	117
39	One-way ANOVA on Teachers' level of concern about local environmental issues/Conditions scores	118
40	Percentage Distributions of the Respondents' overall Environmental awareness	119
41	Mean Scores and SD of Teachers' overall Environmental Awareness	120
42	Independent Sample "t"- test on Teachers' Overall Environmental Awareness scores	121
43	One-way ANOVA on Teachers' Overall Environmental Awareness scores	122
44	Frequency Distributions of the Respondents for NEP Scale statements	123
45	Percentage Responses of Pro and Anti NEP statements	125
46	Mean Scores and SD of Teachers' Environmental Attitude	126
47	Independent Sample "t"- test for Teachers' Environmental Attitudes scores	127
48	One-way ANOVA for Teachers' Environmental Attitudes scores	127
49	Frequency of Percentage Distributions of Responses to EE Attitude Statements	128

Table No.	Title	Page No.
50	Acceptance that EE should be taught across the curriculum by country	131
51	Mean Scores and SD of Teachers' Attitudes towards Environmental Education	133
52	Independent Sample "t"- test on scores of Teachers' Attitudes towards EE	134
53	One-way ANOVA on scores for Teachers' Attitudes towards Environmental Education	135
54	Rankings of EE Practices	137
55	Mean Scores and SD of scores for Teachers' Teaching Practices of EE	138
56	Independent Sample "t"- test on score for Teachers' Teaching Practices of EE	139
57	One-way ANOVA of scores for Teachers' Teaching Practices of EE	140
58	Pearson's Product Moment Correlation-Teachers	141
59	Rankings of the different experiences that have been useful for the teachers' knowledge, attitudes and skills about environmental issues and EE	143
60	Rankings of the Students' Feelings about their Competence to Learn EE	145
61	Mean Scores of Responses for the Various Aspects of EE	146
62	Rank of teachers' competence to teach the various aspects of EE	147
63	Rankings of the various opportunities for EE learning	148
64	Rankings of the various obstacles that hinder students' EE activities	150
65	Rankings of the various opportunities for EE teaching	151
66	Rankings of the various obstacles that hinder teachers' EE activities	152
67	Summary of the Presence (Yes) and Absence (No) of significant differences among all demographic variables with respect to awareness, knowledge, attitude, self-efficacy and actions across all student groups	155
68	Summary of the Presence (Yes) and Absence (No) of significant differences among all demographic variables with respect to awareness, attitude and practices across all teacher groups	156
69	Rank order of the various common and environmental issues facing Tamil Nadu	157
70	Rank order of the various environmental issues for Tamil Nadu government	158

List of Figures

LIST OF FIGURES

Figure No.	Title	Page No.
CHAPTER-III (METHODOLOGY)		
1	The sampling points	54
CHAPTER-IV (RESULTS AND DISCUSSION)		
1	Percentage of students' Environmental awareness level	67
2	Bar graph representation of respondents' perception about their locality environmental conditions	111
3	Respondents' level of concern regarding their environmental conditions	115
4	Percentage of Environmental awareness level among teachers	119
5	Percentage representations of Tamil Nadu government's common issues	158
6	Percentage representations of top ten environmental issues	159

Chapter -I
Introduction

CHAPTER I

INTRODUCTION

"The interest in conservation is the rediscovery of a truth well known to our sages. The Indian tradition teaches us that all forms of life: animal and plant are so closely linked that disturbance in one gives rise to imbalance in the other"

- (Indira Gandhi, World Conservation Strategy for India, March 1988)

In the last couple of decades world over there is serious deliberations on the need for pro-active participation of the public, various social segments, and persons from various walks of life in conservation of the Environment and on identifying effective strategy to accomplish that. It is well recognized that conviction, at the grass root level, on the cruciality of environmental conservation is essential for wide and involved participation of public. Environmental education (EE), especially among the youngsters, to a great extent fulfills that need and facilitates educated decision-making among the public on issues related to environment. Thus, the main goal of EE is developing a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively toward solutions of current problems and prevention of new ones. In other words, the ultimate goal of EE is to promote development of responsible environmental behavior (Hungerford & Volk, 1990). At the formal level of education, the responsibility for EE mainly rests with schools, colleges, and universities and other tertiary institutions (Palmer, 1998). India has more than 40% of young people in the world. Sensitization of that major chunk of populace and inculcating the practice of appropriate environmental mannerism will improve the present environmental conditions (Sivamoorthy, Nalini, & Satheesh, 2013) and ensure the environmental sustainability for posterity. Furthermore, while there is an increase in development of educational policies, there is a serious dearth of research concerning higher education teachers' and students' perspectives in the development and implementation of environmental education. This is particularly manifested in India where research in higher education and environmental

education is sadly lagging. Hence, the present study has been undertaken. The study is perhaps the first of its kind in India that examines the impact of EE among the learning community (students) and explores the functioning of teachers engaged in handling EE as a subject. In a climate of national and international policy reforms in EE (United Nations Environment Programme (UNEP), 1972; National Policy of Education (NPE), 1986; UNESCO-UNEP, 1992; UNESCO, 1992; Supreme Court of India, 2003; University Grants Commission (UGC), 2004; National Curriculum framework (NCF), 2005; UNESCO, (2007); United Nations Decade of Education for Sustainable Development (UNDESD), 2007), this study is particularly important in shedding light on the ways in which EE is understood, negotiated, determined and implemented in higher education institutions.

1.1 Background of the study

Environmental Education (EE) has been increasingly one of the major interests of educational organizations, local communities, corporate agencies, private sector institutions, and local governments for the last several years. The anxiety for the cause for environmental protection was also wide among the concerned citizens and the authorities. Consequently, in December 2003, the Supreme Court of India mandated teaching of environmental education across all years of formal schooling (Supreme Court of India, 2003). At the time, the apex court's order appeared to provide a much-needed impetus in raising the awareness of environmental issues in India; a phenomenon that has been growing significantly alongside the rapid growth of Indian economy (Rangarajan, 2009; Ravindranath, 2007).

While the education community welcomed the mandate, the mode of implementation raised many concerns. Even, the Intergovernmental Conference on Environmental Education (UNESCO, 1977) recommended the primary categories of EE curriculum goals and objectives as (a) awareness, (b) knowledge, (c) attitudes, (d) skills and (e) participation. In order to accomplish this, there were apprehensions on strategy to put emphasis on the importance of awareness, knowledge, or attitude. Madsen (1996) explained that environmental awareness, knowledge, and commitment are necessary to achieve environmental protection and restoration, emphasizing that the public must have

a basic grasp of environmental problems. It was also cleared that leaders in the field of EE must not only have extensive knowledge and understanding of environmental problems, but also must have awareness to address and solve these problems. They must be committed “*to initiate action, based upon knowledge and understanding*” (Madsen, 1996).

Ultimately, this process rests in the hands of well-educated segment of the society who can train their new generations toward becoming environmentally responsible citizens. Successful implementation of EE programs within the formal education system and the extent to which it is adopted outside this sector thus is therefore likely to depend on teachers with good understanding of environmental issues, desirable attitudes towards the environment in general and EE in particular, and commitment to act responsibly. Besides, how the government would support teachers in implementing the mandate and how it would be translated into everyday teaching practice are crucial phenomena. On a more fundamental level, the question as to whether or not teachers were comfortable with the mandate and shared the same environmental concerns in higher education is also important (Hart, 2003).

I have lived Coimbatore district (a fast growing metro city) for almost thirty-five years. However, each visit back to my hometown, Dharmapuri (Relatively bucolic) has left me with a gnawing realization that a lot needs to be done towards stemming the environmental concerns that have been growing disproportionately to the colossal economic strides that Coimbatore has been taking in recent times. The changes have come with dizzying speed and it feels like “watching time-lapse photography”.

Conversations with my doctoral supervisor and eminent personalities in the field of higher education have led me to believe that EE in formal tertiary education institutions is still in a nascent stage, it is a fringe component in the process of formal education, and there is a perceived gap in research about EE in higher education. It is my hope that this study will help to begin bridging that. With this desire, this study is conducted among various college students and their teachers in Coimbatore district.

1.2 Statement of the problem

Worldview determines largely the way in which society relates to nature and the environment (Kyburz-Graber, Regendinger, Hadorn, & Werner Zentner, 1997a, 1997b). The dominant worldview of humans as superior to the rest of nature has dominated for thousands of years (Devall & Sessions, 1985). This worldview led to escalation of the impacts of human activities and influences as well as risks and threats associated with those impacts (Palmer, 1998). That worldview also imparted an authoritarian notion among dominant societies that nature is meant for human consumption and conveniences, to be exploited and managed.

EE has been seen as a basic tool to contribute to the change of conceptions, values, and attitudes (Tracana, Ferreira, Carvalho, & Ferreira, 2008) and foster a considerate attitude towards human-nature relationship. That is why EE is getting increasing attention from people concerned with the problems of a sustainable environment (Rii, 2000). That individuals must learn in a formal way to reflect on the implication of their actions and act in positive ways that support and enhance the quality of life and the environment has been advocated by environmentalists, politicians, educationalists, and EE (both formal and informal) as a response to this (Lee & Williams, 2001). In formal system of education, teaching of EE depends not only on curriculum and on other facilities provided to the students, but also on the quality of teachers in terms of their knowledge, awareness, attitudes and skills relating to EE (Larijani & Yeshodhara, 2008).

Awareness, attitude, knowledge, and participation are objectives that are important components in the scheme of EE. In EE research, these components could be measured in EE research using appropriate evaluation instruments. The purpose of this study was to evaluate the level of these components (awareness, attitudes, knowledge and participation) with respect to environment among students in higher education classes in the context of their EE curriculum and to assess their teachers' awareness, attitude and practice of EE in Coimbatore district.

1.3 Significance of the study

India, a land of ecological, bio-geographical, cultural and social diversity, requires efforts that are rooted in the local context, which present a picture to which the student

can relate and can offer opportunity for solutions in which the student can be a part. What's more, the Article 48 A of the Constitution of India provides that the states should endure to protect and improve the environment and safeguard the forests and wildlife of the country. Article 51 A(g) of the constitution imposes as one of the fundamental duties on every citizen to protect and improve the natural environment, including forests, rivers, lakes and wildlife and to have compassion for living creatures. Nevertheless, despite the deteriorating state of the environment public participation in environmental protection is much less in the country, and hence attention from academics in the form of formal studies of environment and reaching out with the finding to the public are much wanted in the country. Realizing this, the Hon'ble Supreme Court of India directed the University Grants Commission (UGC) to introduce a basic course on environment for every student pursuing a formal course. Accordingly, the matter was considered by the UGC and it was decided that a six-month compulsory core module course in EE be prepared and compulsorily implemented in all the Universities / Colleges in the country.

The University Grants Commission (UGC, 2004) and All India Council for Technical Education (AICTE, 2004) India's top policy-making bodies for higher education clearly acknowledged the crucial role of EE as the subject in creating environmental consciousness amongst all sections of society. These bodies, while appreciating the importance of EE in higher education, also acknowledged the lack of work and progress in the subject. These bodies well appreciated the need for EE to be made compulsory and taught as an integral component of higher education.

Unfortunately, there appears little evidence that this proposal is being implemented in letter and spirit and that is where the significance of the present study lies, i.e., understanding impacts of EE on students and experiences of teachers implementing EE as of now. Following the adoption of the new National Curriculum Framework (NCF) in India, Environmental concerns were infused in almost all subjects of the school curriculum. However, the way of imparting EE in school was not alike throughout the country and there was also no definite or set standard for the same. Moreover, question persisted whether EE could be treated as a separate subject or be infused in curricula through certain chapters in other relevant subjects. Furthermore, the EE in school education suffer from deficient concept, logic, knowledge, and skill needed

to deal with environmental problems (Gordon, 1995). Along the same line, the tertiary level education system have definite compulsory EE subject and the teachers are the prominent actors in implementation of the curricula and hence it is appropriate that an attempt is made about its effectuality in achieving the set objectives.

There has been very little research regarding EE issues in India. Furthermore, the works that have been done so far have tended to focus on school and college students' views with the consequence but the teachers' views and practices of EE have not been amply investigated. Considering these vital cues, this study was conducted to assess the relationship between EE teachers' professional approach and its impacts on college students' awareness, knowledge and attitudes to EE and their actions towards environmental protection. It also attempts to identify the opportunities and constraints for effective EE that will enable educationalists and other concerned bodies to be aware of students' and their teachers' ideas and thoughts, and the nature of EE practices at tertiary level and if required corrective measures can be thought over.

1.4 Research questions

This study is conceived with the following questions in mind:

1. What are the levels of awareness, knowledge, and attitude of college students, who study components of EE in their curriculum?
2. What is the self-efficacy level of awareness, knowledge, and attitude among different groups of students?
3. What is their attitude towards social responsibility needed to resolve an environmental problem?
4. What are the personal actions taken by students to protect their local environment?
5. To what extent demographic and personal factors account for differences in the levels of awareness, knowledge and attitude of the students?
6. What is the level of awareness and attitude on environmental and EE among college teachers who teach components of EE as part of the curriculum?

7. What are the teachers' pedagogical practices for teaching EE in college settings?
8. To what extent do students feel competent and prepared for learning EE?
9. To what extent do teachers feel competent and prepared for teaching EE?
10. What are the sources of information for teachers about environmental issues and EE?
11. What are the opportunities and constraints for learning and teaching EE?

1.5 Definitions of key terms

UNESCO Intergovernmental Conference on Environmental Education (presented by Gough, 1997; Athman & Monroe, 2000) has provided comprehensive and concise explanations / definitions of the variables relating to the present study as follows:

- **Environmental education:** a process of developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.
- **Awareness:** to acquire concern and sensitivity towards the environment and its problems.
- **Knowledge:** to gain experiences and a basic understanding of the environment and its problems.
- **Attitude:** to acquire values, feelings of concern, and motivations towards the participation of environmental improvement and protection.
- **Skills:** to help social groups and individuals acquire the skills for identifying and solving environmental problems.
- **Participation:** to provide social groups and individuals with an opportunity to be actively involved at all levels in working towards resolution of environmental problems

Based on the above definitions for the purpose of clarity and uniformity those variables are defined succinctly by Ernesto (2004) and these are used in the defined sense throughout the present study.

- **Environmental Awareness:** descriptive and interpretive knowledge about separate facts and phenomena and cause - response in the environment; and understanding ecological problems and awareness of the effect of human beings on the environment.
- **Environmental Attitude:** feelings and thoughts towards human - environment interactions.
- **Environmental Education Awareness:** trust and understanding of the role of environmental education in solving environmental problems
- **Environmental Education Attitude:** interest and concern for and understanding of environmental issues and involvement in environmental action and teaching.
- **Practice of Environmental Education:** teaching environmental issues, engagement in co-curricular activities and participation in environmental action in the community.
- **Self-efficacy:** a construct of Bandura's social-cognitive learning theory. According to Gredler, (2001), "perceived self-efficacy is the learner's belief in his or her capabilities to successfully manage situations."
- **Student:** A volunteer participant chosen from the population of students in the Coimbatore colleges.
- **Instrument:** The evaluative questionnaire used to study the participant groups.

1.6 Scope of the study

Of the several issues with respect to EE in India, this study will focus on three issues:

- 1) Students' awareness, attitude, knowledge and actions towards their environmental issues
- 2) Teachers' awareness, attitudes and practice of environmental education
- 3) The opportunities and constraints for learning and teaching EE.

To improve comprehensiveness of the study, the developmental aspects of EE in the existing tertiary level will also be assessed. This study delimits itself to the college students and teachers in Coimbatore district.

1.7 Limitations of the Study

The major limitation of this study is that information collected is restricted to programs being run in the colleges of the Coimbatore district (within 30-40 km radius of the Coimbatore city) and cannot be generalized to all EE programs across wider geographical domain. Another limitation of this study is the scope of subjects/participants, again limited in number and areal coverage. Other limitations include the subjects are informed voluntary participants who returned the completed survey only, all participant groups are not proportionately represented in number; and financial and logistic issues limited the geographical area as well as the sample size of this study.

Chapter-II
Review of Literature

CHAPTER II

LITERATURE REVIEW

This Chapter presents a focused review of the existing literature pertaining to the major concepts of this study. The review progresses through six sections as follows:

- (1) Environmental concerns and challenges (Global to local),
- (2) EE – Important milestones (global to local),
- (3) Studies on awareness, attitudes, knowledge and practice of EE,
- (4) Sources of information on environmental issues and EE
- (5) Constraints to effective implementation of EE, and
- (6) EE studies in India.

Besides a bird's eye view of the studies have been discussed in the Overview section.

2.1. Environmental concerns and challenges (global to local)

Shrinkage and fragmentation habitats in their extent and quality, and over-exploitation of the natural resource much beyond their natural regeneration capacity is the prime global as well as local challenge. According to Brown (2011), forests are shrinking by 13 million acres per year for by clearing land for agriculture and felling trees for timber and paper. Four fifths of oceanic fisheries are being fished at capacity or overfished and heading toward collapse. In the case of natural and aquatic, in system after system, demand is overshooting supply and natural capacity for renewal.

Matthews et al. (2012) are of the opine that humans have caused more changes to the ecosystems in the past 50 years than any comparable period in history to meet fast growing demands for resources (such as food, fresh water, timber, fiber, minerals and fuel) leading to large and irreversible loss to diversity of life on Earth.

UNEP (2012b) reports that if China and India (two economic giants) fail to improve their environmental footprint, they will be responsible for 37% of the raise in the global environmental footprint by 2015.

If the entire world adopted U.S.'s current resource consumption and waste production patterns, Bryner (2011) points out that it would amount to having the world's population growing to 72 billion.

Diamond (2005), Krapivin & Varotsos (2007), Nielsen (2005), Palmer (1998) and the recent GEO 5 report (UNEP, 2012a), amongst others, have described and categorized global environmental problems in detail. In this review, some of obvious global environmental problems are briefed placing them in the following categories.

- **Population growth, mounting consumption and untenable paradigm of development:** Since 1950, the world's population has increased from 2.8 billion to about 7 billion in the year 2011 (Rajagopalan, 2011). In this century, the world has experienced the highest rate of population growth (averaging 2.04% per year) in the 60s and the largest increment to the world population (86 million people every year) in the 80s (U. S. Bureau of Census, 2009), a sudden and very fast growth according to Neilsen (2005). Naturally, this rapid increase placed tremendous burden on the limited and finite resources of the Earth particularly food, freshwater, wood, fiber and fuel (Palmer, 1998; Pretty et al., 2007).

The increasing population has forced a 2.5-fold increase in food production from 1980-2000, more than doubled the freshwater consumption, tripled the use of wood for paper and doubled the power generation from hydroelectric stations (Krapivin & Varotsos, 2007). Concurrently, the modern paradigm of economic development that is based on increasing consumption multiplies and diversifies the resource requirements and what's more produces a variety of relatively recalcitrant and exotic waste materials. The consumerist development essentially requires intensifying harvest of natural resources (conventional as well as unconventional) using modern technology. It is said that in the next 50 years, the need for food will grow by 70-85% and the need for water will increase by 30-85%, and this will lead to further pressure of the ecosystem and its further degradation. Such intensified usage normally lead to the outbreak of diseases, fall in water quality of especially coastal waters, leading to collapse of fisheries and climate change and several other adverse changes.

In short, the continuing rapid population growth leads to scarce cropland, dry wells, disappearing forests, increased soil erosion, rising unemployment and spreading hunger (Brown, 2011). Three issues namely, loss of biodiversity, scarcity of fresh water, and disruptive climate change have been marked as particularly difficult and typical of the environmental problems facing humanity (Bryner, 2011).

- **Deforestation:** Loss of forests at the rate of 15-20% since pre-agricultural times has led to a rapid loss of biodiversity (Cuff & Goudie, 2009). Most deforestation is happening in the tropics with countries like Indonesia losing large tracts of forests for farming (Gornall, Wiltshire, & Betts, 2012). Gornall et al. (2012) reports globally forest cover declining at the rate of 200 km² per day between 2000 and 2005. An estimated 45 million hectares of forests is lost annually that foreshadows the loss of all biologically productive land in 200 years (Nielsen, 2005). In India the forest cover has declined from 40% a century ago to 19%, in effect losing more than half of its forests (Rajagopalan, 2011). In the past 30 years, larger amounts of land were transformed into agricultural lands, 20% of global coral reefs have been lost and 20% have been damaged, 35% mangroves have been destroyed. World over, about 50% of the wetlands have disappeared since 1900 (Bryner, 2011). It is estimated that about one species every 20 minutes or approximately 30,000 species every year vanishing from Earth which is about 1000 times higher than normal (Edwards, 2010). In an interview, as quoted by Mazur & Miles (2009), Vandana Shiva points to the expedited loss of genetic diversity particularly of cultivated species due to genetic manipulation/engineering. Overall, it is estimated that at this rate half of the living species in the world will be wiped out in the next 70 years (Krapivin & Varotsos, 2007).
- **Drought, denudation and desertification:** Desertification affects approximately one-sixth of the world population, about 70% of all dry lands and about a quarter of the entire land area of our planet (Bryner, 2011). While this is caused by natural processes like soil erosion, it is considerably accelerated due to human activities. Removal of forests or grazing pastures for agriculture, large-scale logging and clearing for timber or fuel wood along with agricultural

mismanagement, land conversion, industry and urbanization (including roads and highways) are causes for rapid desertification (Kemp, 2004). While drought and famine have been longstanding issues, these seem to have exacerbated in recent times. Additional desertification, which is mainly human-made, underlines human contribution to the problem. Land management is also a serious issue that affects the environment with a plateau reached in nitrogen use efficiency. This translates to farmers having to use increasing levels of fertilizers that adds to the problem of runoff of nitrogen into the biosphere creating hazardous water and atmospheric pollution (Gornall et al., 2012).

- **Fresh Water:** Fresh water resources, both surface and groundwater, face growing demand and decline in water quality due to pollution and amplified exploitation. As mentioned earlier the increasing population has placed enormous burden on the water systems of the Earth. Only 0.3 % of the Earth's water resources are found in renewable resources like lakes, rivers, marshes, and wetlands, which are becoming increasingly polluted affecting water quality. It is said that global water withdrawals have increased seven fold in the past 100 years. Water availability has fallen by 40% in industrialized nations and 70% in developing, and it is estimated to go down further to 80-90% of the level in 1950s (Nielsen, 2005). According to the World Bank (2003), by 2025 there will be a 50% increase in water consumption over the next thirty years and about half the world's population will live under conditions of severe water stress.
- **Oceans and other marine system:** Degradation of oceans, coast and marine resources due to pollution and over exploitation is another grave environmental issue. The number of large fish in the oceans has decreased by 90% since the beginning of industrial fishery (Orr, 2007). Excessive pollution and oil spills from shipping accidents lead to the formation of 'dead zones' – parts of the oceans that cannot support any form of life (Nielsen, 2005). Plastic debris (Gross, 2005) and the formation of microplastics are other serious issue that threatens the marine ecosystem. Numerous species, from planktons to whale, ingesting plastics of various sizes and qualities either are killed or become increasingly morbid, posing serious threat to their long-term survival.

- **Air pollution:** Air pollution, climate change, ozone layer depletion and acid deposition are pressing environmental issues directly influenced by human contributions. Air pollution mainly caused by the use of fossil fuels has harmful effects on human health, apart from its wide-ranging impacts on plants, ecosystems and even manmade historical monuments. It kills about 1.9 million people each year in developing countries. India and China have the highest levels of air pollution in the world, and cities such as Delhi, Calcutta and Mumbai are amongst the most polluted (Nielsen, 2005), the possible reasons being high vehicle density, intensive construction activities and also at certain locations burning refuse. Some of these pollutants are responsible for thinning and causing holes in the ozone layer, along with increasing amounts of greenhouse gases are advancing the global warming process. Bryner (2011) summarizes the evidences that clearly show the effects of global warming like the almost two fold increase in average Arctic temperatures over the past hundred years or the widespread changes in extreme temperatures over the past fifty years. *‘Climate change threatens, among other things, food security and biodiversity’* and people in *‘developing regions are especially vulnerable to the effects of climate change’* as per UNEP (2012a). It is expected that by the end of the century warming could be up to 5°C compared to pre-industrial times and this would lead to a world with *‘more extreme weather events, most ecosystems stressed and changing, many species doomed to extinction, and whole nations threatened by inundation’* (World Bank, 2010). At the climate conference in Paris (December 2015) 195 countries, among other vital pro climate efforts, agreed to reduce emissions by keeping well below 2°C above preindustrial level; aim to limit the increase to 1.5°C; and undertake rapid reductions with the best available science. Further they also agreed for Intended Nationally Determined Contributions (INDC), transparency and stocking, and continued and enhanced international support for adaptation to developing countries. However, with the change in guard, the USA, the highest contributor of Greenhouse gas in the world, is withdrawing from the agreement, a serious threat to the climate change agreement and further actions to curtail temperature hike within 2°C.

- **Energy:** Growing demand for energy coupled with unsustainable use and pollution of the environment are pressing problems for humankind. Energy consumption has increased nearly 70% since 1971, and it is projected to increase approximately 2% per annum over the next fifteen years (Bryner, 2011). The approaching energy crisis is caused mainly by the exhaustion of fossil fuel supplies, which have already fallen to half and expected to fall further. As demands for these fuels continues to rise there is an ever-widening gap between supply and demand (Nielsen, 2005). Consequently, there is also the threat of increasing pollution from the process of energy production. Although non-conventional energy resources being increasingly tapped much more technical advances are required to make them the chief sources. Further, innovations are wanted to make the gadgets more and more energy-efficient. Technical and policy level changes are also required to delink Gross Domestic Product (GDP - considered as an index of economic development) with energy use.
- **Waste:** Population growth, new lifestyles and rapidly changing technology create serious waste disposal problems (Kemp, 2004). The current business strategy of increasing consumption adds on not only to the quantity but also to quality of waste produced. The types of wastes are increasingly changing from biodegradable to lesser biodegradable to non-biodegradable. Managing exceeding levels of solid waste and use of non-biodegradable products particularly plastics is increasingly becoming a grievous threat to the environment, other flora and fauna, and welfare of humankind. Conventional issues such as Disposal of hazardous substances including nuclear waste also remain serious points of contention.
- **Global Security:** Global security is threatened due to increasing conflicts over sharing (or lack thereof) of resources. The World Commission on Sustainable Development points out that historic response to the above-mentioned scarcity of resources has often been the source of conflict (Barrow, 2012; World Commission on Environment and Development, 2004) and that are going to be drivers to many national and international violations that would cause and huge human miseries.

Apart from the challenges briefly noted above, other issues such as decreasing levels of photosynthetic ceiling, the amount of sunlight fixed by plants to produce food, the proliferation of 'alien species' or non-native species, and increasing production of greenhouse gases by the burgeoning human population are also cause for concern (Diamond, 2005). According to Orr (2007) these issues pose a trouble future for the signature accomplishments of the fourth 'design revolution' (e.g. creating a homogenized industrial civilization through science and technology).

The World Wildlife Fund (WWF, renamed in 1986 as World Wide Fund for Nature), citing the loss of a third of the planet's wildlife in the past 35 years, contends that humans will need the equivalent of two planets if current lifestyles continue unabated (WWF, 2008). Neilsen (2005) affirms that the increasing population is putting enormous stress on the environment, and human needs are now reaching or exceeding the planet's ecological limits. If current consumption levels continue there will be a surplus of 3 billion people on the planet by 2020, and six Earth-like planets will be needed to accommodate the surplus population.

Neilsen (2005) also categorizes social decline as key environmental issue and lists the gap between the "haves and the have-nots" and the disparity in their income as a leading cause for concern. China and India for example account for 76 percent of the world's population but for only 29 percent of its income. Krapivin & Varatsos (2007) point out that about 1.1 billion people live on daily income of less than a dollar a day. Such poverty is particularly acute in Asia and Africa with 29 sub-Saharan African countries forming the bottom rung of the Human Development Index (HDI), an index developed to rank 177 countries based on their level of socio-economic welfare, health and education (Human Development Report Office, 2011). In countries such as Ethiopia, 98% of the population lives on less than \$2 a day. This disparity is evident even locally within countries. For example, on the one hand India is home to some of the multi-billionaires in the world, on the other hand 60% of India's poor live on INR 35 (approx. half a dollar) a day and nearly as many in the cities who live on INR 66 (approximately one dollar) a day. Overall 30% of India's population lives on less than \$1 a day (National Survey Sample Organization, 2012; World Bank, 2012), while we are heading towards becoming one of the top economies of the world.

It is this poverty and disparity in wealth that prompted Nobel Laureate (Peace) Kenyan environmentalist Wangari Muta Maathai (World Commission on Environment and Development, 2004) to say, *‘If you want to save the environment you should protect the people first, because human beings are part of the biological diversity. If we can’t protect our own species, what’s the point of protecting tree species?’* She points to the irony of the poor, who depend most on the environment, yet are also often blamed to be the ones who are responsible for its destruction. She attributes that situation to the fact that the poor are often *‘so preoccupied with their survival that they are not concerned about the long-term damage they are doing to the environment simply to meet their most basic needs’*. This contention, although credible in its own right, also raises the question of long-term vision – if the poor are the most dependent on a resource then that should also impel them to act to save it. While the poor is forced to depend on the natural resource for their very sustenance, it is said that it is the rich who exploit and spoil the environment on a per capita basis for largely luxury usage. In fact, the issue often goes beyond poverty to the unequal distribution and luxury-consumption of natural resources by the privileged smaller proportion of humankind. The issue takes a turn at most times; consumption for sustenance vs consumption for luxury. Industrialized nations containing 20% of the global population shared 86% of global wealth while the 20% living in poor countries shared only 1% of the global wealth, by the end of the 20th century. China, India, Indonesia, Brazil and Russia accounted for 50% of the world’s population, but shared only 9% of its wealth (Nielsen, 2005). Krapivin & Varotsos (2007) highlighted the disparity between global consumption and population (Table 1).

An average American consumes natural resources dozens of times greater than an average individual in developing countries. Cuff & Goudie (2009) observed that the Western countries and the USA in particular, have contributed to two-thirds of greenhouse gases, which are responsible for global warming; yet the brunt of this is being borne most by the developing countries. Besides, according to Young (2002) developing countries do not want to sacrifice their right of development (in order to protect the environment) especially as they view the current environmental crisis as largely the doing of the economic growth patterns and ‘footprints’ of the Northern countries . In general, Young concludes that there is greater emphasis on economy rather than environment, and

lack of consensus between North and South over which environmental issues are of major global concern. Adding further in this line Smyth (2008) opines that the developing countries also disagree with the hegemony of developed countries over solutions to environmental problems and their unwillingness to consider the significance of cultural aspects in seeking alternative solutions.

Table 1. Regional share of global consumption and population (%)

Region	Consumption (%)	Population (%)
USA and Canada	31.7	5.3
Western Europe	28.9	6.5
Eastern Asia and Pacific Ocean Region	21.6	32.9
Latin America and Caribbean Region	6.9	8.7
Eastern Europe and Central Asia	3.7	8.2
South Asia	2.2	22.5
Australia and New Zealand	1.8	0.6
Near East and North Africa	1.7	4.4
Sub-Saharan Africa	1.5	10.9

In his speech at the Rio Earth Summit, then Malaysian President Mahathir Mohammed was quoted as saying: *The rich 25% of the world's population consume 85% of its wealth and produce 90% of its waste and if they reduce their wasteful consumption by 25%, worldwide pollution will be reduced by 22.5%. But, if the poor 75% reduce consumption totally and disappear from this earth altogether, the reduction in pollution will only be by 10%. (Conca & Dabelko, 2004).*

According to Barnett, Matthew & O'Brien (2010) while environmental change is a risk to human security and Global environmental change brings new and often unprecedented threats to human security raising important questions about equity and sustainability, it goes hand in hand with other social factors like poverty and discrimination in creating these insecurities. Nielsen (2005) lists increased migration pressures and terrorism, breeding resentment against richer countries as the result of this conflict of assets, attitude and interests between the haves and have-nots.

As Barnett (2010) states global environmental change is “*inherently a question about the capacity to respond to new challenges and to reconcile the growing disparities that undermine human security*”. Young (2002) suggests that there was real value in an equal and participatory approach in helping local people manage local environmental issues with the help of international expertise, without having this help imposed on them.

Luce (2006) advises given the high population densities and the rapid economic development of countries like India and China, it is crucial that they take environmental sustainability into account failing which they will export their suffering to the rest of the world.

The blurring between local and global environmental problems and challenges has become omnipresent, increasingly with governments referring to current issues in a ‘glocal’ sense. The tensions between developed (rich) and developing (poor) countries are likewise omnipresent. However, for the purpose of this review, each concept is considered individually before identifying the tensions and relations between local and global (or glocal) keeping in mind the arguments concerning developed and developing nations.

According to Nielsen (2005) even a smallest creature is a link in the web of life and loss of such ‘small’ and ‘inconsequential’ species, which humans cannot replace, disturbs the natural equilibrium. The interactions between different ecosystems, species and genes is absolutely critical in determining the overall health of the system and of individual species - humans being one of those (Bryner, 2011)

Lovins & Cohen (2011) estimates that global impacts of the changes by atmospheric pollutions due to climate change, global warming, ozone layer depletion and acid deposition will have widespread effect on the populace killing more than 120,000 people per year in the past decade, which was almost double of the toll in the 1990s. 174 million people were affected annually by natural disasters in the mid-1980s to the mid-1990s. This number rose to 254 million a year in the decade from 1995-2004 and in 2007, just the floods in Asia had affected 250 million people. These numbers show the exponential increase of global impact by natural disasters driven in part by climate change. There are predictions that the environment is reaching its threshold level and any further increase could lead to dramatic and perhaps irreversible changes.

Khoshoo (2010) has estimated that the disparity in GDPs between developed and developing countries can be observed, as only 11% of countries containing 16% of the global population are rich. The estimate further reveals that the richest 20% of the world's population account for 86% of total private expenditure while the poorest 20% consume only 5% or less of these resources. Krapivin & Varotsos (2007) report that China and India account for 76% of the global population, but for only 29% of its income and approximately 1.1 billion of the world's population currently live on a daily income of less than \$1/day. Often the most populated countries are also amongst the poorest and most environmentally stressed.

The veracity of some of the environmental challenges have been challenged as myths that have been created by distorting facts and drawing biased conclusions about a few scientific facts (Bennett, 2012). Cutter-Mackenzie (2009) discusses some of these, including claims that the environmental problems are getting smaller and not bigger, and that environmentalists are anti-modernization in their attitudes. Commonly cited objections range from arguments such as 'Technology will solve our problems' and, 'If we exhaust one resource, we can always switch to some other resource meeting the same need'. The above arguments are superfluous, shortsighted, simplistic and highly techno-centric views about the world and the environment. For instance, while relying heavily on technology to solve our problems we overlook the fact that most of the current environmental problems have been caused by technology or its irrational uses. Shiva (2005) further points out to the dangers of globalization and bio-piracy that developing nations face in dealing with food security/insecurity and he warrants further research into it. However, Cutter-Mackenzie (2003) has made an important observation that 'to date, the arguments of environmental critics have not been analyzed in the environment literature'.

India faces several of the problems highlighted above and it is no surprise that many of these environmental concerns have direct impact on the country. The next section considers the nature of environmental issues as applicable to India.

Local (India)

No other country matters more to the future of our planet than India as it is the second fastest growing economy in the world. There is no challenge that we face, no

opportunity we covet where India does not have critical relevance, as India is very diverse in the political, economic, cultural front (Kamdar, 2007). India, with a population of 1.2 billion, is also the second most populous nation: between 2001- 2011 the addition to India's population is slightly less than the total population of Brazil, the fifth most populous nation in the world; and at 1.2 billion people, India's population is almost equal to that of six other populous nations (Brazil, Indonesia, Bangladesh, Pakistan and Japan) put together. India has only 2.4% of the world's surface area while it accounts for 17.5% of the world's population. In contrast, USA covers 7.2% of the world's surface area, but accounts for only 4.5% of the world's population (Census of India, 2011).

According to Kamdar (2007) the diversity is also found in the Indian ecosystems and India is a world in a microcosm. With approximately 1652 languages and numerous spoken dialects, a myriad mixture of religions and traditions exist in India (Ravindranath, 2000). Its land and population size, unprecedented growth and immense diversity make India's environment and its management vital to the entire world. What happens in India will have deep, long-range consequences for the entire planet (Rangarajan, 2009).

The rapid growth in terms of its population and economy has simultaneously raise major environmental concerns. The Environmental Performance Index (HPI) ranks India at a dismal 125th position among all nations and it has the unhealthiest air quality in the world behind other 133 nations (Yale University, 2012). Unlike the western nations where industrialization was an extended process that took centuries, India has seen tremendous growth in just three decades. Kamdar (2007) contends that the magnitude or velocity of India's transformation along with increase in population and rapid development, in turn placed tremendous demands on its resources (Joshi, 2005; Luce, 2006; Rangarajan, 2009; Ravindranath, 2002a; Sarabhai, 2008). A case in point is India's rivers, once symbols of purity and linked to deep spirituality and reverence (Mallet, 2017), have been reduced to mere receptacles of sewage and toxic waste (Sharma, 2010). India's future, its possibilities and perils reflect globally for according to Kamdar (2007) 'as goes India, so goes the world'. It holds the key to the emerging new world, which has been recalibrated due to Asia's phenomenal rise. This newfound power has serious environmental implications, and social and economic conflicts and disparities. One example is the rise in energy consumption in India; while it is the 'fifth largest

consumer of energy in the world' about '57% of its rural population has no access to electricity' (Srivastava, 2009). Given the economic growth that it has been witnessing, India is expecting to join the league of 'developed' nations by 2020. It is not hard to imagine the kind of energy usage India will reach if every Indian household is to access energy and electricity to the same level as those in 'developed' countries. If India along with China does not stem rapid deterioration of their environment then they will export their suffering to the rest of the world (Luce, 2006).

About 10% of the global population (and half of India's) live in the Ganges valley, it is also concentration of world's greatest poverty (Cuff & Goudie, 2009). The disparity of wealth between rich and the economically underprivileged is vast and is becoming wider. This region is also prone to the most severe effects of climate change - drying up of the rivers, soil erosion, frequent flooding, and earthquakes and at times epidemics and lack of sufficient health services.

Water shortages are also a growing area of concern. Brown (2011) states that the 'water bubble' that India lives in – over pumping aquifers to grow grain to feed over 175 million Indians - could burst anytime leading to mass food shortages.

Cuff & Goudie (2009) raise and consequently answer four major questions about environmental problems and challenges in India:

1) Does the size of the population alone create damaging environmental pressures?

Population size alone prompt major schemes with both negative and positive impacts and potentially damage agrochemical form of agriculture" (Cuff & Goudie, 2009). A large population exerts increasing demands for resources stressing the environment. For example, huge dams like projects across Narmada river, have been built in India and China to meet fresh water and energy requirements of the increasing in population. These dams while solving some problems also create contribute to global warming, destroy productive land areas, disturb habitat of species, contribute to deforestation, and displace people creating 'ecological refugees'. They also change lifestyle with high per-capita water usage and alter the agricultural pattern, indigenous cultivars being replaced with water-guzzler ones. Some such projects also add to international disputes over water sharing treaties (Nielsen, 2005).

2) Does poverty of large areas create environmental pressures?

Poor and dense rural/urban populations in India are said to be often unable to achieve sustainable development. This could be due low access to pertinent resources and to inadequate training and lack of education in sustainable development and procurement of livelihoods (Cuff & Goudie, 2009). Rangarajan (2009) emphasizes that alleviating poverty should not be read as affluence since that leads to luxury consumption and consumption of non-essential materials. He further opines that from the perspective of sustainable development, it would be appropriate to take alleviating poverty as the move towards welfare of the people that goes together with social, cultural, ideological and economic security, and equality.

3) Do the new large cities have damaging ecological footprints?

Of the 100 fastest growing urban cities, 25 in the world are in India. This is in contrast to China that has only eight of them (Barta & Pokharel, 2009). 60% of India's population lives in these cities (World Bank, 2012; World Bank, 2010) in slum-like conditions. These cities place a huge demand on natural resources like food, water and building materials which affects not only the immediate urban, but also the distant rural environments.

4) Is India's unique environment, particularly 'difficult' or 'fragile'?

India's environment is as diverse as the country and consists of different biomes. From windy, wet extended coastlines to the dry hinterlands of central India that lack both wind and rain, from the snow-covered alpine regions in the Himalayas to the desert of Rajasthan, different ecosystems and climates exist within the country. Each of these biogeographic areas poses a different kind of challenge in terms of the environmental issues (Joshi, 2005).

The next section contrasts between global and local.

Glocal

The Asian Development Bank has identified Asia as the world's most polluted and degraded region with a range of potentially dangerous environmental problems and a high economic cost attached to these problems (Yencken, Fien, & Sykes, 2002).

Environmental problems often transcend boundaries as water, air and nature as such does not honour manmade borders (Rangarajan, 2009). With the globalization, many issues concerning India, and for that matter any such nations, are not confined locally and are most likely to have global repercussions. Globalization apart, that is very much applicable to environmental issues including pollution and habitat degradation since the repercussions cannot be restricted by political boundaries.

As identified earlier, unlike western nations where industrialization was a relatively time-taken process (in comparison to India and China), India has seen tremendous growth in just a span of three decades. India's booming growth, both in terms of its population and economy, has led to unprecedented demands on its resources, thereby adding to its environmental problems and challenges. These problems are transposed to neighboring nations and to the planet. Luce (2006) identified India, China and the United States as the three most important obstacles to international consensus in tackling global warming. International agencies like the UNESCO, UNDP (United Nations Development Program) and World Bank are attempting to have a strong presence in India to be actively involved in improvement in environment and creating awareness through education. The World Bank (2009) for example, stresses the need for long-term vision and urgent action in dealing with India's environmental issues, which have made it exceptionally vulnerable to effects of climate change such as cyclones, floods and droughts and such extreme weather events. They believe that growth has led to a higher toll on India's natural resources and emphasize the need for sustainable development and reduction of the burden that environmental degradation imposes on the most vulnerable population group.

On the other hand, it is ironical that the World Bank is also the major funding agency for many of the development projects that have been environmentally unfriendly (E.g. the Narmada Dam labeled as the world's greatest planned environmental disaster is estimated to have displaced 100,000 people, a majority of which were landless tribes, and affected millions more) (Gadgil, 2007).

These double standards often send out mixed messages and further push developing countries such as India into a mindset of environmental protection vs.

economic development. At times, the interests and policies of these international agencies can be in direct contrast to their actions and practices, and the need for egalitarian and sustainable development. The path to environmentally conducive projects aiming at long-term economic progress can only be achieved through support of initiatives that are sustainable. The one essential tool towards sustainability of any sort is Education with public awareness, education and training as the key factors for moving society towards sustainability (McKeown, Hopkins, Rizzi, & Chrystalbridge, 2002).

Keeping this insight the following section discusses the role of education in the environmental context, and begins to provide a background on the state of EE, both globally and in relation to India.

2.2. EE – Important milestones (from global to local)

The origins of EE may be found in what started out as a Nature Study movement in the early 1900s. This was followed by a phase of the conservation movement in the mid1900s (Palmer, 1998). The original emphasis was on getting students out into nature to be able to admire and consequently develop a desire to pursue preservation. Increasing environmental deterioration led to the development of an awareness of human impact on the environment and the need to reduce those affects. This increasing environmental consciousness was triggered and fueled by scientists and authors like Carson (1964) and Gough (2006).

Table 2 (below) offers a timeline of the landmark events and developments in the field of EE since 1970s. The term ‘Environmental Education’ was first used in 1965 at a Keele University Conference in Britain for investigating conservation of the countryside and its implications for the education (Palmer, 2002), and the movement started gaining momentum around 1970. The ‘classic’ definition of the term was developed and adopted in 1970. According to the International Union for Conservation of Nature and Natural Resources (IUCN) EE is: ... *the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality (IUCN, 1971).*

Table 2. Chronology of landmark developments in EE

Year	Event	Development
1972	The United Nations Conference on the Human Environment, Stockholm, Sweden	The International Environmental Development Program (IEEP) 1975
1975	The United Nations Belgrade Workshop	The Belgrade Charter Statement
1977	The UNESCO Intergovernmental Conference on Environmental Education, Tbilisi, Former USSR	‘Tbilisi Declaration’
1980	The International Union of Conservation of Nature (IUCN), Natural Resources, The United Nations Environment Programme (UNEP) and World Conservation Foundation	‘World Conservation Strategy’ (1980)
1988	World Commission on the Environmental Development	Our Common Future – most commonly used definition of Sustainable Development.
1992	The United Nations Conference on Environment and Development, Rio De Janeiro, Brazil	‘Agenda 21’
1997	The United Nations International Conference on Environment and Society, Thessaloniki, Greece	‘Thessaloniki Declaration’
2002	World Summit on Sustainable Development, Johannesburg, South Africa	‘Plan of Implementation’ and the ‘Key Outcomes Statement’
2007	4th International Conference on Environmental Education, Ahmedabad, India	‘The Ahmedabad Declaration 2007’
2012	United Nations Conference on Environment and Development, Rio De Janeiro, Brazil	Rio + 20 Declaration

The first Conference on the Human Environment was held in 1972 at Stockholm and was the first attempt at bringing together higher-level government officials and discussing ways to deal with the environmental situation and raise the issue at an international level (Tilbury, 1994). It was a significant achievement as it marked the first attempt towards international cooperation and commitment to environmental conservation. It was also vital in highlighting the importance of education and training in environmental problems as the means of creating awareness and practical action (Gough, 2006). It was in this conference the then prime minister of India Indira Gandhi spoke at the plenary about the developmental dimension of global environmental concerns (Gandhi, Ministry

of Environment and Forests, 2009). This conference also led to the formation of the United Nations Environment Program (UNEP), which plays important role in negotiating global environmental treaties by bringing all concerned parties together (Cuff & Goudie, 2009).

The establishment of the UNESCO-UNEP International Environment Programme (IEEP) with the goal of furthering EE through a cooperative international programme was in 1975 (Gough, 2006). In that year, IEEP organized the Belgrade International Workshop on EE, which formulated ‘The Belgrade Charter – A Global Framework’ for EE, a strong policy statement that was endorsed by 64 countries. It has been hailed as the greatest landmark in the history of EE where there was a call for establishing a harmonious relationship between humanity and the environment, as well as for eradication of poverty, illiteracy, pollution and exploitation (UNESCO, 1975), a thought reflecting the landmark speech of Indira Gandhi at Stockholm.

The 1977 the Tbilisi Conference (UNESCO & UNEP, 1977) that followed provided goals and objectives that went on to be the basis of EE globally. These included amongst others the provision of ‘opportunities to every individual to acquire knowledge, values, attitudes, commitment and skills to protect the environment’ (Gough, 2006).

The World Conservation Strategy was published in 1980 by the IUCN in collaboration with the UNEP and the World Wildlife Fund (WWF) and was the first to discuss the interdependence of conservation and development and call for the need for ‘sustainable development’ (International Union for Conservation of Nature and Natural Resources (IUCN, 1980).

The 1982 Nairobi conference – a decade after the landmark Stockholm conference- called for setting up United Nation’s World Commission on Environment and Development (WCED). The WCED came up with its milestone report ‘Our Common Future’ also known as the Bruntland Report (World Commission on Environment and Development, 1987) which placed the concept of sustainable development in the realm of international environmental policy. It also provided the most commonly used (although still not universally accepted) encompassing but with less practicality definition for sustainable development i.e. *“development that meets the needs of the present without compromising the ability of future generations to meet their needs”*.

In 1992, the United Nations Conference on Environment and Development (UNCED) called 'Earth Summit' was held in Rio de Janeiro and led to a 'tremendous surge' in environmental consciousness among the general public (UNESCO-UNEP, 1992). It resulted in the following actions:

- Agenda 21, a plan for action into the twenty-first century
- the Rio Declaration on the Environment and Development
- the 1992 United Nations Framework Convention on Climate Change, which was to provide a framework for negotiations on detailed protocols on further issues such as controls on the emissions of greenhouse gases, particularly carbon dioxide-and deforestation
- the 1992 Convention on Biological Diversity, aimed at arresting the alarming rate at which species were disappearing through pollution and habitat destruction, and
- a legally nonbinding declaration on forests (Cuff & Goudie, 2009; Gough, 2006).

As noted earlier, Agenda 21 highlighted education as a priority and as being significant in promoting sustainable development. It stressed participation from everyone involved in education, teachers, teacher educators, curriculum developers, education policy makers and authors of educational materials (UNESCO, 1992).

Since 1980, sustainable development has rightly permeated the field of EE. The Earth Summit in Johannesburg (UNESCO-UNEP, 1992) was crucial in furthering the idea of education for sustainable development recognizing "*Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. It is critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making*" (Cutter-Mackenzie, 2009).

The Thessaloniki (International Conference Environment and Society: Education and Public Awareness, 1997) conference was held to celebrate the 20th anniversary Tbilisi conference (the Intergovernmental Conference on Environmental Education, 1977) with an underlying aim of reorienting education for sustainability for the 20th century.

It was also considered the end for the term Environmental Education with even a call to rename it as education for sustainability. The World Summit on Sustainable Development forwarded the cause of education for sustainable development and sought to replace the name 'Environmental Education' with 'education for sustainable development'. It also proposed a Decade of Education for Sustainable Development from 2005-2014 (UNDESD, 2007). None of the key indicators that were listed by the summit mentioned the term EE; instead, it was replaced with education for sustainable development.

The Bruntland Commission Report (World Commission on Environment and Development, 1987) places emphasis on the need to link environment and development. This is more readily accepted by many developing countries, which are often of the view that industrialization can help alleviate poverty and lead to economic growth and that environment and development are not pitted against each other (Rangarajan, 2009). However, the underlying message that comes across seems to be that development will lead to economic growth and prosperity. The major criticism here is that economic growth by itself may or may not be successful in alleviating poverty or increase sustainability (Goueli, 2003). Again, although the Commission's definition of Education for Sustainable Development has been more widely accepted, there is no consensus and hence no universal accepted and practicable definition for sustainable development so far. Given that there is no agreement on what sustainable development really constitutes, there is no real agreement on how it should be taught and communicated especially to younger generation. For example countries like India may find it difficult to define what 'development' is and how much of it is 'sustainable', as also the ability to quantify or justify the 'needs' of the country. It could therefore be very easy to fall into the trap of mass consumption as a sign of growth and development. To avoid such a fall, it is pertinent that the paradigm of development need to be re-looked prior to defining 'sustainable development' and concepts such as 'need' requires to be well clarified. However, a dogmatic attitude should never be adopted for properly mentoring development of human beings as liberal, tolerant and co-operative beings.

There is also the danger of the environment being considered as a mere resource to meet human needs. Putting a monetary or economic value on the environment and the services it provides undermines the role that these resources play in society, history and

culture. Moreover, assigning monetary values largely depend upon the appreciation the market has upon the components of the environment or the services. However, disposition to put an economic value to the environment is on the rise mainly because it fits into most capitalist approaches. Incidentally, Hunter-Lovins & Cohen (2011) define the current era as an era of ‘climate’ and ‘capitalism’ both intertwined as the cause and the cure for each other. Monetization or valuation of environmental resources in terms money continues to be widespread for three main reasons:

- a) It provides a mechanism to help maintain a record of society’s management of environmental resources often providing a sense of accomplishment to otherwise poorly managed stewardship of these resources.
- b) Economic development and human interventions are now central to policy debates with a need to provide direct effects and opportunity costs of development.
- c) Issues of sustainability have gained more prominence in terms of being mindful of needs of future generations in decisions made today about resource use. This means the trade-off between current and future demands on the environment and the economic valuation that permit these inter-temporal comparisons have become increasingly important (Pretty et al., 2007).

Laying emphasis on the environment as a resource reeks of apathy and a lack of engagement with the environment. Khoshoo (2010) for example echoes this sentiment while comprehending sustainability as ‘the rate of harvest from a renewable system which must not exceed the rate of annual increment’. EE is considered to merely reflect on the quality of the environment and raising awareness and understanding. In contrast, sustainable education is considered to deal with the ecological (environmental) dimension and is expected to look into economic and social issues such as the social, economic and political aspects of change. The ultimate objective of sustainable development is then to improve the quality of life of people living on the planet (Khoshoo & Moolakkattu, 2009). However, this “self-centric” view completely overlooks the well-being of the environment and the quality of life for anything other than humans and ethical view regarding right for life for other life forms. Orr (2002) sees sustainable growth as an

unachievable oxymoron while terming sustainable development as much more achievable. He argues for a change that is to be attained should transcend mere superficial levels if genuinely sustainable.

There are benefits and constraints attributed to both thoughts. Fien & Trainer (1993) believe that often EE and education for sustainable development are intertwined and many a time, particularly in science and social science, EE is also education for sustainable development. Another advantage as Selby (2006) recounts is the opportunity to ‘loosen the clutches of natural science’ on the field paving the way for greater cross disciplinary influences from ethical, political, social and economic lenses. In India, though there has not been a clear demarcation between the two, both EE and education for sustainable development have often (not necessarily appropriately) been interchangeably used. As Chhokar & Chandrasekharan (2006) suggest, in India it is often EE for Sustainability, a mixture of both terminologies and ideologies.

The United Nations World Summit on Sustainable Development (UNWSSD) held in 2002, in Johannesburg also emphasized the role of education, but it broadened the vision to include not just respect and nurture for the environment but also social justice and the fight against poverty. UNWSSD urged all nations to unite and work towards increasing access to basic requirements and to use modern technology in training and education to banish underdevelopment (UNESCO, 2002).

The 2007 International Conference on EE in Ahmedabad declared, ‘*Through education, human lifestyles can be achieved that support ecological integrity, economic and social justice, sustainable livelihoods and respect for all life. Through education we can learn to prevent and resolve conflicts, respect cultural diversity, create a caring society and live in peace*’ (Sarabhai, 2008). It encouraged a shift from viewing education as a delivery mechanism to a lifelong, holistic and inclusive process. As mentioned earlier, 2005-2014 has been declared as the Decade of Education for Sustainable Development (UNESCO, 2005c) in recognition of the need for commitment and skills to strengthen education systems across the world and to integrate ESD (Education for Sustainable Development) in national education plans across all sectors (Fien, 2006). The UNDESD’s main aim is to increase and encourage initiatives that raise the importance of education in achieving sustainable development (UNESCO, 2005c).

Gough (2006) made an interesting comparison between the Belgrade Charter-1975 and current policies framing the UNDESD, and found that the same spirit underlies both the documents. She commented that maybe the path travelled over the past 40 years remains the same, but for a few curves, detours and potholes. Reading Gandhi's thoughts on '*Education for life; through life; throughout life*', his perceptions of '*education as a life-long process which involves harmony of the head, heart and hands*' (Sarabhai, 2007) and his Basic Education Framework, it seems that the path followed for the last several decades needs a detour in education perhaps to Gandhian economics and lifestyles where there is no place for greed and opulence.

EE in India – a brief

Protection and improvement of the natural environment including forests, lakes, rivers and wildlife; and living harmoniously with the environment is embedded in the Constitution of India in Articles 48A and 51G. It is in fact deeply rooted in the religious and cultural traditions of India where nature is perceived as an all-encompassing entity that needs to be protected and revered (Baez, 1987; Bussey, Inayatullah, & Milojevic, 2008; Ravindranath, 2000, 2002a, 2007; Sarabhai, 1995). Scriptures, from Vedas, Upanishads, Smritis, Puranas and the Bhagavadgeeta that describe the traditional way of life in the subcontinent uniformly consider the environment as an integral and inseparable part of humans and vice versa. The Rigveda for example considers the entire creation as one and indivisible; and the entire universe constitutes a life unto which every aspect of creation, including the human, is integrated (Sharma, 2010). This is echoed by Tagore who said, 'the same stream of life that runs through my veins ... runs through the world' and 'the world is a living thing, intimately close to my life, permeated by the subtle touch of kinship, which enhances the value of my own being' (Haigh, 2008).

Unlike Europe where the past is the past, in India not only does the past continue to be visible in the present, it is in many ways also the future (Luce, 2006). India's esoteric traditions continue to survive despite the onslaught of modern consumerism. Sacredness of living things has been a basic tenet of various schools of Indian philosophy for millennia advocated by sages centuries ago (Wali, 1987). Many Indians inherit nature awareness, as part of their culture; worship of trees, tigers, elephants, snakes, monkeys

and other creatures is considered part of religious/social observations with an ecological meaning. For example a tree is considered 'Dasaputra' or 'ten sons' because it provides for ten important needs, i.e. food, fodder, fertilizer, fiber, fuel, air, water, soil, shade and beauty (Parthasarthy, 1987). Strict instructions on the need to preserve the environment and protect it from degradation are part of this ethos and have been laid down in ancient Indian scriptures like the Vedas, Puranas, and the Upanishads (Baez, 1987; Khoshoo, 1987; Ravindranath, 2000a, 2007b; Wali, 1987). Protection of the environment and its connections with daily community life has always been an integral part of the social fabric of Indian society (Ravindranath, 2002b). It has been laid down as one of the five yagnas or daily duties that a man has to perform and is on par with duties to gods, teachers, ancestors and fellow human beings (Sharma, 2010). This ethos has been very simplistically echoed by in very simple manner Gandhi's words 'Live simply so that others may simply live' (Bussey et al., 2008) and his famous saying that "*the world has enough for everyone's need, but not enough for everyone's greed.*"

India's first attempt at incorporating environment in education was initiated by Mahatma Gandhi in a movement called 'Nai Taleem' or Basic Education in 1937. The essential elements of Basic Education policy were productive activity in education, correlation of curriculum with the productive activity and the physical and social environment, and intimate contact between the school and the local community (Chhokar & Pandya, 2005). The aim was to create freethinking individuals with relevant skills to be able to act locally and aspire transcendently for liberation (Haigh, 2008).

This movement ended once India achieved independence and Gandhi was assassinated by a fanatic. It has been replaced by the current conventional model based on colonial methodologies of thinking and limited to the learning by rote techniques, where 'free thinking' is neither sought nor encouraged. Local and regional issues are neglected and the main aim seems to be the production of 'able' individuals who could contribute 'economically', meet the needs of rapid 'industrialization' and 'globalization' of the country.

Landmark policies/developments that shaped EE in India

Table 3 presents the influential landmark developments that shaped EE in India. As is outlined, the field of EE has recently received major impetuses in the form of the Federal Court mandate and development of curriculum policies.

In December 2003, the Supreme Court of India passed a ruling that was hoped would change the EE scenario in India. The direction No. 4 issued by the Court reads thus: *...We accept on principle that through the medium of education awareness of the environment and its problems related to pollution should be taught as a compulsory subject. Learned Attorney General pointed out to us that the Central Government is associated with education at the higher levels and University Grants Commission can monitor only the under graduate and post graduate studies. The rest of it, according to him, is a state subject. He has agreed that the University Grants Commission will take appropriate steps immediately to give effect to what we have said, i.e. requiring the Universities to prescribe a course on environment. They would consider the feasibility of making this a compulsory subject at every level in college education. So far as education up to the college level is concerned, we would require every State Government and every Education Board connected with education up to the matriculation stage or even intermediate college to immediately take steps to enforce compulsory education on environment in a graded way. This should be so done that in the next academic year there would be compliance with this requirement. (Supreme Court of India, 2003)*

This was a follow up to a 1991 ruling, which had directed that ‘through the medium of education, awareness about the environment and its problems related to pollution should be taught in all schools and this should be implemented by the State authorities’ (Supreme Court of India, 2003). The National Commission for Education, Research and Training (NCERT) was also directed to prepare the syllabus/curriculum for EE for all grades. This directive was not uniformly adhered to and hence was followed up by the 2003 directive that provided the government only one year to comply. In 2003, the Supreme Court also reviewed a curriculum framework prepared by the NCERT under its directions. The State governments were asked to develop textbooks using this framework and EE was made mandatory across all grades, in schools all over the country, from the

year 2004-05. This directive, while giving a much-needed boost to the cause of EE concerns, also added to the strains of an already over-burdened educational system. While the mandate was of critical importance, it is still unclear whether or not it is being implemented and how effective the implementation has been.

The Supreme Court intervention seems to have provided a much-needed impetus to the cause of EE in India. The National Curriculum Framework drafted in 2005 attempted to bridge the gap in EE (National Council of Educational Research and Training, 2005). Section 3.9 of the Framework is devoted entirely to Habitat and Learning, which in substance and spirit is equated to EE. In that Section, it was acknowledged that formal education had largely become alienated from the students' 'habitats', which in turn implies that the current education system is far removed from the current lifestyles of students. The section of the NCF goes on to assert that environmental degradation is happening at an unprecedented pace. It substantiates the role of education in helping to comprehend the roots and re-establish the links between education and habitat. Overall issues and concerns pertaining to the environment were designed to better inform the different school subjects and experiences. The main focus of the Section was based on the principle that children learn in relation to their encounters with nature and the environment (NCERT, 2005).

While establishing the necessity of EE in India, the Supreme Court (2003) ruling however also placed large responsibility on the State Education boards to adapt the syllabi from NCERT to their respective education systems. How this was to be done was not clearly spelt out, therefore the policy was open to numerous interpretations and loopholes. On paper, India has done everything to ensure that EE is a major part of the school curriculum. However, as Weiner states, laws and policies in India are 'often seen as a kind of modern talisman which will bring results by the magical power of words themselves unrelated to the action (Weiner, 1991). There is currently little information available on how the different agencies interpret and implement this policy. This study tackles this situation by investigation one teacher education institution and exploring how its teacher educators interpret this federal mandate.

Table 3. Chronology of key developments in EE in India (adapted from, Sarabhai, Raghunathan, & Kandula, 2000).

Period	Key Developments	Impact
1964-1966	Report of the Education Commission –the Kothari Commission.	The root of Environmental Education (EE) in India.
1975	Curriculum for the Ten-Year School: An Approach Paper and Curriculum for the Ten-Year School: A Framework.	First framework to explicitly indicate teaching of EE.
1984	Establishment of the Centre of Environment Education (CEE) as a National Centre for Excellence in EE under Ministry of Environment and Forests.	CEE worked with different sectors – particularly education- to spread environmental awareness.
1986	Adoption of the National Policy on Education. The National Environmental Awareness Campaign of the Ministry of Environment and Forests.	First National policy indicated including EE in schools.
1988-1989	Environmental Orientation to School Education Scheme of the Ministry of Human Resources Development.	Called for orientating curriculum to include EE.
1989	C.P. R. Chennai established as a second Centre of Excellence.	Works towards promoting EE in south India.
1991	First Supreme Court of India mandate requiring the University Grants Commission to prescribe courses on the environment at all levels of higher education.	The judiciary steps in to help control environmental problems – a first of its kind step.
2003	Second Supreme Court judgment mandating EE to be taught across all formal education institutions.	Requires every school in every state of India to teach EE.
2005	National Council for Teacher Education provides the EE curriculum framework for teachers and teacher educators. National Curriculum Framework is drafted – clearly specifies the role of EE.	A major step providing national level impetus for the inclusion of EE in teacher education. School curriculum now includes EE and has to be mandatorily taught.

This section of the chapter explored the evolution of EE and some landmark developments and policies that have influenced the field – both globally and locally. The next section reviews the relationship between teacher education and EE.

2.3. Studies on Awareness, Attitudes and Practice of Environmental Education

Regarding knowledge, Palmer (1998) emphasized that students should acquire appropriate range of knowledge, understanding, and concepts about the environment so that critical judgment can be achieved. Further, experiences and reflection in the environment should be allowed to refine “environmentally focused skills, ...further relevant knowledge, and development of appropriate attitudes and environmental awareness”. These three components, attitude, knowledge, and awareness, play an important role on the impact students will have, in and out of the classrooms, throughout their lives. According to the North American Association of Environmental Educators (NAAEE), levels of awareness are important goals in EE between kindergarten and 3rd grade. Levels of knowledge are important goals from 3rd through 9th grade. Levels of attitude are important throughout the entire educational career (Ballard & Pandya, 1990).

Orr (1992) reflected upon the concept of forming attitudes in order to build on ecological literacy. This ecological literacy should not be interpreted as the knowledge of facts and concepts only, but “the knowledge necessary to comprehend interrelatedness, and an attitude of care or stewardship”. Therefore “knowledge, the attitude of caring, and a practical competence are the basis of an ecological literacy” (Orr, 1990).

Madsen (1996) emphasized the concept that awareness is the ultimate driving force that stimulates knowledge. The acknowledgement that an environmental problem exists entails being more cognizant of the facts about the state of the environment. “This degree of environmental awareness involves a personal commitment to work to solve environmental problems”. He emphasized the power behind the awareness factor by categorizing three levels of awareness as: basic belief of an environmental problem, factual and scientific knowledge, and a commitment to solve environmental problems.

Athman & Monroe (2000) stated that awareness and knowledge of environmental processes and systems play an important role in EE. However, these are not the only factors affecting the behavior outcome. Behavior is what people do, whether it is environmentally appropriate or it is inappropriate (Hernandez & Monroe, 2000). Behavior in general is supported by knowledge and attitude, but there is not a direct cause-and-effect progression from knowledge to attitude to behavior (Monroe, Day, & Grieser, 2000).

Awareness was studied along with environmental knowledge and concern by Hausbeck, Milbrath & Enright (1992). In this study, the authors concluded that awareness and concern scores were significantly higher than knowledge levels in high school students. They linked this result with the fact that a primary source of environmental information is electronic media (NEETF, 1998), whereas awareness and concern can be picked up with little substantive knowledge.

Studies across the world on teachers' and students' awareness, attitudes and practice of environmental issues and environmental education have shown varied results. After extensive review of selected studies on environmental education, Lee & Williams (2001) summarized that students' levels of knowledge tended to be low, and despite having positive attitudes, they tended to show relatively low personal ecological involvement, expressing powerlessness in solving environmental problems.

A study conducted by Barrett, Kuroda & Miyamoto (2002) explored the environmental knowledge, attitude and behavior of young people in Japan. The findings of the study showed that whilst it is true that young Japanese are becoming increasingly familiar with concepts commonly used by the international community such as global warming or the ozone layer, their knowledge is poor. The study further revealed that young people in Japan are bonded to a form of environmentalism that reflects the more widespread adoption of NEP (New Environmental Paradigm). The same study also showed that even though young Japanese had the desire and capability to protect the environment, for a number of complex reasons they appeared unable to move from understanding to action.

A similar study done by Ehrampoush & Moghadam (2005) showed that the knowledge, attitude and practice of medical sciences students of Yazd University of Iran was not appropriate and recommended that it is necessary to improve their long-term environmental awareness programs. A study has also been conducted by Larijani & Yeshodhara (2008) to assess the level of environmental attitude among Indian and Iranian higher primary school teachers. The six areas (dealt with the Likert scale) of the study were attitudes towards 1) Health and Hygiene, 2) Wildlife, 3) Forests, 4) Polluters, 5) Population explosion, and 6) Environmental concern. The study revealed that Iranian

teachers show more positive environmental attitude than their Indian counterparts, except in the subtheme namely wildlife. Irrespective of their countries, female and male teachers did not differ significantly in total attitude scores.

Ndaruga & Irwin (2003) studied how primary school teachers in Kenya perceived wetlands. The idea that triggered the authors to study the issue was that there is a possibility that teacher perceptions about the local wetlands may have an influence on frequency of their mention in the classrooms and in the community, and also teacher involvement in activities to preserve the value of wetlands that they perceives positively. The study revealed that teachers have close and interactive relationships with wetlands and they were aware of their wetland and have some well-developed perceptions of their value and threats. In addition, the study showed that teachers recognized the economic, regulatory or ecological, socio-cultural and political functions of wetlands.

An earlier case study conducted in a rural school in Ontario, Canada (Samuel, 1993) showed that only some teachers were aware of what EE was or how it could be implemented in their subjects. Although teachers exhibited a range of attitude towards the environmental education project, only 10% were negatively inclined, 20% were neutral, and 70% were positively inclined. The study conducted by Taylor, Nathan & Coll (2003) indicated that there is clearly a body of teachers in regional NSW with sufficient knowledge and commitment to education for sustainability and had an intuitive understanding of the concept of education for sustainability. The study further showed that there was consensus that education for sustainability should be delivered across the curriculum. The same study revealed that there were no indications that the teachers were deficient in their understanding of key environmental and social issues, and how those issues might be interrelated. Furthermore, the study indicated that teachers appeared to embrace the notion that education should not simply focus on environmental knowledge and attitudes, but should influence students' decision-making in relation to the environment.

The research done by Yenice, Saracaloglu & Karacaoglu (2008) in Turkey was made in order to assess the views of the classroom teacher candidates related to the environmental science course and environmental sensibility. Regarding the results of the

research, it is stressed that the environmental sensibilities of the classroom teacher program students show discrepancies with regard to their follow up status for the program and articles about environment on media. However, no statistically significant alteration has been determined among the students' environmental sensibilities taking into account their genders, ages, or membership status in an institution related to environment. The 'environmental science course' within the curriculum of classroom teacher program positively affects the students' sensibilities and ideas about environmental education related to air, water, soil, pollution, ecological balance and birth control. Additionally, the students who take the course are found more sensitive to the environment and have developed a positive idea about the sufficiency of the environmental education given at the faculty.

One of the focuses of a recent study in New Zealand by Eames, Cowie & Bolstand (2008) was to investigate teachers' perceived purposes of environmental education. The study showed that 68% of the respondents viewed environmental education as education about the environment, 34% of them as development of attitudes and values towards the environment and fewer respondents (18%) included taking action for the environment in their description. The result is a good indicator that most teachers are not aware of the main dimension of environmental education-education for the environment, which involves action that will contribute to a more sustainable future.

Littledyke (1997) studied the relationships between experience, attitudes and practice of primary teachers in science and environmental education in England. The study revealed that many teachers regarded promoting environmental education as important and included it in their teaching. Moreover, the study identified two interrelated groups of attitudes; 1) interest in environmental issues and action, and 2) interest in environmental education. According to the study teachers in the first group were actively involved in environmental teaching, while those in the second group showed interest, concern for and understanding of environmental issues, and was involved in environmental action and teaching.

An international study to investigate geography educators' perceptions of the aims of EE and its place in teaching geography was conducted by Ballantyne (1999).

The result of the study indicate that geography educators clearly supported the inclusion of environmental education in geography classes, in most cases believing it should be the focus of at least half of geography lessons. They had also strong commitment to teaching environmental knowledge, attitudes / values, responsible environmental behavior and they mostly prefer promoting an environmental ethic rather than an attempt to display a neutral stance. However, the study showed that there was some reticence both to encourage active involvement in local environmental issues and to use that as a teaching method.

2.4. Information Sources on Environmental Issues and Environmental Education

To achieve effective development of EE, full advantage must be taken of all public and private facilities (formal education system, different forms of non-formal education and the mass media) available to the society for education of the population (UNESCO, 1978). Non-formal environmental education involves all educational processes conducted outside of schools directed to all age groups, especially mature people who have finished their studies (Wojcik, 2004). According the Sheleicher (1989), the development of a future oriented sense of environmental responsibility depends largely on the formal education (school teaching). He argues that the comprehension of ecological interdependencies requires more systematic insight than the media or public opinions can offer and attitudinal changes towards nature and natural resources are psychologically easiest with young people.

Lee & Williams (2001) noted that even though the importance of school curricula is unquestionable, the substantial contribution made to EE by a number of other formal and informal agencies, including films and television, environmental youth organizations, and a variety of projects mounted by local, national and international organizations shouldn't be underestimated. The main aim of non-formal environmental education, according to Wojcik (2004), is to prepare society for the understanding of proper actions for environmental protection and management in conformity with principles of sustainable development. And major role in non-formal education is played by i) Mass media: TV, radio, press, the internet, ii) Organizations and civic associations working for the environment, iii) Institutions supporting and co-financing EE, iv) Religious

institutions and organizations of religious character, v) Family, and vi) Work places (Wojcik, 2004). However, the importance of different sources of information varies from society to society. A study conducted in Japan (Barrett, Kuroda & Miyamoto, 2002) showed that the main information sources for the young people in Japan were television followed by newspapers and school where as family and friends played a lesser but important role.

The importance of peer groups, the popular media, well informed teachers and well-structured and accurate texts are the general conclusions reached by the considerable amount of researches carried out into environmental knowledge in England (Chambers, 1999). A study conducted in Brunei Darussalam (Odihi, 2000) showed that despite differences in their relative importance, print media, broadcast media, family, religious organs, interpersonal communications, society / club were sources of information on the status of environment, material environmental actions for the environment and spiritual environmental actions.

Ballantyne (1999) showed that the experiences which are more likely to have contributed to teachers' knowledge / skills/ in EE are video/ films, recreation / leisure activities, prepared teaching materials, conferences, environmental groups, in-service courses, curriculum guides, mass media, involvement in community groups and activities and participation in field excursion with students. Wojcik (2004) suggests that perfection of the existing means of environmental education is a necessity through coordination of complementary actions conducted as part of formal and non-formal education as well as the yet unappreciated incidental education (the effects of the daily activities of people).

2.5. Constraints to Effective Implementation of Environmental Education

Based upon previous researches, Ham & Sewing (1987/88) identified four broad categories of barriers that impede the successful implementation of environmental education in the formal school sector as given below.

- 1) *Conceptual barriers that arise from a lack of consensus about the scope and content of environmental education,*
- 2) *Logistical barriers stemming from perceived lack of time, funding resources, suitable class sizes, and so forth,*

- 3) *Educational barriers stemming from teachers' misgivings about their own competence to conduct EE progress; and*
- 4) *Attitudinal barriers stemming from teachers' attitudes about EE and science instruction.*

Other studies carried out across the world have also shown that the problems lie more or less within these four categories. In the study of primary teacher perspectives and practices of environmental education in England, Littledyke (1997) found that lack of scientific understanding of environmental issues, lack of curriculum time, lack of coordinator and teaching support, poor approaches to teaching and poor resourcing in schools were the major factors that deter environmental education.

Poor approaches to teaching as a problem are also recognized in Poland (Buchcic & Grodzinska-Jurczak, 2004) and Korea (Rii, 2000). In Poland, the educational tools teachers use to convey environmental content are dominated by talks and lectures; only a few teachers make use of field lessons and active methods of teaching. Similarly, teaching and learning in EE are accomplished in the classroom than in fieldwork in Korea.

The study by Ballantyne (1999) that included 419 geography educators from 18 countries showed that time constraints, workload considerations and lack of knowledge/training in EE were the major obstacles to the inclusion of EE in geography classes. The same study showed that pre-service training inadequately prepared teachers for teaching EE. This is consistent with many studies undertaken in Poland (Tarabula-Fiertak, Gajus-Lankamer & Wojcik, 2004) where many teachers considered their preparation for conducting EE to be insufficient. A study in Albania (Sokoli & Doka, 2004) showed that insufficient qualification of teachers and lack of auxiliary environmental literature (such as books, leaflets, magazines or video tapes) has limited the implementation of EE projects.

The lack of funds to support environmental activities and an apparent deficiency in well-organized civic education which would support environmental education are obvious explanations for the lagging EE in south Eastern Europe (Papadimitriou, 2004). In New Zealand the challenges which teachers should struggle against to create a

sustainable EE program are the absence of a school-wide approach to EE, a perception of an ‘over-crowded’ curriculum, resourcing challenges and difficulties creating and maintaining productive links with EE (Eames, Cowie & Bolstad, 2008).

2.6. EE Studies in India

India, gaining drive from the Stockholm (1972), incorporated environmental concern in the constitution through its 42nd Amendment in 1976. Environment became a matter of serious concern in policy statements, plans and strategies especially after 1980 with the establishment of the Ministry of Environment and Forests (MoEF), which was later, in 2014, renamed as Ministry of Environment, Forests and Climate Change (MoEF&CC) in view of the universal importance of climate change actions. Gradually EE in India gained momentum and the government subsequently introduced it in all schools. While the principal responsibility for EE through the formal educational system lies with the Ministry of Human Resource Development (MHRD), the parallel responsibility of EE through non-formal efforts lies with the MoEF&CC.

The National Council of Educational Training and Research (NCERT) is the apex body in developing curriculum for the formal education system in the country. Four elements of their strategy are 1) Strengthening infusion of EE, 2) Teacher training for effective EE, 3) Introduction of Environment as a separate subject and 4) Use of non-formal methods of EE through the involvement of NGOs. The central government also started a couple of programmes such as National Environmental Awareness Programme (NEAC), Environmental Information System (ENVIS), Museums of Natural History, Eco-clubs in Schools and Promoting Mass Media (Sarabhai, 2000). However, these plans did not produce the expected outcome, the main reason is said to be that environmental perceptions here were largely determined by Euro-American perceptions, biggest barrier to effective EE in India (Guha, 2000). Guha (2000) emphasizes that only if the environmental educationists begin listening to authentic voice of the poor, the displaced and the discriminated against, we can hope to create more effective EE.

In India, there are various challenges to effective implementation of EE in schools. Some such issues are 1) In a large and diverse country, to find the right blend between centralized and de-centralized efforts and approaches, 2) Reaching out to large

numbers cost-effectively, 3) Making environmental considerations relevant and meaningful to diverse groups, 4) Putting EE on the agenda of educational decision makers, 5) Putting sustainable development concerns high on the agenda of policy makers, and 6) Finding and developing human and financial resources for EE (Sarabhai, 2002). Above all challenges reflect that the EE, as handled as part of the curriculum now largely does not help much in fostering an environment friendly future citizenry in the country.

While introducing the new 'EE Curriculum Framework for Teachers and Teacher Educators' Shardinu, Chairman of the National Council for Teacher Education (NCTE) - India's apex body for Teacher Education remarked: "*Education, especially teacher education has obviously to play an increasingly vital role towards mitigation of continuing environmental degradation and the complexities of pollution, which pose a great menace to the survival of human life and other species on this planet*" (National Council for Teacher Education, 2005).

The National Council for Teacher Education – India's central body and policy maker on teacher education clearly states that "*Teachers occupy a crucial position in the system of education. Through them its message is conveyed to society, ideas are disseminated and behaviour is shape*" (National Council for Teacher Education, 2005). The NCTE (2005) maintains that the importance of EE is being widely recognized but '*it is yet to get its rightful place in education, much more so, in teacher education*'. The NCTE also asserts that unless EE is prescribed as a compulsory and integral component of education and teacher education its message will not be conveyed to all.

EE is taught as a compulsory core module on Environmental Studies in all undergraduate courses developed by the University Grants Commission which is a six-month course taught through both classroom and field activities. Evaluation of the course is through exams at the end of the semester with 25 out of the 100 marks allotted to fieldwork. India's largest Open University, the Indira Gandhi National Open University, also has some awareness level courses and also a Post Graduate Diploma in Environment and Sustainable Development. The Centre for Science and Environment offers a two-day training program for teachers, educators and others interested in EE (Kaur & Bhati, 2012). These are indicative of the limited efforts being made towards educating/training teachers in EE, but of wider possibilities in imparting EE to students.

Many researchers have reported the meagre efforts in the country towards introducing EE in schools (Chhokar & Pandya, 2005; Joshi, 2005; Pande, 2001; Sarabhai, 1995). According to Khirwadkar & Pushpanadam (2007) most teacher education programs merely satisfy themselves with training the teachers to adjust to the current system of education by transmission of information. The Centre for EE (CEE) and similar organizations' have played a fundamental role in preparing teachers to teach EE. They promote EE through various programs involving teachers; establishing regional centers; offering one year diploma course in EE for practicing teachers and educators (the Green Teacher) (CEE, 2012). CEE works with the government and NGOs to help the effective implementation of EE in schools and has been instrumental in publishing India's first international journal in the field, The Journal of Education for Sustainable Development (Center for Environment Education, 2007-2008). However, the effectiveness of the programs lacks research substantiation.

Environmental Education in Coimbatore district

Environment Education has been compulsorily implemented in all schools of Coimbatore district. From theory to hands-on exposure to rewarding them with brownie points, the latest awareness campaign in some schools is about the ongoing Climate change and Global warming. Though there is greater attention given to commemorative days such as World Environment Day, World Earth Day, Ozone Day and the like, the eco-clubs in few of the schools ensure that EE related activities take place round the year in Coimbatore schools. Today, around 7,700 schools in Tamil Nadu are part of the National Green Corps, a program sponsored by the MoEF&CC (Government of India). Around 100 schools in Coimbatore are part of the Green School Initiative. Nevertheless, as per several concerned people, most schools have EE only in theory, and only a few of them conduct practical sessions or facilitate exposures to real issues. The challenge is to see that the result-driven (concentrating on high pass percentage) schools also take up EE earnestly.

Generally, people, who are educated, and who have resided near natural habitats have more positive attitudes towards conservation than those with lesser education (Sarker & Røskaft, 2010). Levels of education or specific knowledge about conservation

are positively correlated with favorable attitudes towards nature conservation (Infield, 1988; Newmark, Leonard, Sariko, & Gamassa, 1993). In Coimbatore, an educational hub, enjoying several environmentally positive features and facing several negative issues, one can expect a higher level of environmental awareness among the public as well as school students (Prasanyaa, 2011). The major environmental issues of Coimbatore are lack of effective solid and liquid waste management, degradation of water bodies, air pollution and mounting number of vehicles (Mohanraj, Sathishkumar, Azeez, & Sivakumar, 2000; Palanivel, Elayaraja, Ganeshmoorthy, Jagadeeswaran, & Kalaiselvi, 2003; Yuvaraj, Alaguraja, Sekar, Muthuveeran, & Manivel, 2010; Sarathi, Karthik, Logesh, Rao, & Vijayanand, 2011). These issues calls for appropriate, innovative and well-timed social actions like putting strong emphasis on EE (Govind, 1989). So far, only few studies (Priyadarshini & Annakodi, 2013; Priya, 2014) were reported from this district on the level of environmental awareness among the school and college students. The present study would add to the existing body of knowledge with insights regarding how best to develop EE programs that promote pro-environmental behavior and sensitize the student community about the various complex local and global environmental issues in the respective socio-economic context.

Overview

In the broad overview of literature, the concerns, policies, initiatives and key developments in the field of EE have been presented. As the literature reveals, there is a well-established concern for the state of the environment, which is echoed at the global level as well as at the local level. Historically, the emphasis on EE was consistent with nature studies. Concurrent with the changing environment, EE has likewise changed particularly with the advent of the concept of sustainable development. This is especially true in India where the increase in environmental concerns has given rise to numerous calls for developing environmental consciousness. Education is widely seen as a means of responding to these calls.

Over the past decade in particular, efforts from national and state governments to implement EE have redoubled. The Supreme Court directives and the National Curriculum Framework have attempted to provide a push to the field. Policies and

directives however, only make a difference if matched by efforts to put them into practice; as is clear from this chapter, in India, there appears to be a significant gap in praxis.

EE in India as part of formal education is relatively new; although concern for environment and other life forms has been part of Indian ethos for over millennia, it is becoming visible in education only just. It seems apt that any approach to EE in India should build on the cultural and traditional ethos so embedded in Indian culture. Varma (2005) echoes these sentiments by highlighting the antiquity of Indian culture and the need to draw inspiration from that, taking it to a global level. Immersing EE practices into Indian youngsters and using it to frame policies seems to be a logical move.

Recent developments and federal initiatives have managed to put the policies like the National Curriculum Framework and the National Curriculum for teachers and teacher educators into place. These policies are attempts to provide direction and address the future requirements of EE. What needs to be determined is whether these policies are put into practice. In India, there is a danger of using words as magical talismans that are seen to do away all evil (Luce, 2006); but in effect achieving nothing. For example despite numerous laws to deal with issues such as child labour, dowry and child marriage, such practices are quite widespread still (and sometimes flourishing) across India. Unfortunately, as has been established in this literature review, there is very little research and the findings put into the practice of EE in higher education in the country. This study responds to that need, attempting to bridge the gap by establishing a beginning point in understanding students and teachers experiences in EE programme.

Chapter-III
Methodology

CHAPTER III

METHODOLOGY

3.1 Brief Description of the Study Area

Coimbatore is the second largest city in the state of Tamil Nadu with over 2 million people, of which 8.5% is under 6 years of age (Census India, 2011). Coimbatore district has an average literacy of 84.3%, higher than the national average (73%). Male literacy is 89.5% and female literacy 79.2%. It lies at 11°1'6"N 76°58'21"E at 411 meters (1349 ft) above sea level on the banks of the Noyyal River, in western corner of Tamil Nadu. It covers an area of 642.12 km² (247.92 sq mi). It is a major commercial centre in India with a large and a diversified manufacturing hub (India Brand Equity Foundation, 2013). Coimbatore is popularly known as the 'Manchester of South India' because of the large number of cotton processing units and textile mills in and around. Other important industries here include dye-casting, motor parts, software services, education and healthcare (National Institute of Urban Affairs, 2006). Coimbatore is surrounded by the Western Ghats with various types of forests and the Nilgiri Biosphere Reserve (NBR), the first of its kind in the country (Devi & Baboo, 2012). More than 20% of the district is covered by forest (Micro Small Medium Enterprise, 2012). The river Noyyal, coursing through Coimbatore, which once was perennial flowing round the year has become seasonal in recent decades (Pragatheesh & Jain, 2013). The Noyyal river basin had an extensive tank / wetland / channel system largely fed by the monsoonal flow in the river and to a lesser extent by local rains; but during the last couple of decades, most of these have become dysfunctional and the river has mainly become a channel for municipal and industrial sewage. Yet, the Coimbatore urban wetlands harbor more than 116 species of birds - 66 resident, 17 migratory and 33 local migrants (Reginald, Mahendiran, Kumar, & Pramod, 2007).

Coimbatore is an educational hub of south India. As of 2010, the Coimbatore district is home to 7 universities, 78 engineering colleges, 3 medical colleges, 35 polytechnic colleges and 186 Arts and Science Colleges. Presently there are 1958 schools with a total strength of 605947 students, 22611 teachers. In the colleges, there are 17670 teaching staff and 278008 students. (<http://www.coimbatore.tn.nic.in/pdf/SHB011.pdf>).

**Table 1. Schools for general education, students and teachers in Coimbatore
(Year: 2015-2016)**

Sl. No.	Institutions	No. of Institutions	No. of Students			No. of Teachers
			Boys	Girls	Total	
1	Pre-Primary Nursery Schools	207	21948	21999	43947	1844
2	Primary Schools	866	29503	28815	58318	2426
3	Middle Schools	266	21532	22937	44469	1987
4	High Schools	113	17758	24021	41779	1680
5	Higher Secondary Schools	152	53523	56112	109635	3873
6	Central Schools	72	21228	16618	37846	2572
7	Matric. High Schools	75	42321	41715	138849	2598
8	Matric. Hr. Sec. schools	204	94528	86011	127726	5571
9	Anglo Indian Schools	3	1206	2172	3378	60

Source: Chief Educational Officer, District Educational Office, Coimbatore/Pollachi, District Elementary Educational Officer- Coimbatore, Inspector of Matriculation School, Ramanathapuram, Coimbatore/SSA Office, Coimbatore

**Table 2. Colleges for general education, students and teachers in Coimbatore
(Year: 2015-2016)**

Sl. No.	Institutions	No. of Institutions	No. of Students			No. of Teachers
			Boys	Girls	Total	
1	University	8	15330	15363	30693	1396
2	Arts & Science college	54	48193	52670	100863	4353
3	Engineering college	64	82338	37912	120250	10180
4	Teacher education college	34	680	2410	3090	337
5	Polytechnics college	26	20367	2745	23112	1404

Source: Chief Educational Officer, District Educational Office, Coimbatore/Pollachi, District Elementary Educational Officer Coimbatore, Inspector of Matriculation School, Ramanathapuram, Coimbatore/SSA Office, Coimbatore.

Being an industrial city and urban agglomeration, air pollution and degradation of water bodies are major environmental issues in Coimbatore. In addition, the lack of a proper waste management infrastructure is a growing environmental challenge. An earlier study shows that the environment had worsened in the city over last five years for all environmental indicators except the number of bird species, and surface water quality and availability (TERI, 2014).

3.2 Objectives of the study

- 1) Study the level of awareness, knowledge, attitude to environmental education (EE) among college students and their actions in environmental protection
- 2) Study the teachers' level of awareness, attitudes and practices of EE teaching
- 3) Assess teachers' competency and its impacts on students' EE competency
- 4) Explore the opportunities and constraints for EE
- 5) Explore variability in EE related aspects with respect to the demographic status and personal details of the respondents

3.3 Hypotheses of the study

It was assumed that the subjects (students and teachers) responding to the survey answered the statements completely and honestly to the best of their knowledge and after their informed consent. Levels of students' awareness, knowledge, attitude, actions and self-efficacy were also assumed to be indicators of the effectiveness of the program in the colleges they study. Levels of teachers' awareness, attitudes and teaching practices were also assumed to be indicators of the way the program quality and the manner in which it is implemented.

3.4 Methodology

Research methodology in environmental education is based on three paradigms (Palmer, 1998). These are positivist, interpretivist and critical paradigms. The simplest distinction among the three is that the positivist tradition is quantitative, instrumental and objectivist; the interpretivist is qualitative, illuminative and subjectivist; and the critical approach is qualitative, dialectical and emancipatory (Lee & Williams, 2001). Another

distinction among the three approaches is that positivism sees reality as external to the individual, interpretivism sees it as internally constructed, whereas advocates of the critical paradigm argue that our subjective views are not only internally constructed but also influenced by persuasive social forces (Palmer, 1998). Recently, a fourth paradigm: that of mixed methods is suggested (Lindstone & Stoltman, 2008). According to Lindstone & Stoltman (2008) the strength of mixed methods research is that data from a well-designed study can be used to validate the response to a research question in both a qualitative and quantitative manner. In this study, the approach adopted is of mixed methods research.

3.5 Methods of Data Collection

3.5.1 Sampling

To investigate the students' and teacher' awareness, attitudes, knowledge, actions on environmental issues and practice of environmental education, a total of 2150 student participants and 45 EE teacher participants were selected through convenience sampling technique from 38 colleges during the study period of 2013-2016. Of the selected colleges, 17 were arts and science colleges, 11 were engineering colleges, 5 were polytechnic colleges, 3 were teacher education colleges and 2 were agriculture colleges (Figure 1).

Table 3 Number of samples in each college

Sl. No	Name of the College	Type of Course	Type of College	No. of Students	No. of Teachers
1	Bharathiar University	Arts and Science	Government	38	2
2	Tamil Nadu Agricultural University	Agriculture	Government	79	1
3	Karpagam University	Engineering	Self-Finance	70	1
4	Karunya University	Engineering	Self-Finance	58	1
5	Amrita Vishwa Vidyapeetham University	Engineering	Self-Finance	63	1
6	Forest College and Research Institute	Agriculture	Government	78	1
7	Kumaraguru College of Technology	Engineering	Self-Finance	35	1
8	PSG College of Technology	Engineering	Aided	71	2
9	Coimbatore Institute of Technology	Engineering	Aided	75	1
10	Sri Sakthi Institute of Engineering and Technology	Engineering	Self-Finance	40	1
11	Park College of Engineering and Technology	Engineering	Self-Finance	58	0

SI. No	Name of the College	Type of Course	Type of College	No. of Students	No. of Teachers
12	Ranganathan Engineering College	Engineering	Self-Finance	63	1
13	Sri Ramakrishna Institute of Technology	Engineering	Self-Finance	58	0
14	Government College of Technology	Engineering	Government	73	2
15	R.V.S College of Arts and Science	Arts and Science	Self-Finance	44	0
16	Sree Narayana Guru College	Arts and Science	Self-Finance	74	1
17	PSGR Krishnammal College for Women	Arts and Science	Aided	127	2
18	PSG College of Arts and Science	Arts and Science	Aided	83	5
19	Hindusthan College of Arts & Science	Arts and Science	Self-Finance	74	2
20	Dr.N.G.P. Arts and Science College	Arts and Science	Self-Finance	39	2
21	Dr G R Damodaran College of Science	Arts and Science	Self-Finance	54	2
22	CMS College of Science & Commerce	Arts and Science	Self-Finance	46	0
23	Sri Ramakrishna College of Arts and Science for Women	Arts and Science	Self-Finance	57	1
24	Nirmala College for Women	Arts and Science	Aided	62	2
25	Dr. SNS Rajalakshmi College of Arts and Science	Arts and Science	Self-Finance	61	0
26	CSI Bishop Appasamy College of Arts and Science	Arts and Science	Self-Finance	70	2
27	S.N.R Sons College	Arts and Science	Self-Finance	66	1
28	Kongunadu Arts and Science College	Arts and Science	Self-Finance	68	2
29	Salim Ali Centre for Ornithology and Natural History	Arts and Science	Government	10	0
30	Government Arts College	Arts and Science	Government	26	1
31	PSG Polytechnic	Polytechnic	Aided	19	1
32	Christ The King Polytechnic College	Polytechnic	Self-Finance	35	1
33	GRG Polytechnic College	Polytechnic	Aided	51	1
34	Nanjappa polytechnic college	Polytechnic	Self-Finance	48	0
35	The Government Polytechnic	Polytechnic	Government	72	1
36	Government College of Education for Women	Teacher Education	Government	33	1
37	Sri Ramakrishna Mission Vidyalaya College of Education	Teacher Education	Aided	37	1
38	Dr. N.G.P. College of Education	Teacher Education	Self-Finance	35	1

Figure 1. The sampling points

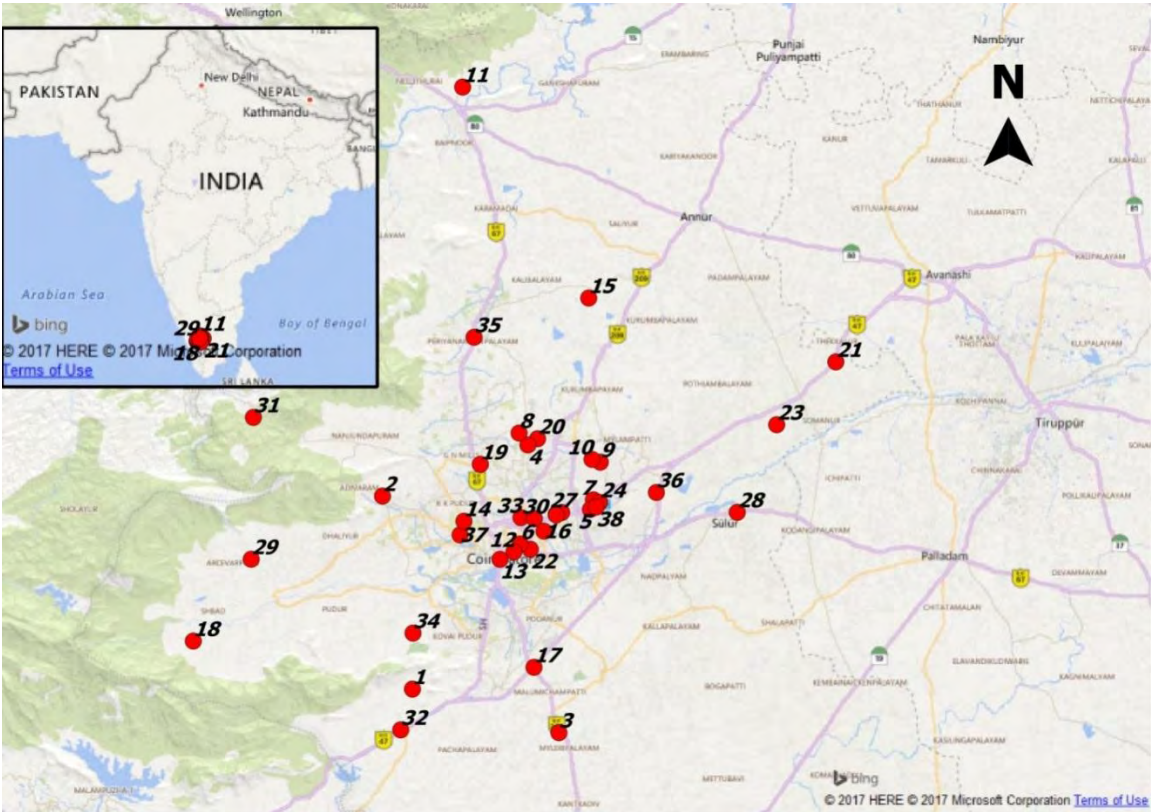


Table 4. Demographic Characteristics of the student participants

Independent Variable	Category	No. of Students	%
Gender	Male	917	42.65
	Female	1233	57.35
Age	<18	710	33.02
	19-23	1374	63.91
	>24	66	3.07
Parents literacy	Literate	1654	76.93
	Illiterate	496	23.07
Residence Location	Rural	1000	46.51
	Urban	1150	53.49
Nativity	Native	1018	47.35
	Non-Native	1132	52.65
Year of Study	1 st	534	24.84
	2 nd	498	23.16
	3 rd	744	34.60
	4 th	293	13.63
	>5	81	3.77
Type of Course	Agricultural	157	7.30
	Arts and Science	999	46.47
	Engineering	664	30.88
	Polytechnic	225	10.47
	Teacher Education	105	4.88
Type of College	Government	409	19.02
	Aided	525	24.42
	Self-finance	1216	56.56
Type of Programme	UG	1720	80
	PG	182	8.47
	Research	23	1.07
	Diploma	225	10.47

Table 5. Demographic Characteristics of the Teacher participants

Independent Variable	Category	No. of Teachers	%
Gender	Male	19	42.22
	Female	26	57.78
Age	<30	12	26.67
	31-40	19	42.22
	>41	14	31.11
Parents literacy	Literate	28	62.22
	Illiterate	17	37.78
Residence Location	Rural	14	31.11
	Urban	31	68.89
Nativity	Native	24	53.33
	Non-Native	21	46.67
Educational Qualification	PG	9	20.00
	M.Phil	10	22.22
	Ph.D	26	57.78
Teaching Experience	<8	26	57.78
	9-10	8	17.78
	>11	11	24.44
Type of College	Government	9	20.00
	Aided	16	35.56
	Self-finance	20	44.44
College Location	Rural	14	31.11
	Urban	31	68.89
EE Qualification	Yes	15	33.33
	No	30	66.67

3.5.2 Instrument

The instrument used in this study was developed using the following published instruments and documents: The New Ecological Paradigm (NEP 2000) (Dunlap, Van Liere, Mertig, & Jones, 2000), New Environmental Paradigm / Dominant Social Paradigm (NEP/DSP) (Trobe & Acott, 2000); the ecological knowledge questionnaire developed by Morrone, Mancl, and Carr (2001). Then the instrument was tested for reliability, scoring ranges of 0.71 to 0.85 in the Cronbach's Alpha coefficient (Dunlap et al., 2000; Trobe & Acott, 2000). Some of the environmental issues from the original tools were edited and other regional environmental issues were added to conform to a realistic regional based instrument.

The instrument was constructed to measure awareness, attitude, knowledge, self-efficacy, and the participants' demographic description. Awareness, defined as concern for what is happening in the environment, was examined with a series of statements inquiring about the influences, the perception and the concerns of local environmental issues. Attitude, defined as the acquisition of values, feelings, and motivations towards the environment, was examined using the amended NEP 2000 instrument, asking statements regarding a balance between social responsibility and environmental interest, government regulations, and political actions taken to protect the environment. Knowledge, defined as an understanding of the basic fundamentals in the environment, was measured with statements regarding basic fundamental ecological concepts and regional issues. Self-efficacy was measured with a series of statements inquiring about personal levels of satisfaction, importance, and perception of effectiveness regarding awareness, knowledge and attitude. The rest of the instrument measured the participant's demographic description.

All instruments evaluating students and their teachers were in essence identical except for some statements regarding the demographics of the groups. The instrument consisted of 91 statements (96 for teachers' instruments) with five different modalities of statements: (1) four point Likert – type response scale, (2) yes/no statements with characterization of the level of effectiveness, (3) true/false statements (agree or disagree), (4) multiple choice questions, and (5) selection of the proper response.

3.5.2.1 Structure - Students' Instrument

The instrument meant for students contained 91 statements. Statements 1 to 5 in the instrument (Appendix 1) measured awareness as the influences of the family and authoritative figures regarding environmental issues. The answers to these statements were given scores as 1 = Never, 2 = Seldom, 3 = Often, and 4 = Very Often. High scores indicated a person with strong influences and extensive degree of awareness. Statements 6 to 14 measured awareness as perception of local environmental conditions or issues in Coimbatore. The scores for the answers here were 1 = Much worse, 2 = Worse, 3 = Better, to 4 = Much better. Scores in this group of statements described a general perception without compromising knowledge of those surveyed. Statements 15 to 20, was meant to measure awareness as the level of concern about environmental issues. Scores assigned for answers to these statements were 1 = Not concerned at all, 2 = Somewhat concerned, 3 = Concerned, to 4 = Very concerned. High scores indicated a person with strong concerns about diverse environmental issues. Statements 21 to 35, measured attitude using statements adapted from the NEP 2000 instrument. The statements used a four point Likert – type response scale (1 = Strongly disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly agree) to measure the attitudes toward the environment. The statements alternate statements that classify a participant's attitude from a pro-environmentalist to an anthropocentric point of view as was intended in the original instrument (Dunlap, Liere, Mertig, & Jones, 2000). Statements 36 to 45, measured self-efficacy with statements inquiring about self-knowledge, self-awareness, respondent's efficacy, and level of importance by measuring the willingness to allocate monies towards environmental causes. The statements used a four point Likert - type response scale (1 = Strongly disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly agree). Statements 46 to 49, measured the attitude towards social responsibility by using statements with a four point Likert – type response scale (1 = Strongly disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly agree). Statements 50 to 62, measured the political actions taken to protect the environment.

Table 6 Student Survey Questionnaire – Tool (Instrument structure)

S. No	Theme	Sub-Theme	Statement No.	Scoring
I	Students' demographic status	Gender, age, parents' literacy, residence location, native place, year of study, type of course, type of college, type of programme		
II	Students' awareness on environmental issues	Influences of the family and authoritative figures	1 to 5	1, 2, 3, 4
		Perception of local environmental conditions or issues in Coimbatore	6 to 14	1, 2, 3, 4
		Level of concern about environmental issues	15 to 20	1, 2, 3, 4
III	Students' Environmental attitude	Towards the environment (NEP 2000 instrument)	21 to 35	Odd (1, 2, 3, 4), Even (4,3,2,1)
IV	Students' level of self-efficacy	(Self-efficacy) self-knowledge, self-awareness, one-person's efficacy, and level of importance	36 to 45	1, 2, 3, 4, Except 37 (4,3,2,1)
V	Students' level of social responsibility	Towards social responsibility	46 to 49	1, 2, 3, 4
VI	Students' Environmental actions	Personal actions taken to protect the environment	50 to 62	If yes (1, 2, 3, 4) No = 0
VII	Students' local environmental knowledge	Local environment	63 to 70	1= Disagree or 2 = Agree
VIII	Students' Feelings about their Competence to Learn Environmental Education	Aspects of Environmental Education, (Rank order)	71 to 75	5, 4, 3, 2, 1
IX	Learning environmental education: opportunities	Enhancing student environmental education activities (rank order)	76 to 80	5, 4, 3, 2, 1
X	Learning environmental education: constraints	Obstacles hindering student environmental education activities (rank order)	81 to 89	5, 4, 3, 2, 1
XI	Students' priorities towards common issues of Tamil Nadu (Future)	(Rank order), Common issues	90	1
		Environmental issues	91	1

The following list of actions were presented and requested a yes/no answer: (1) wrote a letter to the newspaper, (2) attended a meeting, (3) made a formal submission, (4) read or sought information, (5) telephoned a public official, (6) took part in a protest, (7) complained to the company/person causing the damage, (8) joined an action group, (9) signed a petition, and (10) contributed money to an environmental cause. In addition, If they say “yes” for the above statements, participants were requested to rate the effectiveness of the action on a scale ranging from 1 = Not effective at all, 2 = Slightly effective, 3 = Fairly effective, and 4 = Very effective. Statements 63 to 70, measured the knowledge using a true/false (1= Disagree or 2= Agree) pattern of statements. Statements 71 to 75 were used to measure students’ feelings about their competence in environmental education. The scores were 5 = Excellent, 4 = Very good, 3 = Good, 2 = Fair and 1 = Poor. High scores indicated a person with strong willingness/interest towards learning Environmental Education. Statements 76 to 80, were used to identify the opportunities and constraints to teaching environmental education with a five point Likert - type response scale (5 = Greatly important, 4 = Considerably important, 3 = Somewhat important, 2 = Little important and 1 = Not important). The statements 81 to 89, used a four point Likert – type response scale (5 = greatly, 4 = considerably, 3 = somewhat, 2 = little and 1 = Not at all) to measure the attitudes toward the environment. Two multiple-choice questions asked participants to choose from a list, first (question 90) common issues facing Tamil Nadu government and second (question 91) most important environmental issues facing Coimbatore district.

3.5.2.2 Structure –Teacher’s Instrument

The instrument meant for teachers contained 96 statements. Of these, statements 1 to 10 is meant to elicit the teachers’ awareness about environment in general and environmental education in particular; 10 multiple-choice questions containing 5 environmental awareness statements and 5 environmental education awareness statements were used. Since the teachers obviously are from different academic backgrounds, the statements relating to environmental awareness focused more on concepts than factual information. The statements related to environmental education focused on concepts, goals, and principles. The split-half reliability of this part of the questionnaire was 0.76. Both percentage scores and raw scores were used for analyzing the data.

Statements 11 to 15, was meant to measured awareness as perception of local environmental conditions or issues in the study area, Coimbatore. The scores were 1 = Much worse, 2 = Worse, 3 = Better, and 4 = Much better. Scores in this group of statements described a general perception without compromising knowledge of those surveyed. The statements 16 to 20, measured awareness among the teachers as the level of concern about their local environmental issues. Scores assigned for the responses were 1 = Not Concerned at all, 2 = Somewhat concerned, 3 = Concerned, to 4 = Very concerned. High scores indicated a person with strong concerns about diverse environmental issues.

Environmental attitudes, beliefs, values and worldview in most cases are measured by the NEP (New Environmental Paradigm) scale. The notion of this environmental paradigm emerging as a replacement to the contemporary dominant social paradigm was first proposed by Priages & Ehrlich in 1974 (Barrett, Kuroda, & Miyamoto, 2002). Sensing that environmentalists were calling for more far-reaching changes than the development of environmental protection policies and stimulated by Pirages & Ehrlich's explication of the anti-environmental thrust of Society's Dominant Paradigm (SDP), Dunlap & Van Liere (1978) developed the New Environmental Paradigm (NEP) scale. Even though this New Environmental Paradigm (NEP) scale has become a widely used measure of pro-environmental orientation, Dunlap, Van Liere, Mertig and Jones (2000) revised it to improve the original one in several respects and developed a new scale with a very respectable internal consistency of coefficient alpha 0.83. The statements 21 to 35, measured the teachers' environmental attitudes using this new scale, with 15 statements was used in this study. The scale ranges from strongly disagree to strongly agree. For each statement, points were assigned in such a way that 5 = Strongly agree, 4 = Mildly agree, 3 = Unsure, 2 = Mildly disagree and 1 = Strongly disagree. According to the NEP scale agreement with the eight odd-numbered statements and disagreement with the seven even numbered statements indicate pro-environmental responses. Thus, scores are reversed for even numbered statements.

Likert type statements with 5 responses (strongly agree, agree, undecided, disagree and strongly disagree) were prepared by the investigator to assess participants' attitudes towards environmental education. Initially, an 18 statement scale was

constructed and administered to the 10 college teachers working in various institutions. The means and standard deviations of these statements were calculated and 6 statements with extreme means and / or low variability were eliminated indicating that everyone answered almost the same. The final version of the scale contained 12 statements and its Cronbach's alpha was 0.65.

The statements 36 to 47 comprised both favorable and unfavorable attitudes. With reference to each statement the options were assigned a weight ranging from 5 (strongly agree) to 1 (strongly disagree), for favorable statements (Statements 36, 39, 41, 44, 45 & 47). In case of unfavorable statements (Statements 37, 38, 40, 42, 43 & 46) the weight was reversed, i.e. from 1 (strongly agree) to 5 (strongly disagree). As the statements were twelve the highest score a participant could get was 60 and the lowest 12. The higher the score would indicate the more favorable attitude towards environmental education and the vice versa.

Statements 48 to 68, assessed teachers' environmental education practice by 21 statements consisting of three areas. The three areas that were dealt with were practices in (1) teaching environmental education (48 to 54); (2) extracurricular activities in school (55 to 61) and (3) out of school activities (62 to 68). The purpose of these statements was to measure teachers' practice of environmental education and how often they practiced it. The statements had five alternatives with a weight of 5 (usually), 4 (often), 3 (sometimes), 2 (seldom) and 1 (never). The score of an individual would be the sum total of statement scores in all the above three areas. The highest score would be 105 and the lowest 21. A higher score would be an indicator of a good practice of environmental education and vice versa. The test retest reliability of this part of the questionnaire is 0.69.

The statements 69 to 75, was meant to investigate the importance of different sources of environmental and environmental education for teachers, a survey questionnaire was prepared that would require respondents to rate different aspects. The statements had five alternatives with a weight of 5 (Greatly useful), 4 (Considerably useful), 3 (Somewhat useful), 2 (Little useful) and 1 (Not useful). Statements 76 to 80 were meant to measure teachers' feelings about their competence to teach environmental education. The scores for the responses to these statements were 5 = Excellent, 4 = Very good,

3 = Good, 2 = Fair to 1 = Poor. High scores indicated a person with strong feelings towards learning Environmental Education. A similar questionnaire was also prepared to identify the opportunities (81 to 85) by using statements with a five point Likert – type response scale (5 = Greatly important, 4 = Considerably important, 3 = Somewhat important, 2 = Little important and 1 = Not important) and constraints (86 to 94) to teaching environmental education by using four point Likert type response scale (5 = greatly, 4 = considerably, 3 = somewhat, 2 = little and 1 = Not at all). Two multiple-choice questions asked participants to choose from a list, the first (question 95) relating to common issues facing Tamil Nadu government and second (question 96) about most important environmental issues facing Coimbatore district.

All the statements were presented in both Tamil (Regional Language) and English, the language of instruction for several subjects in the tertiary level education in the Coimbatore region. The questionnaire was distributed, administered and collected by the researcher personally during their free hours with the help of teaching and non-teaching faculties. To avoid any lingual problems in the test or conceptual misunderstandings a half day discussion was made on the questionnaire with the subject teachers and also investigator was physically present during the survey which enabled the respondents to clarify their doubts directly. Teachers in the same college completed their questionnaire at the same time ensuring independent responses.

The statements relating to general information were intended to determine the following demographic characteristics for students: (a) Gender, (b) Age, (c) Parents' literacy, (d) Residence location, (e) Nativity, (f) Year of study, (g) Type of course, (h) Type of college, and (i) Type of programme. For teachers the information collected were (a) Gender, (b) Age, (c) Parents' literacy, (d) Residence location, (e) Nativity, (f) Educational qualification, (g) Teaching experience, (h) Type of college, (i) College location, and (j) Environmental education Qualification.

Table 7. Teacher Survey Questionnaire-Tool (Instrument structure)

S. No	Theme	Sub-Theme	Statement No.	Scoring
I	Teachers' demographic status	Sex, Age, Parents' Educational Qualification, Residence Location, Native Place, Teaching Experience, Educational Qualification, Type of college, College Location, University affiliation, Qualification in EE subject		
		Environmental awareness = 5	1 to 5	Correct = 1
		Environmental education awareness = 5	6 to 10	Wrong = 0
II	Teachers' environmental and environmental education awareness	Perception of local environmental conditions (Coimbatore)	11 to 15	1,2,3,4
		Level of concern about environmental issues (Coimbatore)	16 to 20	1,2,3,4
III	Teachers' environmental attitudes	Fragility of the Balance of nature	23, 28, 33	Agreement Statement
		Limits to growth	21, 26, 31	Odd numbers
		Anti-anthropocentrism	22, 27, 32	5,4,3,2,1
		Rejection of Human exemptionalism	24, 29, 34	Disagreement statement
		The likelihood of "eco-crisis"	25, 30, 35	Even numbers 1,2,3,4,5
IV	Teachers' attitudes towards Environmental Education	Favorable statement	36, 39, 41, 44, 45, 47	5,4,3,2,1
		Unfavorable statement	37, 38, 40, 42, 43, 46	1,2,3,4,5
V	Teachers' practices of Environmental Education	Classroom Teaching	48 to 54	
		Extracurricular activities in college	55 to 61	5,4,3,2,1
		Out of college activities	62 to 68	
VI	Teachers' information sources on Environmental Issues and Environmental Education	Teachers were asked to rate the degree to which each has been useful for their knowledge, attitude and skills (Rank order)	69 to 75	5, 4, 3, 2, 1
VII	Teachers' perception on their level of EE teaching competency	Aspects of Environmental Education (Rank order)	76 to 80	5, 4, 3, 2, 1
VIII	Teaching Environmental Education: Opportunities	Enhancing teacher environmental education activities (Rank order)	81 to 85	5, 4, 3, 2, 1
IX	Teaching Environmental Education: Constraints	Obstacles hinder teacher environmental education activities (Rank order)	86 to 94	5, 4, 3, 2, 1
X	Teachers' priorities towards common issues of Tamil Nadu (Future)	(Rank order)		
		Common issues	95	1
		Environmental issues	96	1

3.5.3 Data Collection

After receiving permission from the College/Institution managements, the tools / questionnaires were distributed to the participants in the study after their informed consent. Confidentiality and anonymity were warranted as well as there was no compulsion through the respective institutions for participation. Prior to actual administration, several trials of the instrument were conducted with a group of expert environmentalists, educationists, scientists, language teachers and research scholars of environmental studies to refine the instrument to its final version. The results and comments from these groups helped in evaluating the instrument, to observe consistencies, and to refine the survey.

3.6 Statistical Analysis

Both qualitative and quantitative data analyses were employed for the study. Percentages, means, modes and standard deviations were calculated where applicable. One-way ANOVA and independent sample t-tests were used to find the significance of the difference among the independent variables in awareness, knowledge, attitudes, self-efficacy and practice scores. Pearson's product moment correlation was employed to examine the magnitude and strength of relationships among the dependent variables. These were analyzed using SPSS (Version 21.0).

Rankings were used to analyze the importance of different sources of information, the opportunities and constraints, students' feelings about their competence to learn environmental education and teachers' feelings about their competence to teach the subject. The overall ranks and the ranks by the independent variables were calculated by multiplying the frequency for responses to each parameter by the coding numbers and the products per parameter were used to determine the ranks.

Chapter-IV
Results and Discussion

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Rate of Return of completed questionnaires / instruments

The participants in EE programs at the tertiary education level in Coimbatore region was surveyed using a custom-made questionnaire / instrument. The responses of students and teachers were collected from 38 colleges in Coimbatore. Then, a database of data generated by the surveys. Of the total of 2640 questionnaires issued (Students + Teachers), 2195 were returned (83.14%). Of the 2580 questionnaires issued to the student group the return was 83.33%, while of the 60 questionnaires issued to the teacher group the return was 75.00%. Table 1 presents the detailed breakup as per course of the total questionnaires issued, returned after fully completing it, returned with no answers or partially completed, and not returned at all.

Table 1. Details about questionnaires distributed and returned for the Study

Group type	Issued	Returned	Returned in %	Returned (Partially completed)	Not returned
Agricultural	180	157	87.22	22	1
Arts and Science	1200	999	83.25	184	17
Engineering	800	664	83.00	127	9
Polytechnics	260	225	86.54	32	3
Teacher Education	140	105	75.00	35	0
EE Teachers	60	45	75.00	5	10
Total	2640	2195	83.14	405	40

4.2 Research Questions

4.2.1 Students' Environmental Awareness (EA)

The first question we tried to address is what is the level of awareness, knowledge and attitude of college students who have components of environmental education (EE) as part of the curriculum? To address this we formulated a series of hypotheses as

presented below. Since the students come from different demographic and personal background, the first hypothesis was relating to that.

Hypothesis - 1: No difference in the level of environmental awareness (EA) among the students with respect to their demographic and personal data.

The overall awareness study revealed that students are relatively well aware about their Environment, having good understanding about their local environmental issues and having higher level of concerns over their local environmental issues. Fortunately, they are having good support from their family and well-wishers regarding environmental issues. Finally, the students hold marginally greater level of overall awareness; however, it indicates that students must need to improve in sensitivity and concern towards the environment, has implications for the way in which they acquired the environmental information, perceived it, and expressed it (Table 2 & figure 1).

Table 2. Percentage distributions of the respondents’ overall Environmental awareness (EA)

S. No	Variables	Scores secured	Maximum Scores	Percentage (%)
1	Influences of family & authoritative figures	29082	43000	67.63
2	Perception on locality	47711	77400	61.64
3	Level of concern	33243	51600	64.42
4	Overall Awareness	110036	172000	63.97

Figure 1. Percentage of students’ Environmental awareness level

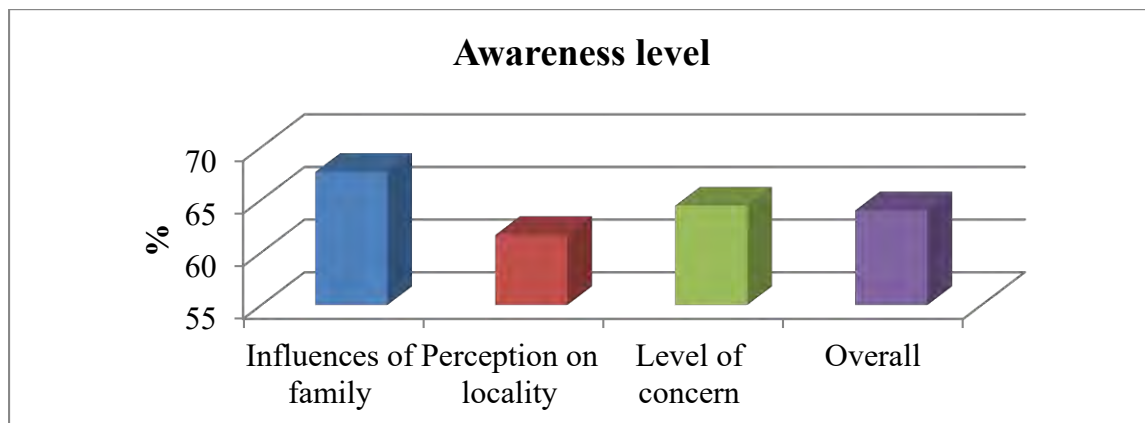


Table 3. Scores of Environmental Awareness (EA) among students

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	50.62	917	7.13	0.24
	Female	51.60	1233	6.69	0.19
Age	<18	50.81	710	6.70	0.25
	19-23	51.22	1374	6.98	0.19
	>24	54.29	66	6.71	0.83
Parents literacy	Literate	51.47	1654	7.01	0.17
	Illiterate	50.20	496	6.42	0.29
Residence location	Rural	51.63	1000	7.02	0.22
	Urban	50.79	1150	6.77	0.20
Nativity	Native	50.82	1018	6.72	0.21
	Non-native	51.50	1132	7.05	0.21
Year of Study	First Year	50.64	534	6.65	0.29
	Second Year	51.28	498	6.89	0.31
	Third Year	50.88	744	7.12	0.26
	Fourth Year	52.31	293	6.70	0.39
	Above Fifth Year	52.84	81	6.75	0.75
Type of Course	Agricultural	52.89	157	6.73	0.54
	Arts & Science	50.35	999	6.71	0.21
	Engineering	52.22	664	6.86	0.27
	Polytechnics	50.26	225	7.63	0.51
	Teacher Education	51.90	105	6.11	0.60
Type of College	Government	52.08	409	6.87	0.34
	Aided	51.06	525	6.73	0.29
	Self-Finance	50.93	1216	6.96	0.20
Type of Programme	Under Graduate	51.18	1720	6.76	0.16
	Post Graduate	51.65	182	7.08	0.52
	Research	56.09	23	6.44	1.34
	Diploma	50.26	225	7.63	0.51
	Total	51.18	2150	6.90	0.15

The descriptive analysis revealed that the mean raw score of female students is above the overall mean score and is much higher than that of the male students (Table 3). The independent-samples t-test was conducted to compare the dependent variable (the scores on EA) with independent variables (gender, parents' literacy level, residence locality and nativity of the students). Significant difference was found in the scores of male (M=50.62, SD=7.13) and female (M=51.60, SD=6.69) students [$t(2148) = 3.25, p = 0.001$]. Similarly, wards of literate parents scored higher than those of illiterate parents, with former getting scores above the total mean score. The independent sample t-test done on the group data revealed significant difference between the students of literate (M=51.47, SD=7.0) and illiterate parentage (M = 50.19, SD = 6.42), [$t(2148) = 3.80, p = 0.000$]. The mean raw score of rural students are above the overall mean score and are much higher than that of urban students. The independent-samples t-test, the difference between rural and urban students is significant [(rural - M = 51.63, SD = 7.02, and urban M=50.79, SD=6.77); $t(2148) = 2.79, p = 0.005$]. The mean raw score of non- native students are above the total mean score and are much higher than native the students. The independent-samples t-test showed significant difference between the two group of students [non-native (M=51.50, SD=7.04) and native (M=50.82, SD=6.72); $t(2148) = 2.31, p = 0.021$]. Thus, Female students, those of literate parentage, rural and non-native students hold higher level of EA than their counterparts. Results also revealed that gender, parents' literacy level, residence locality and nativity have great influence on students' EA level (Table 4).

Table 4. Independent Sample “t”- test for EA Scores by Gender, Parents literacy, Residence location and Nativity

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	917	50.62	7.13	2148	3.25	0.001*
	Female	1233	51.60	6.69			
Parents literacy	Literate	1654	51.47	7.01	2148	3.80	0.000*
	Illiterate	496	50.20	6.42			
Residence location	Rural	1000	51.63	7.02	2148	2.79	0.005*
	Urban	1150	50.79	6.77			
Nativity	Native	1018	50.82	6.72	2148	2.31	0.021*
	Non-native	1132	51.50	7.05			

*Significant at 0.05 level

Table 5. One-way ANOVA on EA Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	734.650	367.325	7.763	0.000*
	Within Groups	2147	101592.050	47.318		
	Total	2149	102326.700			
Year of Study	Between Groups	4	827.104	206.776	4.370	0.002*
	Within Groups	2145	101499.596	47.319		
	Total	2149	102326.700			
Type of Course	Between Groups	4	2096.349	524.087	11.216	0.000*
	Within Groups	2145	100230.350	46.727		
	Total	2149	102326.700			
Type of College	Between Groups	2	416.950	208.475	4.392	0.012*
	Within Groups	2147	101909.749	47.466		
	Total	2149	102326.700			
Type of Programme	Between Groups	3	784.208	261.403	5.524	0.001*
	Within Groups	2146	101542.491	47.317		
	Total	2149	102326.700			

*Significant at 0.05 level

One-way analysis of variance (ANOVA) was done on students' EA scores as the dependent variable against the independent variables age, year of study, type of course, type of college and type of programme. The F-statistics from this analysis is shown in Table 5. There was a statistically significant difference for independent variables age, year of study, type of course, type of college and type of programme with respect to the participants' EA.

Age group descriptive statistics shows that the mean raw score of >24 years students is above the total mean score and is much higher than 19-23 years and <18 years student groups. There was a statistically significant difference between the age groups as determined by one-way ANOVA [F (2, 2147) = 7.763, p = 0.000]. A close examination of the Tukey post-hoc test for the mean difference of EA revealed that there was a

statistically significant difference among the lower scores of <18 years (50.81 ± 6.70 , $p = 0.000$) and 19-23 years (51.22 ± 6.98 , $p = 0.001$) student groups when compared with the higher scores of >24 years (54.29 ± 6.71) group. There were no statistically significant differences between <18 and 19-23 age groups ($p = 0.410$).

The descriptive statistics with respect to year of study revealed that mean raw score of fifth year student is above the total mean score and is much higher than other four groups; first year; second year; third year and fourth year respectively. This was confirmed by the statistically significant difference between the year of study groups as determined by one-way ANOVA ($F(4, 2145) = 4.370$, $p = 0.002$). A Tukey post-hoc test for the mean difference of EA also revealed statistically significant difference among the lower scores of first year (50.60 ± 6.64 , $p = 0.007$) and third year (50.88 ± 7.12 , $p = 0.022$) student groups when compared with the higher score of fourth year (52.31 ± 6.70) group. There were no statistically significant differences when compared with the other 'year of study' groups (first, second, third, and fourth year) with fifth year group regarding environmental awareness.

The mean raw score of agricultural student is above the total mean score and is much higher than the other four groups (Arts & science, Engineering, Polytechnic and teacher education) respectively. However, there was a statistically significant difference between the type of course groups as determined by one-way ANOVA ($F(4, 2145) = 11.216$, $p = 0.000$). A close examination of the Tukey post-hoc test for the mean difference of EA revealed that a statistically significant difference among the lower scores of Arts & science (50.35 ± 6.73 , $p = 0.000$) and polytechnics (50.26 ± 7.63 , $p = 0.002$) student groups compared to the higher score of agricultural students group (52.89 ± 6.73). Likewise between arts & science (50.35 ± 6.73) and engineering (52.22 ± 6.86 , $p = 0.000$), and engineering (52.22 ± 6.86) and polytechnics (50.26 ± 7.63 , $p = 0.002$) groups showed statistically significant differences. On the other hand, there were no statistically significant differences between other course groups (Agricultural, Arts & Science, Engineering and Polytechnics) with Teacher education group regarding EA.

Descriptive statistics of 'type of colleges' shows that the mean raw score of Government College students is above the total mean score and is much higher than

Aided and Self-finance student groups. One-way ANOVA ($F(2, 2147) = 4.392$, $p = 0.012$) confirmed the same. A close examination of the Tukey post-hoc test for the mean difference of EA also revealed a statistically significant difference among the lower scores of Self-finance (50.93 ± 7.00 , $p = 0.010$) students when compared with the higher scores of Government (52.08 ± 6.90) students. There was no statistically significant differences between other two type of college groups (Government and Self-finance) with Aided group regarding EA level.

Descriptive statistics on 'type of programme' group shows that the mean raw score of research group students is above the total mean score and is much higher than other three student groups. There was statistically significant difference between the different types of programme as seen by one-way ANOVA [$F(3, 2146) = 5.52$, $p = 0.001$]. Tukey post-hoc test for the mean difference of environmental awareness also revealed statistically significant difference among the lower scores of diploma (50.26 ± 7.63 , $p = 0.001$), under graduate (51.18 ± 6.80 , $p = 0.004$) and post graduate (51.65 ± 7.08 , $p = 0.019$) student groups when compared with the higher scores of research (56.09 ± 6.44) group. However, there were no statistically significant differences among the under graduate, postgraduate and diploma groups with respect to their respective EA scores.

The above results revealed that variables like age, year of study, type of course, type of college and type of programme have greater impacts on students' EA level and the group of students such as >24years old, above fifth year, agricultural, government college and research possessed higher level of awareness regarding their local environment.

4.2.2 Students' Environmental Attitudes (EAtt.)

Hypothesis - 2: No significant difference in the level of environmental attitudes (EAtt.) among the college students with respect to their demographic and personal variables.

A revised NEP scale with 15 statements adopted from Dunlap et al. (2000) was used to measure the environmental attitudes of college students. The percentage distributions of responses to each of the statements are presented in Table 6. Though the NEP scale has four scales (strongly agree, mildly agree, mildly disagree and strongly disagree), these were reduced into two categories by combining 'strongly agree' with 'mildly agree' and 'mildly disagree' with 'strongly disagree' for the presentation here.

The content of the NEP scale has five facets, i) balance of nature, ii) limits to growth, iii) anti-anthropocentrism, iv) “human exemptionalism” and v) the likelihood of “ecocrisis”. Statements 21, 26 and 31 are related to the reality of the limits to growth. The results show that 3/4th of the respondents (75.67%) agreed to statement 21 that says “we are approaching the limit of the number of people the earth can support”. More than 3/4th of the respondents (87.95%) disagreed to the unfavorable statement (Statement No 26) which is “the earth has plenty of natural resources if we just learn how to develop them”. To the statement “the earth is like a spaceship with very limited room and resources” (Statement No 31), 62.19% of the respondents agreed. These results indicate that the majority of students have a strong belief in the inevitability of “limits to growth”.

Anthropocentric views are also reflected in the students’ responses. The three statements that are related to this view are statements 22, 27 and 32. For the anthropocentric worldview, that says, “humans have the right to modify the natural environment” (No 22), 50.51% of the respondents agreed while 49.49% disagreed. It shows that in general they were neutral to this statement. For the eco-centric view that “plants and animals have as much right as humans’ (statement No 27) only 9.40% of the respondents disagreed. For the other anthropocentric view that “humans were meant to rule over the rest of nature” (statement No 32), 63.77 % of the respondents agreed. It revealed that students are relatively positive towards anthropocentrism.

Students’ beliefs on the fragility of the balance of nature were tested by statements 23, 28 and 33. The majority of the respondents believed that human interference with nature often leads disastrous consequences as 79.63% of them agreed to statement No 23. This belief of the respondents is reassured by the responses to the unfavorable statements (Statement No 28) that says “the balance of nature is strong enough to cope with the impacts of nature” to which only a little above half of them (57.53 %) agreed. Their belief on the fragility of the balance of nature is further strengthened by the responses to statement 33 that states, “the balance of nature is very delicate and easily up set” to which 74.65% of them agreed and only 25.35% disagreed.

In addition, students believe that humans, like other species, are not exempted from the constraints of nature. This is evidenced by the responses given to the statements

related to “rejection of exemptionalism” (statements 24, 29 and 34). For the unfavorable statements “Science and technology can overcome any environmental problem” (statements No 24) and “Maintaining economic growth is more important than protecting the natural environment” (statement No 34), 44.23% and 28.28% respectively of the respondents disagreed. For the favorable statement (No 29) “despite our special abilities humans are still subject to the laws of nature”, the majority of the respondents (85.81%) agreed.

Unless appropriate measures are taken, students believe, there is possibility of ecological crises as shown by the responses given to the statements relating to this issue (statements 25, 30 and 35). For the statement “humans are severely abusing the environment” (statement No 25), more than 85.53% agreed. For statement (No 30), that states ‘the so-called “ecological crisis” facing human kind has been greatly exaggerated’ 65.12% disagreed. The possibility of an eco-crisis in the future, well stated by the statement No 35, that “if things continue on their present course, we will soon experience a major ecological catastrophe” to which 86.28% agreed.

Generally, the percentage distributions of the respondents indicate that there is a tendency on the part of students to support pro-environmental beliefs. As can be seen in Table 7 below, 41.45% supported pro-environmental beliefs; but it is even lesser than that reported from elsewhere in Asia where most country responses were in a range of 51-61% indicating a higher pro-environmental behavior (Barett, Kuruda and Miyamoto, 2002) than that of Coimbatore. One concern here is that a considerable number of participants have held a neutral stance about each of the 15 statements, which is 29.24%.

Table 6. Frequency distributions of the Respondents for NEP Scale

Code*	Statements	Disagree		Agree	
		No.	%	No.	%
21	We are approaching the limit of the number of people the Earth can support.	523	24.33	1627	75.67
22	Humans have the right to modify the natural environment to suit their needs.	1064	49.49	1086	50.51
23	When humans interfere with nature, it often produces disastrous consequences.	438	20.37	1712	79.63
24	Science and technology can overcome any environmental problem.	951	44.23	1199	55.77
25	Humans are severely abusing the environment.	311	14.47	1839	85.53
26	The Earth has plenty of natural resources if we just learn how to develop them.	1891	87.95	259	12.05
27	Plants and animals have as much right as humans to exist.	202	9.40	1948	90.60
28	The balance of nature is strong enough to cope with the impacts of modern industrial nations.	913	42.47	1237	57.53
29	Despite our special abilities, humans are still subject to the laws of nature.	305	14.19	1845	85.81
30	The so-called “ecological crisis” facing humankind has been greatly exaggerated.	1400	65.12	750	34.88
31	The Earth has very limited room and resources.	813	37.81	1337	62.19
32	Humans were meant to rule over the rest of nature.	779	36.23	1371	63.77
33	The balance of nature is very delicate and easily upset.	545	25.35	1605	74.65
34	Maintaining economic growth is more important than protecting the natural environment.	608	28.28	1542	71.72
35	If things continue on their present course, we will soon experience a major ecological catastrophe.	295	13.72	1855	86.28

*The statements are coded as numbered in the questionnaire

Table 7. Percentage Responses of pro and anti NEP Scale

S. No	Category	Percentage response (%)
1	Pro-environmentalist attitude	41.45
2	Anthropocentric Attitude	29.31
3	Neutral	29.24

Table 8. Mean and SD of Environmental Attitude Scores

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	42.47	917	4.95	0.16
	Female	42.44	1233	4.55	0.13
Age	<18	42.11	710	4.51	0.17
	19-23	42.63	1374	4.80	0.13
	>24	42.55	66	5.27	0.65
Parents literacy	Literate	42.49	1654	4.76	0.12
	Illiterate	42.33	496	4.60	0.21
Residence location	Rural	42.27	1000	4.85	0.15
	Urban	42.62	1150	4.60	0.14
Nativity	Native	42.28	1018	4.60	0.14
	Non-native	42.61	1132	4.83	0.14
Year of Study	First Year	42.28	534	4.50	0.19
	Second Year	42.04	498	4.54	0.20
	Third Year	42.41	744	4.85	0.18
	Fourth Year	43.45	293	4.88	0.29
	Above Fifth Year	43.02	81	5.06	0.56
Type of Course	Agricultural	44.18	157	5.16	0.41
	Arts & Science	42.21	999	4.75	0.15
	Engineering	42.41	664	4.66	0.18
	Polytechnics	42.07	225	4.27	0.28
	Teacher Education	43.31	105	4.50	0.44
Type of College	Government	43.87	409	4.78	0.24
	Aided	43.03	525	4.50	0.20
	Self-Finance	41.74	1216	4.66	0.13
Type of Programme	Under Graduate	42.35	1720	4.70	0.11
	Post Graduate	43.81	182	5.19	0.39
	Research	43.78	23	4.86	1.01
	Diploma	42.07	225	4.27	0.28
	Total	42.46	2150	4.72	0.10

The descriptive statistics revealed that the mean raw score of the male students is above the total mean score and is much higher than the female students' score (Table 8). The independent-samples t-test showed no significant difference in the mean score of male (M=42.47, SD=4.95) and female (M=42.44, SD=4.54) students [$t(2148) = 0.138$, $p = 0.890$]. Similarly, students of literate parents scored higher than those of illiterate parents and the score was above the total mean score. The independent sample t-test calculated for the group revealed that there is no significant difference between the literate (M=42.49, SD=4.76) and illiterate parental students (M=42.33, SD=4.60) [$t(2148) = 0.656$, $p = 0.512$] with reference to their environmental attitude.

The mean raw score of urban students are above the total mean score and are higher than that of rural students. However, the independent-samples t-test conducted showed no significant difference in the scores of rural (M=42.27, SD=4.85) and urban (M=42.62, SD=4.60) students [$t(2148) = -1.720$, $p = 0.086$]. The mean raw score of non- native students are above the total mean score, but it is close to that of native students. Independent-samples t-test conducted on the environmental attitude score of the native and non-native students also showed the score of non-native (M=42.61, SD=4.83) and native (M=42.28, SD=4.60) students [$t(2148) = -1.619$, $p = 0.106$] are not significantly different.

Hence, it can be stated that gender, parents' literacy level, residence locality and nativity variables do not have any impacts on students' environmental attitude and these groups of students do not vary regarding their level of environmental attitude (Table 9).

Table 9. Independent Sample “t”- test for Environmental Attitude Scores by Gender, Parents literacy, Residence location and Nativity

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	917	42.47	4.95	2148	0.138	0.890
	Female	1233	42.44	4.55			
Parents literacy	Literate	1654	42.49	4.76	2148	0.656	0.512
	Illiterate	496	42.33	4.60			
Residence location	Rural	1000	42.27	4.85	2148	1.720	0.087
	Urban	1150	42.62	4.60			
Nativity	Native	1018	42.28	4.60	2148	1.619	0.106
	Non-native	1132	42.61	4.83			

Table 10. One-way ANOVA for Environmental Attitude Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	130.122	65.061	2.922	0.054
	Within Groups	2147	47801.355	22.264		
	Total	2149	47931.477			
Year of Study	Between Groups	4	422.169	105.542	4.765	0.001*
	Within Groups	2145	47509.308	22.149		
	Total	2149	47931.477			
Type of Course	Between Groups	4	639.789	159.947	7.255	0.000*
	Within Groups	2145	47291.688	22.047		
	Total	2149	47931.477			
Type of College	Between Groups	2	1615.040	807.520	37.433	0.000*
	Within Groups	2147	46316.438	21.573		
	Total	2149	47931.477			
Type of Programme	Between Groups	3	429.882	143.294	6.474	0.000*
	Within Groups	2146	47501.595	22.135		
	Total	2149	47931.477			

*Significant at 0.05 level

One-way analysis of variance (ANOVA) was done with students' environmental attitude scores as the dependent variable and age, year of study, type of course, type of college and type of programme as independent variables. The F-statistics obtained from this analysis is shown in Table 10. There was statistically significant difference for independent variables year of study, type of course, type of college and type of programme (except age).

Age group descriptive statistics shows that the mean raw score of 19-23 years students is above the total mean score and is much higher than >24 years and <18 years student groups. There were no statistically significant difference among the age groups as seen by one-way ANOVA ($F(2, 2147) = 2.922, p = 0.054$). A close examination of the Tukey post-hoc test for the mean difference of environmental attitude revealed statistically significant differences among the lower scores of <18 years (42.10 ± 4.50 ,

$p = 0.042$) student groups and the higher scores of 19-23 years (46.79 ± 4.80) group. However, there were no statistically significant differences between the <18 year group, 19-23 year group and >24 years group regarding environmental attitude.

The descriptive statistics on 'year of study' revealed that mean raw score of 'above fourth' year students is above the total mean score and is much higher than other four groups (first year, second year, third year and fifth year). There was statistically significant differences between the different 'year of study' groups as shown by one-way ANOVA [$F(4, 2145) = 4.765, p = 0.001$]. Tukey post-hoc test for the mean difference of environmental attitude revealed that statistically significant differences among the lower scores of first year ($42.28 \pm 4.50, p = 0.006$), second year ($42.04 \pm 4.54, p = 0.000$) and third year ($42.41 \pm 4.85, p = 0.012$) student groups when compared with the higher scores of fourth year (43.45 ± 4.88) group. On the other hand, there were no statistically significant differences between the 'above fifth' year group students and rest of the 'year of study' groups.

The mean raw score of agricultural students is above the total mean score and is much higher than other four groups (arts & science, Engineering, Polytechnic and teacher education). Further, there was statistically significant differences between the type of course groups as seen from one-way ANOVA [$F(4, 2145) = 7.255, p = 0.000$]. An examination of the Tukey post-hoc test among the mean difference of environmental attitude revealed a statistically significant difference between the lower scores of arts & science ($42.21 \pm 4.75, p = 0.000$), polytechnics ($42.07 \pm 4.27, p = 0.000$) and engineering ($42.40 \pm 4.66, p = 0.000$) student groups compared to the higher score of agricultural student (44.18 ± 5.16) group. Additionally, there were no statistically significant differences between the four groups (Agricultural, Arts & Science, Engineering and Polytechnics) with Teacher education group regarding level of environmental attitude.

Descriptive statistics of 'Type of college' groups shows that the mean raw score of Government College students is above the total mean score and is much higher than Aided and Self-finance student groups. There was a statistically significant difference between the 'type of college' groups as shown by one-way ANOVA [$F(2, 2147) = 37.433, p = 0.000$]. The Tukey post-hoc test for the mean difference of environmental attitude revealed statistically significant differences among the lower scores of Self-finance

(41.74 ± 4.066 p = 0.000) and Aided (43.03 ± 4.50, p = 0.017) student groups compared to the higher scores of Government (43.87 ± 4.78) group.

Descriptive statistics of 'Type of programme' groups shows that the mean raw score of post 'graduate group' students is above the total mean score and is much higher than the other three student groups. There was statistically significant difference between the 'type of programme' groups as seen from one-way ANOVA [F (3, 2146) = 6.474, p = 0.000]. The Tukey post-hoc test for the mean difference of environmental attitude revealed that there was a statistically significant difference among the lower scores of diploma (42.07 ± 4.27, p = 0.001) and under graduate (42.35 ± 4.70, p = 0.000) student groups when compared with the higher scores of postgraduate (43.81 ± 5.19) group. Further, there were no statistically significant differences among the groups of under graduate, postgraduate and diploma when compared with research group with reference to their environmental attitude.

Thus, it was seen that variables like year of study, type of course, type of college and type of programme have greater impacts on students' environmental attitude and 19-23 years aged, fourth year, agricultural, government and postgraduate students have higher level of environmental attitude than other groups.

4.2.3 Students' Environmental Knowledge (EK)

Hypothesis - 3: No significant difference in the level of environmental knowledge among the college students with respect to their demographic and personal variables.

To measure the students' local EK, eight self-made statements were prepared, which measured the knowledge using a true/false (1 = Disagree or 2 = Agree) pattern of questions. The percentage distributions for responses to each of the statements are presented in Table 11.

The content of the scale intended to address grab the students' opinion about their local environmental conditions and issues. Statements 63, 64 and 69 are related to deal the water quality. To the statement (No. 63) "Pollution in Coimbatore rivers and streams comes mainly from Industries", more than 89.72% agreed. For statement No 64 which states 'Most storm water drains and road sewage gutters drain directly into streams, rivers and ponds' 89.12% agreed. The statement No 69, "Most water for human consumption in Coimbatore comes from river water dams and lakes" to which 84.28% agreed. Similarly,

statement No 65, 68 and 70 used to label the issues like “Rapid increase in vehicular movement is one of the serious threats to Coimbatore environment”, “Each summer the government is sprayed with the same bug killer to control mosquitoes. After many years of spraying the same product the mosquitoes will likely become resistant to the spray” and “Plastic carry bags are serious threat to effective solid waste management”, 89.72%, 74.23% and 86.28% of the respondents respectively agreed. Majority of the students (88.14%) agreed with the statement (no 66), which says, “The most effective way to save an endangered plant & animal is to establish a large enough nature reserve for it to live and reproduce”. It shows that students were positive towards conserving the plant and animal species in their natural habitats. For the adverse statement “As the population in an area increases, the potential for pollution decreases” (statement No 67) the majority of the respondents (62.00%) disagreed.

Table 11. Frequency and Percentage Distributions of the responses indicating the Respondents’ Environmental knowledge

Code*	Statements	Disagree		Agree	
		No.	%	No.	%
63	Pollution in Coimbatore rivers and streams comes mainly from Industries.	221	10.28	1929	89.72
64	Most storm water drains and road sewage gutters drain directly into streams, rivers and ponds.	234	10.88	1916	89.12
65	Rapid increase in vehicular movement is one of the serious threats to Coimbatore environment.	221	10.28	1929	89.72
66	The most effective way to save an endangered plant & animal is to establish a large enough nature reserve for it to live and reproduce.	255	11.86	1895	88.14
67	As the population in an area increases, the potential for pollution decreases.	1333	62.00	817	38.00
68	Plastic carry bags are serious threat to effective solid waste management.	295	13.72	1855	86.28
69	Most water for human consumption in Coimbatore comes from river water dams and lakes.	332	15.44	1818	84.56
70	Each summer the government is sprayed with the same bug killer to control mosquitoes. After many years of spraying the same product, the mosquitoes will likely become resistant to the spray.	554	25.77	1596	74.23

*The statements are coded as numbered in the questionnaire

Table 12. Mean Scores and SD of Environmental Knowledge Scores

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	14.28	917	1.34	0.04
	Female	14.48	1233	1.22	0.03
Age	<18	14.41	710	1.30	0.05
	19-23	14.39	1374	1.26	0.03
	>24	14.33	66	1.33	0.16
Parent's literacy	Literate	14.40	1654	1.28	0.03
	Illiterate	14.40	496	1.27	0.06
Residence location	Rural	14.37	1000	1.33	0.04
	Urban	14.42	1150	1.23	0.04
Nativity	Native	14.42	1018	1.24	0.04
	Non-native	14.38	1132	1.30	0.04
Year of Study	First Year	14.45	534	1.28	0.06
	Second Year	14.19	498	1.49	0.07
	Third Year	14.47	744	1.14	0.04
	Fourth Year	14.46	293	1.15	0.07
	Above Fifth Year	14.44	81	1.28	0.14
Type of Course	Agricultural	14.62	157	1.07	0.09
	Arts & Science	14.34	999	1.31	0.04
	Engineering	14.45	664	1.30	0.05
	Polytechnics	14.25	225	1.28	0.09
	Teacher Education	14.56	105	1.05	0.10
Type of College	Government	14.63	409	1.03	0.05
	Aided	14.61	525	1.17	0.05
	Self-Finance	14.23	1216	1.37	0.04
Type of Programme	Under Graduate	14.42	1720	1.27	0.03
	Post Graduate	14.40	182	1.28	0.09
	Research	14.35	23	1.23	0.26
	Diploma	14.25	225	1.28	0.09
	Total	14.40	2150	1.28	0.03

The descriptive analysis revealed that the mean raw score of female students is above the total mean score and it is much higher than the male students (Table 12). Independent-samples t-test conducted to compare the dependent variable EA scores with independent variables gender, parents' literacy level, residence locality and nativity of the students showed significant difference in the mean scores of male ($M=14.28$, $SD=1.34$) and female ($M=14.48$, $SD=1.22$) students [$t(2148) = -3.589$, $p = 0.000$].

Students of literate parentage and those of illiterate parentage have same mean score. The independent sample t-test calculated for the group also confirmed no significant difference between the student of literate ($M=14.40$, $SD=1.28$) and illiterate parents ($M=14.40$, $SD=1.27$); $t(2148) = -0.111$, $p = 0.912$ with reference to their EA. The mean raw scores of urban students are above the total mean score and are much higher than rural students. An independent-samples t-test comparing the EA scores of the rural and urban students showed no significant difference in the scores of rural ($M=14.37$, $SD=1.33$) and urban ($M=14.42$, $SD=1.23$) students [$t(2148) = -0.798$, $p = 0.422$]. The mean raw score of native students are above the total mean score and are much higher than that of non-native students. Independent-samples t-test comparing the EA scores showed no significant difference in the scores of non-native ($M=14.37$, $SD=1.30$) and native ($M=14.42$, $SD=1.24$) students; $t(2148) = 0.785$, $p = 0.433$.

Thus, only gender alone was seen having significant difference while other variables parents' literacy level, residence locality and nativity do not have any impacts on students' EK. The female students possessed greater local EK than others (Table 13).

Table 13. Independent Sample “t”- test for Environmental Knowledge Scores by Gender, Parents literacy, Residence location and Nativity.

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	917	14.28	1.34	2148	3.538	0.000*
	Female	1233	14.48	1.22			
Parents literacy	Literate	1654	14.40	1.28	2148	0.111	0.912
	Illiterate	496	14.40	1.27			
Residence location	Rural	1000	14.37	1.33	2148	0.798	0.425
	Urban	1150	14.42	1.23			
Nativity	Native	1018	14.42	1.24	2148	0.785	0.433
	Non-native	1132	14.38	1.30			

*Significant at 0.05 level

Table 14. One-way ANOVA for Environmental Knowledge Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	0.463	0.231	0.142	0.867
	Within Groups	2147	3494.526	1.628		
	Total	2149	3494.988			
Year of Study	Between Groups	4	28.396	7.099	4.393	0.002*
	Within Groups	2145	3466.592	1.616		
	Total	2149	3494.988			
Type of Course	Between Groups	4	20.761	5.190	3.205	0.012*
	Within Groups	2145	3474.227	1.620		
	Total	2149	3494.988			
Type of College	Between Groups	2	81.693	40.846	25.693	0.000*
	Within Groups	2147	3413.295	1.590		
	Total	2149	3494.988			
Type of Programme	Between Groups	3	5.712	1.904	0.319	0.319
	Within Groups	2146	3489.276	1.626		
	Total	2149	3494.988			

*Significant at 0.05 level

One-way analysis of variance (ANOVA) was calculated with students' environmental knowledge scores as the dependent variable against the independent variables age, year of study, type of course, type of college and type of programme. The F-statistics from this analysis is shown in Table 14. There was a statistically significant difference for independent variables year of study, type of course and type of college (except age and type of programme) with regard to the participants' EK.

Age group descriptive statistics shows that the mean raw score of <18 years students is above the total mean score and is much higher than >24 years and 19-23 years student groups. There were no statistically significant difference among the age groups as determined by one-way ANOVA ($F(2, 2147) = 0.142, p = 0.867$). A close examination of the Tukey post-hoc test for the mean difference of environmental knowledge revealed no statistically significant differences among the participant groups regarding their environmental attitude.

With reference to descriptive statistics of 'the year of study' revealed that mean raw score of third year students is above the total mean score and is much higher than other four groups (first year; second year; fourth year and fifth year). Statistically significant differences between the year of study groups was seen from one-way ANOVA ($F(4, 2145) = 4.393, p = 0.002$). A Tukey post-hoc test for the mean difference of environmental knowledge revealed that there was a statistically significant difference exists among the higher scores of first year ($14.45 \pm 1.28, p = 0.008$), third year ($14.47 \pm 1.14, p = 0.001$) and fourth year ($14.46 \pm 1.15, p = 0.034$) student groups when compared with the lower score of second year (14.18 ± 1.49) group. Besides, there were no statistically significant differences when comparing the fifth year students with second year student group regarding environmental knowledge.

The mean raw score of agricultural student is above the total mean score and is much higher than other four groups (arts & science, Engineering, Polytechnic and teacher education). There was statistically significant difference between the 'type of course' [one-way ANOVA ($F(4, 2145) = 3.205, p = 0.012$)]. Tukey post-hoc test for the mean difference of EK revealed statistically significant difference among the lower scores of polytechnics ($14.25 \pm 1.28, p = 0.043$) student groups compared to the higher score of

agricultural student (14.62 ± 1.07) group. However, there were no statistically significant differences in EK scores within the group and between the groups except in the case of agricultural students.

‘Type of college’ group descriptive statistics shows that the mean raw score of Government College students is above the total mean score and is much higher than Aided and Self-finance student groups. There was a statistically significant difference between the ‘type of college’ groups [one-way ANOVA ($F(2, 2147) = 25.693, p = 0.000$)]. Tukey post-hoc test for the mean difference of EK revealed statistically significant difference resides among the higher scores of government ($14.63 \pm 1.03, p = 0.000$) and Aided ($14.60 \pm 1.17, p = 0.000$) student groups when compared with the lower scores of self-finance (14.23 ± 1.36) group.

‘Type of programme’ group descriptive statistics shows that the mean raw score of under graduate group students is above the total mean score and is much higher than other three student groups. There were no statistically significant difference between the type of ‘programme groups’ as determined by one-way ANOVA ($F(3, 2146) = 1.171, p = 0.319$).

Hence variables like year of study, type of course and type of college have greater impacts on students’ environmental knowledge and second year, polytechnics and self-finance college students’ environmental knowledge level is significantly lower than their counterparts.

4.2.4 Students’ self-efficacy (SE)

What is the self-efficacy (SE) level of awareness, knowledge and attitude among the different group students studied?

Hypothesis - 4: No significant difference in the level of self-efficacy among the college students with respect to their demographic and personal variables.

For the analysis of the level of self-efficacy (statements 36 to 45), subcategories was created regarding (a) knowledge (statements 36, 37, and 39), (b) one-person impact (statements 40, 44, and 45), (c) level of self-awareness and taxation (statements 41, 42, and 43). For statement 37, it was necessary to invert the score since the question was

framed with a negative environmental implication. Self-efficacy (SE) was measured with a series of questions inquiring about personal levels of satisfaction, importance, and perception of environmental levels of awareness, knowledge and attitude (Table 15).

The responses given to the statements related to “knowledge” (statements 36, 37, and 39) used to find out the students’ knowledge towards environment. For the favorable statements “I am very well informed about environmental issues in Coimbatore” (statements No 36) and “Environmental education is as important as any other curriculum in college” (statement No 39), 75.02% and 92.47% of the respondents respectively agreed. For the adverse statement which says “I pay very little attention as environmental issues are reported by the news media, including radio, TV, newspapers, and magazines” (statement No 37) more than half of the respondents (58.42%) disagreed. The statements related to one-person impact (statements 40, 44 and 45) which says “There is a lot I, as an individual, can do to protect the environment in my community” (statement No 40), more than 86.37% agreed. For statement No 44 which states ‘One person can influence how environmental problems and issues are resolved’ 60.56% agreed and the statement No 35 that is “Personally, working as an individual and on your own, can influence the solution of environmental issues” to which 70.88% agreed. To understand the level of self-awareness and taxation statements (41, 42, and 43) were used. The statements “I perceive myself as very concerned about environmental issues in my community” (statement No 41), more than 84.37% agreed. For the statement (No 42), “I am willing to pay extra taxes to protect the environment in my community” 71.30% agreed and to the statement No 43 that says “I would be willing to appreciate the government, if they reassess the existing policies to protect the environment in my community” 83.49% agreed. According to Bandura (1997), there are four influences upon a person’s SE. These include mastery experiences, vicarious experiences, social persuasion, and physiological/emotional states. Given the ranking of SE results across the present study groups, it may be interpreted that individuals having more mastery and vicarious experiences had higher SE as relating to environmental issues, while students self-efficacy may have been based upon the social persuasion of EE teachers.

Table 15. Frequency and Percentage distributions of the respondents' self-efficacy statements

Code*	Statements	Disagree		Agree	
		No.	%	No.	%
36	I am very well informed about environmental issues in Coimbatore	537	24.98	1613	75.02
37	I pay very little attention as environmental issues are reported by the news media, including radio, TV, newspapers, and magazines.	1256	58.42	894	41.58
38	Tribal people know a lot about environmental issues.	695	32.33	1455	67.67
39	Environmental education is as important as any other curriculum in college.	162	7.53	1988	92.47
40	There is a lot I, as an individual, can do to protect the environment in my community.	293	13.63	1857	86.37
41	I perceive myself as very concerned about environmental issues in my community.	336	15.63	1814	84.37
42	I am willing to pay extra taxes to protect the environment in my community.	617	28.70	1533	71.30
43	I would be willing to appreciate the government, if they reassess the existing policies to protect the environment in my community.	355	16.51	1795	83.49
44	One person can influence how environmental problems and issues are resolved.	848	39.44	1302	60.56
45	Personally, working as an individual and on your own, can influence the solution of environmental issues.	626	29.12	1524	70.88

*The statements are coded as numbered in the questionnaire

The descriptive analysis revealed that the mean raw score of the female students is above the total mean score and is much higher than the male students (Table 16). The independent-samples t-test conducted to relating the dependent variable students' SE scores with independent variables gender, parents' literacy level, residence locality and

nativity of the students showed significant difference in the mean scores of female (M=29.86, SD=3.56) and male (M=29.18, SD=3.82) students [$t(2148) = -4.242, p = 0.000$].

Table 16. Mean Scores and SD of Self-efficacy Scores

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	29.18	917	3.83	0.13
	Female	29.86	1233	3.56	0.10
Age	<18	29.62	710	3.90	0.15
	19-23	29.52	1374	3.57	0.10
	>24	30.17	66	3.98	0.49
Parent's literacy	Literate	29.54	1654	3.73	0.09
	Illiterate	29.70	496	3.57	0.16
Residence location	Rural	29.60	1000	3.77	0.12
	Urban	29.55	1150	3.63	0.11
Nativity	Native	29.63	1018	3.71	0.12
	Non-native	29.53	1132	3.68	0.11
Year of Study	First Year	29.70	534	3.98	0.17
	Second Year	29.34	498	3.79	0.17
	Third Year	29.28	744	3.53	0.13
	Fourth Year	30.19	293	3.20	0.19
	Above Fifth Year	30.68	81	3.75	0.42
Type of Course	Agricultural	30.00	157	3.47	0.28
	Arts & Science	29.85	999	3.78	0.12
	Engineering	29.07	664	3.66	0.14
	Polytechnics	29.19	225	3.52	0.23
	Teacher Education	30.33	105	3.27	0.32
Type of College	Government	30.27	409	3.41	0.17
	Aided	30.15	525	3.51	0.15
	Self-Finance	29.09	1216	3.79	0.11
Type of Programme	Under Graduate	29.51	1720	3.72	0.09
	Post Graduate	30.48	182	3.43	0.25
	Research	31.13	23	3.61	0.75
	Diploma	29.19	225	3.52	0.23
	Total		29.57	2150	3.69

Although, students of literate parents had lesser mean score than those of illiterate parents, the independent sample t-test calculated for the group revealed no significant difference between the groups [literate (M=29.53 SD=3.73); illiterate (M=29.70, SD=3.57); $t(2148) = -0.889, p = 0.374$] with reference to their SE. The mean raw score of rural students is slightly above the total mean score. However, the independent-samples t-test conducted to compare the SE scores of the rural and urban students showed no significant difference [rural (M=29.60, SD=3.76) and urban (M=29.55, SD=3.62); $t(2148) = 0.300, p = 0.765$]. Similarly, although the mean raw score of native students are above the total mean score and it is higher than non-native students, an independent-samples t-test showed no significant difference in the scores of non-native (M=29.62, SD=3.71) and native (M=29.52, SD=3.67) students [$t(2148) = 0.634, p = 0.526$]. Thus, only gender showed significant impact while other variables (parents' literacy level, residence locality and nativity) do not have any impacts on students' SE (Table 17).

Table 17. Independent Sample “t”- test for self-efficacy Scores by Gender, Parents literacy, Residence location and Nativity

Independent Variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	917	29.18	3.83	2148	4.197	0.000*
	Female	1233	29.86	3.56			
Parents literacy	Literate	1654	29.54	3.73	2148	-0.889	0.374
	Illiterate	496	29.70	3.57			
Residence location	Rural	1000	29.60	3.77	2148	0.300	0.765
	Urban	1150	29.55	3.63			
Nativity	Native	1018	29.63	3.71	2148	0.634	0.526
	Non-native	1132	29.53	3.68			

*Significant at 0.05 level

Table 18. One-way ANOVA for Self-efficacy Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	28.110	14.055	1.031	0.357
	Within Groups	2147	29265.483	13.631		
	Total	2149	29293.593			
Year of Study	Between Groups	4	313.120	78.280	5.794	0.000*
	Within Groups	2145	28980.473	13.511		
	Total	2149	29293.593			
Type of Course	Between Groups	4	368.510	92.127	6.832	0.000*
	Within Groups	2145	28925.083	13.485		
	Total	2149	29293.593			
Type of College	Between Groups	2	663.352	331.676	24.873	0.000*
	Within Groups	2147	28630.241	13.335		
	Total	2149	29293.593			
Type of Programme	Between Groups	3	245.543	81.848	6.047	0.000*
	Within Groups	2146	29048.050	13.536		
	Total	2149	29293.593			

*Significant at 0.05 level

One-way analysis of variance (ANOVA) was done on students' self-efficacy scores as the dependent variable against the independent variables age, year of study, type of course, type of college and type of programme (Table 18). There was a statistically significant difference for independent variables year of study, type of course, type of college and type of programme (except age) with reference to the participants' SE level of effectiveness regarding awareness, knowledge and attitude.

'Age group' descriptive statistics shows that the mean raw scores of >24 years students is above the total mean score and is higher than <18 years and 19-23 years student groups. There were no statistically significant difference among the age groups as revealed by one-way ANOVA ($F(2, 2147) = 1.031, p = 0.357$). The Tukey post-hoc test for the mean difference of SE revealed that there are no statistically significant differences among the participant groups.

The 'year of study' descriptive statistics revealed that mean raw score of >fifth year students is above the total mean score and is much higher than other four groups (first year; second year; third year and fourth year). There was statistically significant difference between the year of study groups as seen by one-way ANOVA ($F(4, 2145) = 5.794, p = 0.000$). A Tukey post-hoc test for the mean difference of self-efficacy level revealed that there was a statistically significant difference among the lesser scores of second year ($29.33 \pm 3.79, p = 0.020$) and third year ($29.28 \pm 3.53, p = 0.010$) student groups when compared with the higher score of above fifth year (30.68 ± 3.75) group. Likewise fourth year (30.19 ± 3.19) students had higher scores when compared with lower scores of second year ($29.34 \pm 3.79, p = 0.13$) and third year ($29.28 \pm 3.53, p = 0.003$) group. In addition, there were no statistically significant differences between the fifth year students and first year and fourth year student group regarding level of SE.

The mean raw score of 'teacher education' students is above the total mean score and is much higher than the other four groups (Arts & science, Engineering, Polytechnic and Agricultural education). There was statistically significant differences between the 'type of course' groups as shown by one-way ANOVA ($F(4, 2145) = 6.832, p = 0.000$). The Tukey post-hoc test for the mean difference of students' SE revealed statistically significant difference among the higher scores of teacher education ($30.33 \pm 3.27, p = 0.009$), agricultural ($30.00 \pm 3.47, p = 0.035$) and arts and science ($29.85 \pm 3.78, p = 0.00$) student groups compared to the lower score of engineering student (29.07 ± 3.66) group. Moreover, there were no statistically significant differences in the SE level scores within the group and between the groups except in the case of polytechnics students.

'Type of college' group descriptive statistics shows that the mean raw score of Government College students is above the total mean score and are much higher than Aided and Self-finance student groups. There was a statistically significant difference between the 'type of college' groups as determined by one-way ANOVA ($F(2, 2147) = 24.873, p = 0.000$). Tukey post-hoc test for the mean difference of SE level revealed statistically significant difference among the higher scores of government ($30.27 \pm 3.41, p = 0.000$) and Aided ($30.15 \pm 3.51, p = 0.000$) student groups compared with the lower scores of self-finance (29.57 ± 3.88) group.

'Type of programme' group descriptive statistics shows that the mean raw score of research group students is above the total mean score and is much higher than other three student groups. There was a statistically significant difference between the type of programme groups as determined by one-way ANOVA ($F(3, 2146) = 6.047, p = 0.000$). Tukey post-hoc test for the mean difference of SE level revealed statistically significant difference among the higher scores of research ($31.13 \pm 3.60, p = 0.075$) and post graduate ($30.48 \pm 3.43, p = 0.002$) student groups compared with the lower scores of diploma (29.19 ± 3.52) group. Likewise, there was a significant difference between under graduate (29.50 ± 3.72) and postgraduate ($30.48 \pm 3.43, p = 0.004$) students.

Thus, variables like year of study, type of course, type of college and type of programme have greater impacts on students' EK and female and fourth year students have high level of EK than their counterparts. On the contrary, self-finance, engineering diploma students showed lower level in EK.

4.2.5 Students' Attitude towards Social responsibility (SR)

What is the level of attitude towards social responsibility needed to resolve an environmental problem?

Hypothesis - 5: No significant difference in the level of attitude towards social responsibility among the college students with respect to their demographic and personal variables.

For the analysis of the level of attitude towards social responsibility (statements 46 to 49), the statements were ranked by a degree of social support needed to resolve an environmental problem (Table 19). The statements were as follows; (a) "collectively working with others" (statement 47) to which highest number of respondents agreed (83.67%), (b) "you as an individual" (statement 49) to which 83.07% agreed, (c) "chance determines the resolution" (statement 48) with 74.51% agreements, and (d) "by aristocratic means" (statement 46) with 67.07% agreements. A review of the literature suggests that awareness, knowledge, and attitude are paramount in the development of an environmental curriculum that fosters a social responsibility to the environment.

Table 19. Frequency and Percentage distributions of the respondents' Social Responsibility (SR) statements

Code*	Statements	Disagree		Agree	
		No.	%	No.	%
46	The use of powerful people is the most effective way to influence how environmental problems and issues are resolved.	708	32.93	1442	67.07
47	Personally, working with others, can influence the solution of environmental issues.	351	16.33	1799	83.67
48	Chance determines how environmental problems and issues are solved.	548	25.49	1602	74.51
49	You can influence the resolution of environmental issues in your community using action strategies.	364	16.93	1786	83.07

*The statements are coded as numbered in the questionnaire

The descriptive analysis revealed that the mean raw score of the female students is above the total mean score and is moderately higher than the male students (Table 20). An independent-samples t-test conducted to compare the dependent variable level of attitude towards SR scores with independent variables gender, parents' literacy level, residence locality and nativity of the students showed no significant difference in the mean scores of male (M=11.55, SD=1.75) and female (M=11.68, SD=1.67) students [t (2148) = -1.711, p = 0.087].

It was seen that mean score of students of illiterate parents having slightly higher SR attitude than their counterparts, the students of literate parents. However, the independent sample t-test calculated for the group revealed that there is no significant difference between the literate (M=11.59, SD=1.71) and illiterate parental students (M=11.73, SD=1.68); t (2148) = -1.530, p = 0.126 with reference to their attitude towards SR. The mean raw scores of urban students are above the total mean score and are much higher than rural students. The independent-samples t-test conducted to compare the attitude towards SR scores of the rural and urban students showed significant difference in the scores [urban (M=11.70, SD=1.64) and rural (M=11.54, SD=1.78) students; t (2148) = -2.256, p = 0.025].

Table 20. Mean Scores and SD of Social responsibility Scores

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	11.55	917	1.76	0.06
	Female	11.68	1233	1.67	0.05
Age	<18	11.76	710	1.66	0.06
	19-23	11.56	1374	1.73	0.05
	>24	11.59	66	1.75	0.22
Parents literacy	Literate	11.60	1654	1.71	0.04
	Illiterate	11.73	496	1.68	0.08
Residence location	Rural	11.54	1000	1.78	0.06
	Urban	11.70	1150	1.64	0.05
Nativity	Native	11.67	1018	1.73	0.05
	Non-native	11.59	1132	1.68	0.05
Year of Study	First Year	11.70	534	1.73	0.07
	Second Year	11.64	498	1.88	0.08
	Third Year	11.52	744	1.65	0.06
	Fourth Year	11.72	293	1.48	0.09
	Above Fifth Year	11.67	81	1.72	0.19
Type of Course	Agricultural	11.48	157	1.70	0.14
	Arts & Science	11.68	999	1.79	0.06
	Engineering	11.56	664	1.67	0.06
	Polytechnics	11.63	225	1.57	0.10
	Teacher Education	11.70	105	1.37	0.13
Type of College	Government	11.67	409	1.59	0.08
	Aided	11.90	525	1.65	0.07
	Self-Finance	11.49	1216	1.76	0.05
Type of Programme	Under Graduate	11.62	1720	1.73	0.04
	Post Graduate	11.69	182	1.65	0.12
	Research	11.61	23	1.50	0.31
	Diploma	11.63	225	1.57	0.10
	Total	11.63	2150	1.71	0.04

The mean raw score of native students is above the total mean score and is much higher than that of non-native students. An independent-samples t-test, conducted to compare the attitude towards SR scores of the native and non-native students, showed no significant difference in the scores of non-native (M=11.59, SD=1.68) and native (M=11.67, SD=1.73) students [$t(2148) = 0.980, p = 0.327$].

Accordingly, only locality is found to have significant difference while other variables such as parents' literacy level, residence locality and nativity do not significantly influence students' SR attitude development. Urban students possessed higher level of SR than their counterparts (Table 21).

Table 21. Independent Sample “t”- test for social responsibility Scores by Gender, Parents literacy, Residence location and Nativity

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	917	11.55	1.76	2148	1.711	0.087
	Female	1233	11.68	1.67			
Parents' literacy	Literate	1654	11.60	1.71	2148	1.530	0.126
	Illiterate	496	11.73	1.68			
Residence location	Rural	1000	11.54	1.78	2148	2.243	0.025*
	Urban	1150	11.70	1.64			
Nativity	Native	1018	11.67	1.73	2148	0.980	0.327
	Non-native	1132	11.59	1.68			

*Significant at 0.05 level

One-way analysis of variance (ANOVA) was done on students' SR attitude scores as the dependent variable and independent variables age, year of study, type of course, type of college and type of programme. The F-statistics from this analysis is shown in Table 22. There was a statistically significant difference for independent variables age and type of college on comparing all the participants' level of attitude towards social responsibility.

'Age group' descriptive statistics shows that the mean raw score of <18years students is above the total mean score and is higher than >24 years and 19-23 years

student groups. There was a statistically significant difference among the age groups as shown by one-way ANOVA ($F(2, 2147) = 3.333, p = 0.036$). Tukey post-hoc test on the mean difference of SR attitude scores revealed that statistically significant differences exist among the lesser scores of 19-23 years ($11.55 \pm 1.73, p = 0.027$) student groups compared with the higher scores of <18 years (11.76 ± 1.66) group.

Table 22 One-way ANOVA for Social responsibility Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	19.383	9.691	3.333	0.036*
	Within Groups	2147	6243.453	2.908		
	Total	2149	6262.835			
Year of Study	Between Groups	4	13.623	3.406	1.169	0.322
	Within Groups	2145	6249.212	2.913		
	Total	2149	6262.835			
Type of Course	Between Groups	4	9.851	2.463	0.845	0.497
	Within Groups	2145	6252.984	2.915		
	Total	2149	6262.835			
Type of College	Between Groups	2	63.121	31.561	10.930	0.000*
	Within Groups	2147	6199.714	2.888		
	Total	2149	6262.835			
Type of Programme	Between Groups	3	0.878	0.293	0.100	0.960
	Within Groups	2146	6261.958	2.918		
	Total	2149	6262.835			

*Significant at 0.05 level

‘Type of college’ group descriptive statistics shows that the mean raw score of Aided College students is above the total mean score and are much higher than Government and Self-finance student groups. There was a statistically significant difference between the ‘type of college’ groups as seen from the one-way ANOVA [$F(2, 2147) = 10.930, p = 0.000$]. Close examination of the Tukey post-hoc test for the mean

difference of SR level revealed that there was a statistically significant difference among the higher scores of aided (11.90 ± 1.65 , $p = 0.000$) student groups when compared with the lower scores of self-finance (11.49 ± 1.76) group.

The study also revealed that, there were no statistically significant differences among the other independent variable groups (year of study, type of course and type of programme) regarding their level of attitude towards SR.

Hence, variables like age and type of college have greater impacts on development of students' SR attitude. Further, students belonging to <18 years and aided college too have higher level of social responsibility towards environmental protection.

4.2.6 Students' Environmental Actions

What are the personal actions taken by students to protect their local environment?

Hypothesis - 6: No significant difference in the level of environmental actions among the college students with respect to their demographic and personal variables.

The actions taken by the participants on environmental issues were summarized in a percent frequency format and presented in Table 23. The most frequent action taken by the respondents were contributed money to an environmental cause (48.7%) with 3.3% high effectiveness, attended a meeting (48.5%) with 15% slight effectiveness, and read or sought information (46.6%) with 9.8% fair effectiveness. Table 17 presents the findings regarding the actions taken.

Table 23. Responses to actions taken on behalf of Environmental issues by all participating student groups

Code*	Actions	Yes (%)	No (%)	Not at all effective	Slightly effective	Fairly effective	Very effective
50.	Wrote a letter to the newspaper	15.4	84.6	7.7	4.4	2.6	0.8
51.	Attended a meeting	48.5	51.5	21.6	15.0	9.5	0.1
52.	Made a formal submission	18.1	81.9	9.9	4.4	3.0	0.8
53.	Read or sought information	46.6	53.4	20.4	13.8	9.8	2.6
54.	Wrote a letter to an organization or public official	11.9	88.1	6.7	2.3	2.0	0.8
55.	Telephone a public official	13.3	86.7	8.1	3.2	1.2	0.8
56.	Took part in a protest	36.4	63.6	19.9	9.2	5.4	2.0
57.	Complained to the company/person causing the damage	17.1	82.9	8.9	4.3	2.1	1.7
58.	Joined an action group	32.5	67.5	16.3	7.2	5.8	3.1
59.	Signed a petition	32.6	67.4	19.4	7.3	4.0	1.8
60.	Contributed money to an environmental cause	48.7	51.3	25.1	12.8	7.5	3.3
61.	Other (specify)	6.3	93.7	2.5	1.3	1.0	1.5
62.	None of the above	1.3	98.7	0.6	0.5	0.1	0.1

*The statements are coded as numbered in the questionnaire

The environmental actions, descriptive analysis revealed that the mean raw scores of female students is above the total mean score and is slightly higher than the male students (Table 24). An independent-samples t-test was conducted, to compare the dependent variable environmental actions scores with independent variables gender, parents' literacy level, residence locality and nativity of the students, showed no significant difference in the mean scores of male (M=5.76, SD=5.62) and female (M=5.97, SD=5.51) students; $t(2148) = -0.790, p = 0.430$.

Table 24 Mean Scores and SD of Environmental actions Scores

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	5.78	917	5.62	0.19
	Female	5.97	1233	5.51	0.16
Age	<18	5.51	710	5.40	0.20
	19-23	6.07	1374	5.57	0.15
	>24	6.11	66	6.63	0.82
Parents' literacy	Literate	6.09	1654	5.63	0.14
	Illiterate	5.20	496	5.25	0.24
Residence location	Rural	6.09	1654	5.63	0.14
	Urban	5.20	496	5.25	0.24
Nativity	Native	6.02	1018	5.91	0.19
	Non-native	5.77	1132	5.22	0.16
Year of Study	First Year	5.60	534	5.60	0.24
	Second Year	5.35	498	5.30	0.24
	Third Year	6.02	744	5.39	0.20
	Fourth Year	6.96	293	5.92	0.35
	Above Fifth Year	5.93	81	6.40	0.71
Type of Course	Agricultural	6.03	157	5.55	0.44
	Arts & Science	6.07	999	5.79	0.18
	Engineering	6.02	664	5.54	0.21
	Polytechnics	4.63	225	4.54	0.30
	Teacher Education	5.77	105	5.13	0.50
Type of College	Government	5.82	409	5.56	0.28
	Aided	6.02	525	5.73	0.25
	Self-Finance	5.85	1216	5.48	0.16
Type of Programme	Under Graduate	5.90	1720	5.51	0.13
	Post Graduate	7.05	182	6.42	0.48
	Research	7.70	23	7.96	1.66
	Diploma	4.63	225	4.54	0.30
	Total	5.89	2150	5.56	0.12

When comparing their mean score students of literate parents' students have higher level of environmental actions than their counterparts, the students of illiterate

parents. The independent sample t-test calculated for the group revealed that there was statistically significant difference between the students of literate (M=6.08, SD=5.63) and illiterate parents [(M=5.20, SD=5.25); $t(2148) = 3.121, p = 0.002$] with reference to their environmental actions.

The mean raw score of urban students are above the total mean score and are much higher than that of rural students. An independent-samples t-test, conducted to compare the environmental actions scores of the rural and urban students, resulted in strong statistically significant difference in the scores of urban (M=6.13, SD=5.53) and rural (M=5.61, SD=5.58) students [$t(2148) = -2.166, p = 0.030$].

The mean raw score of native students are above the total mean score and are much higher than that of non-native students. The independent-samples t-test, conducted to compare the environmental actions scores of the native and non-native students, showed no statistically significant difference in the scores of non-native (M=5.77, SD=5.22) and native (M=6.02, SD=5.91) students [$t(2148) = 1.034, p = 0.301$].

Thus, only parents' literacy and residence location alone have significant difference and other variables, age and nativity; do not have any impacts on students' environmental actions. It shows that students of literate parents and urban area showed higher level of personal actions to protect their environment (Table 25).

Table 25. Independent Sample “t”- test for Environmental actions Scores by Gender, Parents literacy, Residence location and Nativity

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	917	5.78	5.62	2148	0.790	0.430
	Female	1233	5.97	5.51			
Parents literacy	Literate	1654	6.09	5.63	2148	3.121	0.002*
	Illiterate	496	5.20	5.25			
Residence location	Rural	1000	5.61	5.58	2148	2.166	0.030*
	Urban	1150	6.13	5.53			
Nativity	Native	1018	6.02	5.91	2148	1.027	0.305
	Non-native	1132	5.77	5.22			

*Significant at 0.05 level

Table 26. One-way ANOVA for Environmental Actions Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	150.485	75.243	2.440	0.087
	Within Groups	2147	66194.138	30.831		
	Total	2149	66344.624			
Year of Study	Between Groups	4	543.386	135.846	4.428	0.001*
	Within Groups	2145	65801.238	30.677		
	Total	2149	66344.624			
Type of Course	Between Groups	4	403.618	100.904	3.282	0.011*
	Within Groups	2145	65941.006	30.742		
	Total	2149	66344.624			
Type of College	Between Groups	2	13.029	6.515	0.211	0.810
	Within Groups	2147	66331.595	30.895		
	Total	2149	66344.624			
Type of Programme	Between Groups	3	676.422	225.474	7.368	0.000*
	Within Groups	2146	65668.201	30.600		
	Total	2149	66344.624			

The F-statistics from One-way ANOVA on students' environmental actions scores as the dependent variable and age, year of study, type of course, type of college and type of programme independent variables is given in Table 26. There was statistically significant differences for independent variables, year of study, type of course, type of college and type of programme with regard to the participants' personal actions towards environmental protection.

The 'year of study' descriptive statistics revealed that mean raw score of fourth year student is above the total mean score and is much higher than other four groups (first year; second year; third year and above fifth year). There was statistically significant difference between the 'year of study' groups as determined by one-way ANOVA ($F(4, 2145) = 4.428, p = 0.001$). A Tukey post-hoc test on mean difference in environmental protection actions revealed that there was statistically significant

difference among the lower scores of first year (5.60 ± 5.60 , $p = 0.006$) and second year (5.35 ± 5.30 , $p = 0.001$) student groups with the higher score of fourth year (6.96 ± 5.92) group. Further, there were no statistically significant differences when comparing the other year of study groups (first, second, third, and fourth year) with fifth year group regarding personal actions.

The mean raw score of polytechnics students is below the total mean score and is much lower than other four groups (agricultural, arts & science, Engineering and teacher education) respectively. However, there was statistically significant difference between the 'type of course' groups as shown by one-way ANOVA [$F(4, 2145) = 3.282$, $p = 0.011$]. The Tukey post-hoc test on the mean difference of personal actions revealed statistically significant differences among the higher scores of arts & science (6.07 ± 5.79 , $p = 0.004$) and engineering (6.02 ± 5.54 , $p = 0.010$) student groups compared to the lower score of polytechnics student (4.63 ± 4.54) group. Further, there were no statistically significant differences compared to the other 'type of course' groups (Agricultural, Arts & Science, Engineering and Polytechnics) with Teacher education group regarding environmental actions.

'Type of programme' group descriptive statistics shows that the mean raw scores of diploma group students is below the total mean score and is much lower than other three student groups. There was a statistically significant difference between the type of programme groups as determined by one-way ANOVA ($F(3, 2146) = 7.368$, $p = 0.000$). Close examination of the Tukey post-hoc test for the mean difference of personal actions revealed that there was statistically significant difference among the higher scores of under graduate (5.90 ± 5.51 , $p = 0.007$) and post graduate (7.05 ± 6.42 , $p = 0.000$) student groups compared to the lower score of diploma (4.63 ± 4.54) group. Further, there were no statistically significant differences compared the other type of programme groups (under graduate, post graduate, diploma) with research group regarding environmental actions.

The above results revealed that variables like year of study, type of course, type of college and type of programme have greater impacts on students' actions and these group of students possessed higher level of personal actions regarding to protecting their local environment.

4.2.7 Students' Awareness-Knowledge-Attitude-Self-efficacy-Actions linkage

Conventional thinking in the field of EE suggests a liner model for changing behavior; as individuals become more knowledgeable, they become more aware of environmental problems and, thus become more motivated to act towards the environment in more responsible ways (Lee & Williams, 2001). An analysis of the relationships among the students' awareness, knowledge, attitudes, self-efficacy and actions towards environment and environmental issues (Table 27) showed, knowledge having positive correlation with awareness and attitudes; self-efficacy possessed better positive correlation with all four factors (awareness, knowledge, attitude; awareness and actions) and also awareness having positive correlation with actions.

Table 27. Pearson's Product Moment Correlation

		Environmental Awareness	Environmental Attitude	Environmental Knowledge	Self- efficacy	Environmental actions
Environmental Awareness	Pearson Correlation					
	Sig. (2-tailed)					
	N	2150				
Environmental Attitude	Pearson Correlation	0.027				
	Sig. (2-tailed)	0.207				
	N	2150	2150			
Environmental Knowledge	Pearson Correlation	0.090	0.164			
	Sig. (2-tailed)	0.000**	0.000**			
	N	2150	2150	2150		
Self-efficacy	Pearson Correlation	0.220	0.217	0.248		
	Sig. (2-tailed)	0.000**	0.000**	0.000**		
	N	2150	2150	2150	2150	
Environmental Actions	Pearson Correlation	0.181	-0.010	0.030	0.133	
	Sig. (2-tailed)	0.000**	0.645	0.166	0.000**	
	N	2150	2150	2150	2150	2150

** . Correlation is significant at the 0.01 level (2-tailed)

4.2.8 Teachers' Awareness about Environmental Issues and Environmental Education

What are the levels of awareness and attitude on environment and EE among college teachers teaching components of environmental education (EE) as part of the curriculum?

Hypothesis - 7: No significant difference in the level of awareness on Environmental Issues (EI) and Environmental Education among the teachers with respect to their demographic and personal variables.

Ten statements (statements / questions) related to important environmental issues and EE were used to test the level of awareness of teachers. The results revealed that teachers are relatively less familiar with environmental and related issues like the impacts of rapid population growth, the impacts of climate change, the relationship between economic growth and environment, the indirect drivers of environmental damage and the concept of sustainable development (Table 28).

Teachers' familiarity with the impacts of climate change concept was higher than other environmental concepts. It may be attributed to the fact that it is a hot issue in the media during the study period when the UN Climate Change Summit was to be held in Copenhagen and for three consecutive years 2011, 2012 and 2013, the state has been reeling under drought, having received below normal rainfall (Rajendran, 2014). However, there are indications that their knowledge of climate change is not deep as more than half of the respondents failed to give correct responses to questions No 2.

While it is discouraging that more than 75% of the respondents are unaware of the impacts of rapid population growth, it is further apparent that teachers' awareness of complex interrelationships of environmental factors is limited. The majority of the respondents (nearly 73%) gave incorrect responses to questions related to the factors that are responsible for the deterioration of the environment indirectly (Question No 3). Even though teachers are unaware of positive and negative impacts of economic growth on environment (Question No 4), it is frustrating that nearly 85% of the respondents held misconceptions about the notion of sustainable development.

The study observed that teachers are moderately aware of the rationale for the need of EE. It also revealed that they are relatively more aware of Environmental education & global partnership, teaching strategies for environmental education and instructional resources in environmental education. On the other hand, they are less familiar with the goals of environmental education. Even though it is appreciated that teachers know the purposes of EE, the implementation is under question as they have limited knowledge of its details and lack in the necessary skills to teach EE. It is widely believed that quality of instruction in EE is high when it takes place in the environment i.e. the environment is the best instructional medium and resource in EE. It is amazing that only 51% acknowledged this.

The overall mean of correct responses to the 10 questions (39.33%) is much lower than their counterparts in Punjab whose mean score is 64.28% (Nagra, 2010). Even it is lower than the scores of students of some countries of Asia Pacific Region on similar environmental concepts (Barett et al., 2002).

Table 28 Percentage of Teachers Giving Correct Responses

Code *	Questions	No. of correct response	Percentage (%)
1	The impacts of rapid population growth	10	22.22
2	The impacts of climate change	15	33.33
3	Indirect drivers of environmental damage	12	26.67
4	Economic growth and environment	16	35.56
5	Sustainable development	7	15.56
6	The rationale for environmental education	20	44.44
7	The goals of environmental education	16	35.56
8	Environmental education & global partnership	32	71.11
9	Teaching strategies for environmental education	26	57.78
10	Instructional resources in environmental education	23	51.11
Total		177	39.33

*The questions are coded as numbered in the questionnaire

The descriptive analysis revealed that the mean scores of the female teachers, <30 years aged teachers, teachers of illiterate parents, urban teachers, non-native teachers, post graduate teachers, teachers with 9-10 years teaching experience, urban college teachers, aided college teachers and EE qualified teachers are above the total mean score and is marginally higher than their counterparts with respect to awareness on EI and EE subject (Table 29).

Table 29. Mean Scores and SD of Teachers' Awareness about Environmental Issues and Environmental Education

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	3.84	19	1.21	0.28
	Female	4.00	26	1.77	0.35
Age	<30	4.58	12	1.68	0.48
	31-40	4.11	19	1.56	0.36
	>41	3.14	14	1.10	0.29
Parents' literacy	Literate	3.79	28	1.52	0.29
	Illiterate	4.18	17	1.59	0.39
Residence location	Rural	3.64	14	1.28	0.34
	Urban	4.06	31	1.65	0.30
Nativity	Native	3.67	24	1.46	0.30
	Non-native	4.24	21	1.61	0.35
Educational Qualification	PG	5.00	8	1.31	0.46
	M.Phil	3.09	11	1.76	0.53
	Ph.D	3.96	26	1.34	0.26
Teaching experience	<8 years	4.00	26	1.79	0.35
	9-10 years	4.63	8	1.06	0.38
	>11 years	3.27	11	0.90	0.27
College location	Rural	3.64	14	1.15	0.31
	Urban	4.06	31	1.69	0.30
Type of college	Government	4.11	9	1.62	0.54
	Aided	4.13	16	1.50	0.38
	Self-finance	3.70	20	1.59	0.36
EE Qualification	Yes	4.40	15	1.45	0.38
	No	3.70	30	1.56	0.28
	Total	3.93	45	1.54	0.23

An independent-samples t-test was conducted to compare the dependent variable (scores on level of awareness on EI and EE) with independent variables (Gender, Parents' literacy, Residence Location, Nativity, College Location and Environmental Education Qualification). Results revealed that surprisingly none of variables shown significant differences among the teachers' awareness on EI and EE. It shows that invariably all teacher respondents possessed with same level of awareness on EI and EE (Table 30).

Table 30. Independent Sample “t”- test for Teachers’ Awareness about Environmental Issues and Environmental Education Scores

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	19	3.84	1.21	43	0.336	0.739
	Female	26	4.00	1.77			
Parents’ literacy	Literate	28	3.79	1.52	43	0.820	0.417
	Illiterate	17	4.18	1.59			
Residence location	Rural	14	3.64	1.28	43	0.846	0.402
	Urban	31	4.06	1.65			
Nativity	Native	24	3.67	1.46	43	1.247	0.219
	Non-native	21	4.24	1.61			
College location	Rural	14	3.64	1.15	43	0.846	0.402
	Urban	31	4.06	1.69			
EE Qualification	Yes	15	4.40	1.45	43	1.452	0.154
	No	30	3.70	1.56			

Table 31. One-way ANOVA for Teachers' Awareness about Environmental Issues and Environmental Education Scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	14.380	7.190	3.340	0.045*
	Within Groups	42	90.420	2.153		
	Total	44	104.800			
Educational Qualification	Between Groups	2	16.929	8.465	4.046	0.025*
	Within Groups	42	87.871	2.092		
	Total	44	104.800			
Teaching Experience	Between Groups	2	8.743	4.372	1.911	0.161
	Within Groups	42	96.057	2.287		
	Total	44	104.800			
Type of College	Between Groups	2	1.961	0.981	0.400	0.673
	Within Groups	42	102.839	2.449		
	Total	44	104.800			

*Significant at 0.05 level

One-way ANOVA performed on awareness about environmental issues and Environmental Education scores as the dependent variable against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed a statistically significant difference for independent variables age [F (2, 42) = 3.340, p = 0.045] and educational qualification [F (2, 42) = 4.046, p = 0.025] . Close examination of the Tukey post-hoc test for the mean difference of teachers' awareness scores revealed that there was a statistically significant difference among the lower scores of >41 years (3.14 ± 1.09 , p = 0.043) group when compared with the higher scores of <30 years (4.58 ± 1.67) group. Likewise, there was a statistically significant difference between lower scores of M.Phil. (3.09 ± 1.76 , p = 0.019) teacher group when compared with the higher scores of PG (5.00 ± 1.31) group (Table 31). This implies that <30 years aged and post graduate teachers having greater awareness on environmental issues and environmental education.

4.2.9 Teachers' perception of local (Coimbatore) environmental conditions

Hypothesis - 8: No significant difference in the perception level of local (Coimbatore) environmental conditions/issues among the teachers with respect to their demographic and personal variables.

Statements 11 to 15, measured awareness as perception of local environmental conditions or issues in Coimbatore. Scores in this group of questions described a general perception without compromising knowledge of those surveyed. Responses 'much worse' and 'worse' were combined and 'better' and 'much better' were combined for the presentation in the figure 2.

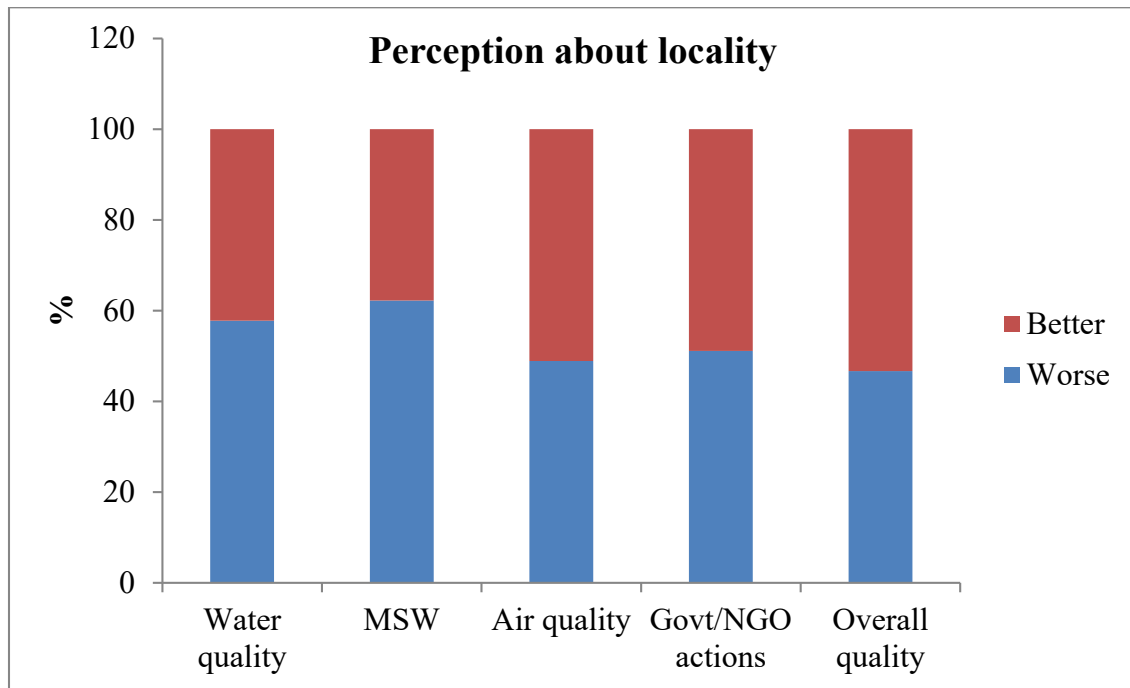
The study observed that teachers felt that overall environmental conditions and air quality of their locality is relatively better. It also revealed that water quality supplied to them and municipal solid waste management in their locality seems to be moderately poor. Further, the steps taken by the government and non-government organizations on environmental protection is average in the sense of effectiveness (Table 32).

Table 32. Frequency and Percentage Distributions of the Respondents' perception of local environmental conditions statements

Code*	Statements	Much Worse		Worse		Better		Much Better	
		No.	%	No.	%	No.	%	No.	%
11	The water quality in your local streams, rivers, and lakes	8	17.8	18	40	19	42.2	0	0
12	The level of pollution or waste produced by nearby business centres, public places, houses and industries	8	17.8	20	44.4	16	35.6	1	2.2
13	The state/level of air quality in your area	3	6.7	19	42.2	21	46.7	2	4.4
14	The steps taken by the government/non-government organizations on environmental protection	11	24.4	12	26.7	20	44.4	2	4.4
15	The overall environmental state of Coimbatore district	4	8.9	17	37.8	22	48.9	2	4.4

*The statements are coded as numbered in the questionnaire

Figure 2. Bar graph representation of respondents’ perception about their locality environmental conditions



The descriptive analysis revealed that the mean raw scores of the male teachers, >41 years aged teachers, teachers with literate parents, urban teachers, native teachers, M.Phil holding teachers, teachers with >11 years teaching experience, rural college teachers, self-finance college teachers and environmental education qualified teachers is above the total mean score and is marginally higher than their counterparts (Table 33). It revealed that these teachers are possessed better opinions about their locality than their counterparts. An independent-samples t-test was conducted to compare the dependent variable level of teachers’ perception of local environmental issues scores with independent variables (Gender, Parents’ literacy, Residence Location, Nativity, College Location and Environmental Education Qualification) revealed that statistically significant differences were found among the scores of rural (M=12.86, SD=2.41) and urban (M=11.23, SD=2.58) teachers; $t(43) = 2.003, p = 0.050$. This implies that teachers working in the rural college system having better perception in understanding their local environmental issues (Table 34).

Table 33. Mean Scores and SD of Teachers' perception of local Environmental Issues

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	11.79	19	2.53	0.58
	Female	11.69	26	2.72	0.53
Age	<30	11.92	12	1.73	0.50
	31-40	11.37	19	3.11	0.71
	>41	12.07	14	2.62	0.70
Parents literacy	Literate	11.86	28	2.59	0.49
	Illiterate	11.53	17	2.72	0.66
Residence location	Rural	11.36	14	3.20	0.86
	Urban	11.90	31	2.34	0.42
Nativity	Native	11.79	24	3.04	0.62
	Non-native	11.67	21	2.11	0.46
Educational Qualification	PG	11.88	8	2.30	0.81
	M.Phil	12.36	11	1.80	0.54
	Ph.D	11.42	26	3.00	0.59
Teaching experience	<8 years	11.73	26	2.47	0.49
	9-10 years	10.88	8	2.59	0.91
	>11 years	12.36	11	3.01	0.91
College location	Rural	12.86	14	2.41	0.64
	Urban	11.23	31	2.58	0.46
Type of college	Government	11.56	9	2.35	0.78
	Aided	10.56	16	2.63	0.66
	Self-finance	12.75	20	2.40	0.54
EE Qualification	Yes	12.60	15	2.77	0.72
	No	11.30	30	2.47	0.45
	Total	11.73	45	2.61	0.39

Table 34. Independent Sample “t”- test for Teachers’ perception of local Environmental Issues

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	19	11.79	2.53	43	0.122	0.904
	Female	26	11.69	2.72			
Parents’ literacy	Literate	28	11.86	2.59	43	0.404	0.688
	Illiterate	17	11.53	2.72			
Residence location	Rural	14	11.36	3.20	43	0.644	0.523
	Urban	31	11.90	2.34			
Nativity	Native	24	11.79	3.04	43	0.158	0.875
	Non-native	21	11.67	2.11			
College location	Rural	14	12.86	2.41	43	2.003	0.050*
	Urban	31	11.23	2.58			
EE Qualification	Yes	15	12.60	2.77	43	1.6	0.117
	No	30	11.30	2.47			

*Significant at 0.05 level

One-way analysis of variance performed using teachers’ perception of local environmental issues scores as the dependent variable against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed statistically significant difference for independent variable type of college [$F(2, 42) = 3.492, p = 0.040$] when comparing all the participants’ perception of local Environmental issues. A close examination of the Tukey post-hoc test for the mean difference of teachers’ perception scores revealed that there was a statistically significant difference among the lower scores of aided ($10.56 \pm 2.63, p = 0.031$) group when compared with the higher scores of self-finance (12.75 ± 2.40) group (Table 35). This implies that only self-finance college teachers having greater degree of perception about their local environmental issues.

Table 35. One-way ANOVA for Teachers' perception of local Environmental Issues/Conditions scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	4.534	2.267	0.321	0.727
	Within Groups	42	296.266	7.054		
	Total	44	300.800			
Educational Qualification	Between Groups	2	7.033	3.517	0.503	0.608
	Within Groups	42	293.767	6.994		
	Total	44	300.800			
Teaching Experience	Between Groups	2	10.264	5.132	0.742	0.482
	Within Groups	42	290.536	6.918		
	Total	44	300.800			
Type of College	Between Groups	2	42.890	21.445	3.492	0.040*
	Within Groups	42	257.910	6.141		
	Total	44	300.800			

*Significant at 0.05 level

4.2.10 Teachers' Level of concern about local environmental issues

Hypothesis - 9: No significant difference in the level of concern about local environmental issues among the teachers with respect to their demographic and personal variables.

Statements 16 to 20 measured awareness as the level of concern about environmental issues among the teachers. High scores indicated a person with strong concerns about diverse environmental issues. Of the responses, 'Not at all concerned' and 'somewhat concerned', and 'Concerned' and 'Very concerned' were combined for presentation in the figure 3.

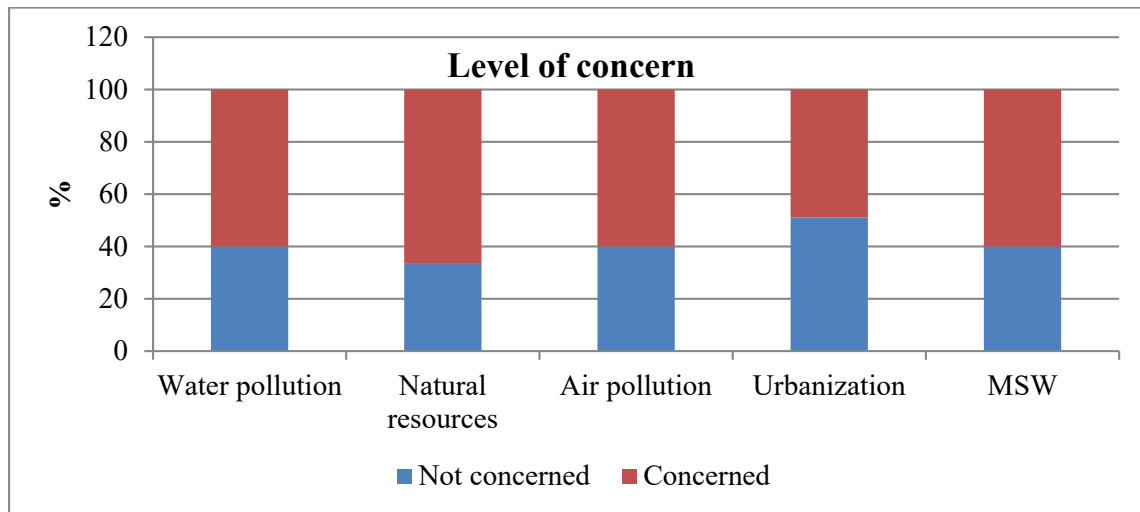
The present study observed that teachers possessed relatively better level of concern over their local environmental issues such as water pollution caused by nearby industries and urban sewages, conservation of natural resources, air pollution and municipal waste management. On the other hand, they are neutral in issues relating to urbanization (Table 36).

Table 36. Frequency and Percentage distributions of the respondents for level of concern about local environmental issues statements

Code*	Statements	Not at all concerned		Somewhat concerned		Concerned		Very concerned	
		No.	%	No.	%	No.	%	No.	%
16	Water pollution from industries and urban development	4	8.9	14	31.1	13	28.9	14	31.1
17	The conditions of agricultural land and nature preserves	4	8.9	11	24.4	18	40	12	26.7
18	Air pollution	6	13.3	12	26.7	17	37.8	10	22.2
19	Unlimited development of cities	7	15.6	16	35.6	11	24.4	11	24.4
20	Solid waste management	5	11.1	13	28.9	10	22.2	17	37.8

*The statements are coded as numbered in the questionnaire

Figure 3. Respondents' level of concern regarding their environmental conditions



The descriptive analysis revealed that the mean raw scores of the male teachers, >41 years aged teachers, teachers with literate parents, urban teachers, native teachers, post graduate teachers, teachers with 9-10 years teaching experience, urban college teachers, government college teachers and environmental education qualified teachers is above the total mean score and is slightly higher than their counterparts with respect to environmental concerns and they possessed strong concerns about diverse environmental issues (Table 37).

Table 37. Mean Scores and SD of Teachers' level of concern about local environmental issues

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	14.32	19	4.00	0.92
	Female	13.42	26	4.48	0.88
Age	<30	13.58	12	2.64	0.76
	31-40	13.63	19	5.08	1.17
	>41	14.21	14	4.42	1.18
Parents literacy	Literate	13.86	28	3.67	0.69
	Illiterate	13.71	17	5.22	1.27
Residence location	Rural	12.79	14	4.81	1.28
	Urban	14.26	31	3.99	0.72
Nativity	Native	13.83	24	4.62	0.94
	Non-native	13.76	21	3.92	0.86
Educational Qualification	PG	14.50	8	3.16	1.12
	M.Phil	12.55	11	4.16	1.25
	Ph.D	14.12	26	4.62	0.91
Teaching experience	<8 years	12.73	26	4.29	0.84
	9-10 years	17.00	8	3.07	1.09
	>11 years	14.00	11	4.00	1.21
College location	Rural	13.64	14	3.73	1.00
	Urban	13.87	31	4.54	0.81
Type of college	Government	15.44	9	3.47	1.16
	Aided	13.81	16	4.72	1.18
	Self-finance	13.05	20	4.19	0.94
EE Qualification	Yes	15.87	15	3.87	1.00
	No	12.77	30	4.12	0.75
	Total	13.80	45	4.26	0.64

The independent-samples t-test conducted to compare the dependent variable level of teachers' scores (level of concern about local environmental issues scores) with independent variables (Gender, Parents' literacy, Residence Location, Nativity, College Location and Environmental Education Qualification) revealed only EE qualification variable having statistically significant difference between the scores of EE qualified group (M=15.87, SD=3.87) and non-qualified (M=12.77, SD=4.12) teachers [$t(43) = 2.424, p = 0.020$]. This implies that EE subject qualified teachers' have higher level of concerns about their local environmental issues (Table 38).

Table 38. Independent Sample “t”- test for Teachers’ level of concern about local environmental issues scores

Independent variables	Category	N	Mean	SD	D.F	T	Sig.
Gender	Male	19	14.32	4.00	43	0.690	0.494
	Female	26	13.42	4.48			
Parents literacy	Literate	28	13.86	3.67	43	0.114	0.910
	Illiterate	17	13.71	5.22			
Residence location	Rural	14	12.79	4.81	43	1.075	0.288
	Urban	31	14.26	3.99			
Nativity	Native	24	13.83	4.62	43	0.055	0.956
	Non-native	21	13.76	3.92			
College location	Rural	14	13.64	3.73	43	0.164	0.870
	Urban	31	13.87	4.54			
EE Qualification	Yes	15	15.87	3.87	43	2.424	0.020*
	No	30	12.77	4.12			

*Significant at 0.05 level

Table 39. One-way ANOVA on Teachers' level of concern about local environmental issues/Conditions scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	3.505	1.753	0.093	0.912
	Within Groups	42	795.695	18.945		
	Total	44	799.200			
Educational Qualification	Between Groups	2	23.819	11.909	0.645	0.530
	Within Groups	42	775.381	18.461		
	Total	44	799.200			
Teaching Experience	Between Groups	2	112.085	56.042	3.426	0.042*
	Within Groups	42	687.115	16.360		
	Total	44	799.200			
Type of College	Between Groups	2	35.590	17.795	0.979	0.384
	Within Groups	42	763.610	18.181		
	Total	44	799.200			

*Significant at 0.05 level

One-way analysis of variance performed on teachers' level of concern about local environmental issues/Conditions scores (as the dependent variable) against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed there is statistically significant difference for independent variable teaching experience ($F(2, 42) = 3.426, p = 0.042$) when comparing all the participants' concerns. A close examination of the Tukey post-hoc test for the mean difference of teachers' concerns scores revealed that statistically significant differences were found among the lower scores of <8 years ($12.73 \pm 4.29, p = 0.033$) group when compared with the higher scores of 9-10 years (17.00 ± 3.07) group (Table 39). This implies that teachers with 9-10 years teaching experience having greater level of concerns about their local environmental issues.

4.2.11 Teachers' Overall Environmental Awareness

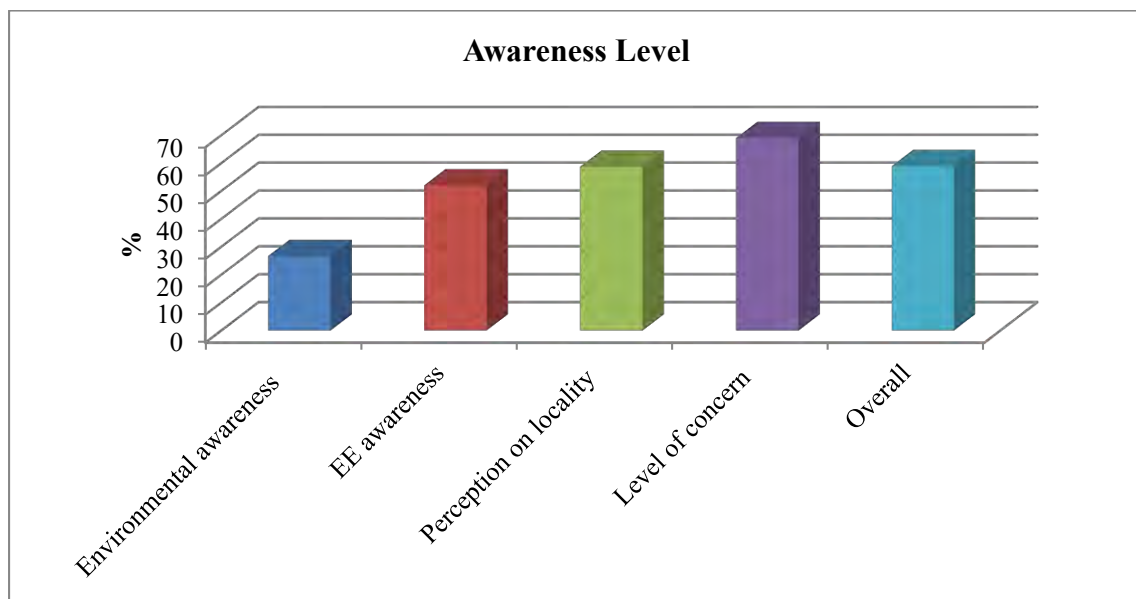
Hypothesis - 10: No significant difference among the teachers' level of overall Environmental Awareness with respect to their demographic and personal variables.

The overall awareness study revealed that teachers are well aware about EE as a subject, having good understanding about their local environmental issues and having higher level of concerns over such issues. Unfortunately, they are having very poor level of understanding about environment and its significances. Finally, the teachers hold medium level of overall awareness and it indicates that teachers must need to improve their fundamentals of environment and EE (Table 40 & figure 4).

Table 40. Percentage Distributions of the Respondents' overall Environmental awareness

S. No	Variables	Marks secured	Total marks awarded	Percentage (%)
1	Environmental awareness	60	225	26.67
2	EE awareness	117	225	52.00
3	Perception on locality	528	900	58.67
4	Level of concern	621	900	69.00
5	Overall	1326	2250	58.93

Figure 4. Percentage of Environmental awareness level among teachers



The descriptive analysis revealed that the mean raw scores of the male teachers, <30 years aged teachers, teachers with literate parents, urban teachers, non-native teachers, post graduate teachers, teachers with 9-10 years teaching experience, rural college teachers, government college teachers and EE qualified teachers is above the total mean score and is marginally higher than their counterparts with respect to overall EA. (Table 41).

Table 41 Mean Scores and SD of Teachers' overall Environmental Awareness

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	29.95	19	4.45	1.02
	Female	29.12	26	6.13	1.20
Age	<30	30.08	12	3.78	1.09
	31-40	29.11	19	5.98	1.37
	>41	29.43	14	6.19	1.65
Parents' literacy	Literate	29.50	28	4.53	0.86
	Illiterate	29.41	17	6.86	1.66
Residence location	Rural	27.79	14	6.07	1.62
	Urban	30.23	31	5.06	0.91
Nativity	Native	29.29	24	5.86	1.20
	Non-native	29.67	21	5.07	1.11
Educational Qualification	PG	31.38	8	3.02	1.07
	M.Phil	28.00	11	5.46	1.65
	Ph.D	29.50	26	5.97	1.17
Teaching experience	<8 years	28.46	26	5.83	1.14
	9-10 years	32.50	8	2.78	0.98
	>11 years	29.64	11	5.50	1.66
College location	Rural	30.14	14	4.49	1.20
	Urban	29.16	31	5.87	1.05
Type of college	Government	31.11	9	4.73	1.58
	Aided	28.50	16	5.84	1.46
	Self-finance	29.50	20	5.50	1.23
EE Qualification	Yes	32.87	15	4.42	1.14
	No	27.77	30	5.16	0.94
	Total	29.47	45	5.45	0.81

An independent-samples t-test was conducted to compare the dependent variable level of teachers' level of overall Environmental Awareness scores with independent variables (Gender, Parents' literacy, Residence Location, Nativity, College Location and Environmental Education Qualification) revealed only EE qualification having statistically significant differences among the scores of EE qualified group (M=32.87, SD=4.42) and non-qualified (M=27.77, SD=5.15) group [$t(43) = 3.271$, $p = 0.002$]. This implies that EE qualified teachers' having higher level of Environmental Awareness than the EE degree unqualified teacher group (Table 42).

Table 42. Independent Sample “t”- test on Teachers’ Overall Environmental Awareness scores

Independent Variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	19	29.95	4.45	43	0.502	0.618
	Female	26	29.12	6.13			
Parents literacy	Literate	28	29.50	4.53	43	0.047	0.963
	Illiterate	17	29.41	6.86			
Residence location	Rural	14	27.79	6.07	43	1.407	0.167
	Urban	31	30.23	5.06			
Nativity	Native	24	29.29	5.86	43	0.228	0.821
	Non-native	21	29.67	5.07			
College location	Rural	14	30.14	4.49	43	0.555	0.582
	Urban	31	29.16	5.87			
EE Qualification	Yes	15	32.87	4.42	43	3.271	0.002*
	No	30	27.77	5.16			

*Significant at 0.05 level

One-way analysis of variance performed using teachers' overall Environmental Awareness scores as the dependent variable against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed no significant differences were found in all of the variables. This implies that all these group teachers having same level of environmental awareness (Table 43).

Table 43. One-way ANOVA on Teachers' Overall Environmental Awareness scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	7.065	3.533	0.114	0.892
	Within Groups	42	1298.135	30.908		
	Total	44	1305.200			
Educational Qualification	Between Groups	2	52.825	26.413	0.886	0.420
	Within Groups	42	1252.375	29.818		
	Total	44	1305.200			
Teaching Experience	Between Groups	2	100.193	50.097	1.746	0.187
	Within Groups	42	1205.007	28.691		
	Total	44	1305.200			
Type of College	Between Groups	2	39.311	19.656	0.652	0.526
	Within Groups	42	1265.889	30.140		
	Total	44	1305.200			

4.2.12 Teachers' Environmental Attitudes

Hypothesis - 11: No significant difference in the level of Environmental Attitudes among the teachers with respect to their demographic and personal variables.

A revised NEP scale with 15 statements adopted from Dunlap et al. (2000) was used to measure the environmental attitudes of teachers. The percentage distributions for responses to each of the statements are presented in Table 44. Though the NEP scale has five scales (strongly agree, mildly agree, unsure, mildly disagree and strongly disagree), 'strongly agree' and 'mildly agree', and 'mildly disagree' and 'strongly disagree' were combined for presentation of the data.

As noted earlier the content of the NEP scale has five facets: balance of nature, limits to growth, anti-anthropocentrism, "human exemptionalism" and the likelihood of "ecocrisis". Statements 21, 26 and 31 are related to the reality of the limits to growth. The results show that nearly half of the respondents (48.89%) agreed to statement 21, that "we are approaching the limit of the number of people the earth can support". More than 3/4th of the respondents (84.44%) agreed to the unfavorable statement (Statement No 26) which says "the earth has plenty of natural resources if we just learn how to develop

them”. To the statement that “the earth is like a spaceship with very limited room and resources” (Statement No 31), 66.22% of the respondents agreed. These results indicate that the majority of teachers have a strong belief in the inevitability of “limits to growth”.

Table 44. Frequency Distributions of the Respondents for NEP Scale statements

Code*	Statements	Agree		Unsure		Disagree	
		No.	%	No.	%	No.	%
21	We are approaching the limit of the number of people the earth can support	22	48.89	11.00	24.44	12	26.67
22	Humans have the right to modify the natural environment to suit their needs	13	28.89	5.00	11.11	27	60.00
23	When humans interfere with nature it often produces disastrous consequences	36	80.00	5.00	11.11	4	8.89
24	Human ingenuity will insure that we do Not make the earth unlivable	30	66.67	8.00	17.78	7	15.56
25	Humans are severely abusing the environment	36	80.00	5.00	11.11	4	8.89
26	The earth has plenty of natural resources if we just learn how to develop them	38	84.44	4.00	8.89	3	6.67
27	Plants and animals have as much right as humans to exist	42	93.33	2.00	4.44	1	2.22
28	The balance of nature is strong enough to cope with modern industrial nations	23	51.11	5.00	11.11	17	37.78
29	Despite our special abilities humans are still subject to the laws of nature	28	62.22	14.00	31.11	3	6.67
30	The so-called "ecological crisis" facing human kind has been greatly exaggerated	26	57.78	8.00	17.78	11	24.44
31	The earth is like a spaceship with very limited room and resources	28	62.22	7.00	15.56	10	22.22
32	Humans were meant to rule over the rest of nature	12	26.67	3.00	6.67	30	66.67
33	The balance of nature is very delicate and easily upset	31	68.89	6.00	13.33	8	17.78
34	Humans will eventually learn enough about how nature works to be able to control it	26	57.78	10.00	22.22	9	20.00
35	If things continue on their present course, we will soon experience a major ecological catastrophe	41	91.11	3.00	6.67	1	2.22

*The statements are coded as numbered in the questionnaire

Anti-anthropocentric views are also reflected in the teachers' responses. The three statements that are related to this view are statements 22, 27 and 32. For the anthropocentric worldview that says "humans have the right to modify the natural environment" (Statement No 22), 60.00% of the respondents disagreed. For the eco-centric view that "plants and animals have as much right as humans" (Statement No 27) only 2.22% of them disagreed. For the other anthropocentric view that "humans were meant to rule over the rest of nature" (Statement No 32), 66.67% of the respondents disagreed. It revealed that teachers are having negative opinion about anthropocentrism.

Teachers' beliefs on the fragility of the balance of nature were tested by statements 23, 28 and 33. The majority of the respondents believed that human interference with nature often produces disastrous consequences as 80.00% of them agreed to Statement No 23. This belief of the respondents is reassured by the responses given to the adverse statements (Statement No 28) which says "the balance of nature is strong enough to cope with the impacts on nature" to which only half of them (51.11%) agreed. Indication to their belief on the fragility of the balance of nature is further strengthened by the responses given to statement 33 which states that "the balance of nature is very delicate and easily up set" to which 68.89% agreed while only 17.78% disagreed.

In addition, teachers believe that humans, like other species, are not exempted from the constraints of nature. This is evidenced by the responses given to the statements related to "rejection of exemptionalism" (Statements 24, 29 and 34). For the adverse statement, "human's ingenuity will insure that we do not make the earth unlivable" (Statements No 24) and "humans will eventually learn enough about how nature works to be able to control it" (Statement No 34), respectively 15.56% and 20.00% of the respondents disagreed. For the favorable statement that says "despite our special abilities humans are still subject to the laws of nature" (Statement No 29) the majority of the respondents (62.22%) agreed. However, it is also important to note that 31.11% are unsure about it.

Unless appropriate measures are taken, teachers believe, there is a possibility of an ecological crisis as indicated by the responses given to the statements related to this

issue (Statements 25, 30 and 35). For the statement that says “humans are severely abusing the environment” (Statement No 25), more than 80.00% agreed. For statement (No 30) that states ‘the so-called “ecological crisis” facing human kind has been greatly exaggerated’ 57.78% agreed. The possibility of an eco-crisis in the future is well stated by Statement No 35. It says, “if things continue on their present course, we will soon experience a major ecological catastrophe” and 91.11% respondents agreed with that.

Generally, the percentage distributions of the respondents indicate that there is a tendency on the part of teachers to support pro-environmental beliefs. As can be seen in Table 45 below, 43.17% supported pro-environmental beliefs. However, it is even lesser than those found elsewhere in Asia where most country responses were in a range of 51-61% indicating a higher pro-environmental behavior (Barett, Kuruda, & Miyamoto, 2002). One concern here is that a considerable number of participants have held an unsure stance about each of the 15 statements that range from 4.44% to 31.11 %.

Table 45. Percentage Responses of Pro and Anti NEP statements

S.No	Category	Percentage response (%)
1	Pro-environmentalist attitude	43.17
2	Anthropocentric Attitude	25.33
3	Neutral	31.50

For all the teachers participated in this study, the mean score of the summated ratings was 68.50 in the range of 40-67, which is 3.43 (above average) in the range of 1-5. Thus, as in past studies (Melaku, 1994; Akililu, 1998), teachers endorsed pro-environmental views. It is also consistent with the study done by Larijani & Yeshodhara (2008) who reported that Iranian and Indian teachers possessed favorable attitudes towards environment and sustainable development.

The descriptive analysis revealed that the mean raw scores of the male teachers, <30 years aged teachers, teachers with literate parents, urban teachers, non-native teachers, post graduate teachers, teachers with 9-10 years teaching experience, urban college teachers, aided college teachers and environmental education qualified teachers are above the total mean score of environmental attitude and is marginally higher than their counterparts and they have high degree of positive attitude towards their

environment (Table 46). Further, an independent-samples t-test conducted to compare the level of teachers' Environmental Attitude with respect to independent variables (Gender, Parents' literacy, Residence Location, Nativity, College Location and Environmental Education Qualification) revealed no significant differences were found among the respondents. This implies that all these teachers' possessed with same level of environmental attitude (Table 47).

Table 46. Mean Scores and SD of Teachers' Environmental Attitude

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	52.95	19	4.49	1.03
	Female	50.23	26	6.17	1.21
Age	<30	51.75	12	7.46	2.15
	31-40	50.95	19	5.52	1.27
	>41	51.64	14	4.18	1.12
Parents literacy	Literate	52.32	28	5.86	1.11
	Illiterate	49.82	17	5.02	1.22
Residence location	Rural	49.93	14	5.77	1.54
	Urban	52.03	31	5.53	0.99
Nativity	Native	50.63	24	5.35	1.09
	Non-native	52.24	21	5.95	1.30
Educational Qualification	PG	53.13	8	7.32	2.59
	M.Phil	48.55	11	3.30	0.99
	Ph.D	52.04	26	5.61	1.10
Teaching experience	<8 years	50.42	26	5.95	1.17
	9-10 years	54.75	8	3.85	1.36
	>11 years	51.18	11	5.40	1.63
College location	Rural	50.71	14	4.95	1.32
	Urban	51.68	31	5.96	1.07
Type of college	Government	53.11	9	5.95	1.98
	Aided	52.75	16	5.12	1.28
	Self-finance	49.50	20	5.58	1.25
EE Qualification	Yes	53.27	15	5.64	1.46
	No	50.43	30	5.48	1.00
	Total	51.38	45	5.63	0.84

Table 47. Independent Sample “t”- test for Teachers’ Environmental Attitudes scores

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	19	52.95	4.49	43	1.629	0.111
	Female	26	50.23	6.17			
Parents literacy	Literate	28	52.32	5.86	43	1.462	0.151
	Illiterate	17	49.82	5.02			
Residence location	Rural	14	49.93	5.77	43	1.165	0.250
	Urban	31	52.03	5.53			
Nativity	Native	24	50.63	5.35	43	0.958	0.343
	Non-native	21	52.24	5.95			
College location	Rural	14	50.71	4.95	43	0.527	0.601
	Urban	31	51.68	5.96			
EE Qualification	Yes	15	53.27	5.64	43	1.621	0.112
	No	30	50.43	5.48			

Table 48. One-way ANOVA for Teachers’ Environmental Attitudes scores

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	6.166	3.083	0.093	0.911
	Within Groups	42	1388.412	33.057		
	Total	44	1394.578			
Educational Qualification	Between Groups	2	124.014	62.007	2.050	0.141
	Within Groups	42	1270.564	30.252		
	Total	44	1394.578			
Teaching Experience	Between Groups	2	115.095	57.548	1.889	0.164
	Within Groups	42	1279.483	30.464		
	Total	44	1394.578			
Type of College	Between Groups	2	127.689	63.844	2.117	0.133
	Within Groups	42	1266.889	30.164		
	Total	44	1394.578			

One-way analysis of variance performed on teachers' Environmental Attitudes scores as the dependent variable against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed no significant differences. This implies that all these teachers are having more or less the same level of Environmental Attitudes (Table 48).

4.2.13 Teachers' Attitudes towards Environmental Education

Hypothesis - 12: No significant difference in the level of Attitudes towards Environmental Education among the teachers with respect to their demographic and personal variables

Teachers' views about the importance of EE in solving environmental problems, the role of colleges in general and the roles of their students and themselves in implementing EE programs were assessed by self-made 12 Likert scale statements. For presentation of data 'strongly agree' and 'agree', and 'strongly disagree' and 'disagree' responses are combined and presented in Table 49 below.

Table 49. Frequency of Percentage Distributions of Responses to EE Attitude Statements

Code*	Statements	Agree		Undecided		Disagree	
		No.	%	No.	%	No.	%
36	There is a pressing need for teachers to become better informed so that their students are given the most up-to-date information about environmental trends	42	93.33	1	2.22	2	4.44
37	The methods teachers use to convey environmental content are less important than the curriculum as far as effective environmental education program is concerned	33	73.33	0	0.00	12	26.67
38	Since environmental degradation is sometimes due to the absence of options for engaging in environmentally friendly activities, the role of environmental education for the solution of environmental problems is insignificant	26	57.78	10	22.22	9	20.00

Code*	Statements	Agree		Undecided		Disagree	
		No.	%	No.	%	No.	%
39	Since many people do not know the full consequences of their environmental actions, environmental education is important	42	93.33	2	4.44	1	2.22
40	As information and communication technologies are developing faster, the role of higher education in realizing the goals of environmental education is insignificant	32	71.11	1	2.22	12	26.67
41	Environmental education should be delivered across the curriculum (should be part of all the subjects taught)	45	100.00	0	0.00	0	0.00
42	Environmental Education in higher education should be left to EE qualified teachers so that its implementation will become effective	36	80.00	5	11.11	4	8.89
43	The focus of environmental education should be to promote the belief in the rights of humans to control nature and the capacity of science and technology to manage the effects of environmental degradation	36	80.00	3	6.67	6	13.33
44	The focus of environmental education should be on how humans can live in harmony with nature	42	93.33	2	4.44	1	2.22
45	Environmental knowledge should be constructed, generated and initiated by the students themselves	32	71.11	3	6.67	10	22.22
46	Environmental teaching and learning should be based on standardized outcomes (predetermined knowledge and attitudes of the students)	31	68.89	3	6.67	11	24.44
47	Teaching about the possibility of a major ecological catastrophe in the future will alert students for a responsible environmental action	42	93.33	2	4.44	1	2.22

*The statements are coded as numbered in the questionnaire

The study observed inconsistencies regarding respondents' views about the importance of EE in solving environmental problems. For the unfavorable statement which says "since environmental degradation is sometimes due to the absence of options for engaging in environmental friendly activities, the role of environmental education for the solution of environmental problems is insignificant" (Statement No 38), only 20.00% disagreed and quite a considerable number of respondents (57.78%) agreed. This may lead to an interpretation that teachers believed that it is not lack of awareness through EE but it is due to the "absence of options" that the environment is deteriorating. In contrast, more than half of the respondents (93.33%) believed that since so many people are ignorant of the environmental consequences of their actions, EE is important (Statements No 39). The majority of the respondents also believed that responsible environmental action comes after successful EE programs as 93.33% of them agreed to the statement which says 'teaching about the possibility of a major ecological catastrophe in the future will alert students for a responsible environmental action (Statement No 47).

The anthropocentric environmental belief of teachers is reflected in their attitude towards environmental education. For the statement which reflects an anthropocentric environmental worldview (Statement No 43) and states that "the focus of environmental education should be to promote the belief in the rights of humans to control nature and the capacity of science and technology to manage the effects of environmental degradation" only 13.33% of the respondents disagreed and the majority of them (80.00%) agreed. Their anthropocentric view is further reflected in their responses given to statement No 44 that says "the focus of environmental education should be on how humans can live in harmony with nature" to which except a few all (93.33%) agreed. This shows the majority of teachers believe that EE should not be underpinned by anti-anthropocentric environmental worldview, but should be based on eco-centric views so that EE can promote how humans can live in harmony with nature.

The percentage frequency distribution of the responses showed that belief in the role of teachers in the implementation of EE programs is encouraging. For the statement, which emphasizes on the pressing need for teacher to become better informed so that their students are given the most up-to-date information about environmental trends (Statement No 36) majority of them (93.33%) agreed. Dissimilar attitudes are reflected in

the responses given to statement No 37 which says, “the methods teachers use to convey environmental content is less important than the curriculum as far as effective environmental education program is concerned”. Most (73.33%) of the respondents gave responses in favor of the statement which implies that the majority of them believed that the role of the teacher is not important besides effective curriculum and other inputs in place.

Although it is much higher than in other studies, respondents’ showed support for the inclusion of EE in all the subjects taught as 100% agreed for statement No 41 that says “environmental education should be delivered across the curriculum”. For the sake of comparison, the result of an international survey conducted by Ballantyne (1999) is reproduced below in Table 50.

Table 50. Acceptance that EE should be taught across the curriculum by country (% of Respondents)

Country	Agreed	Undecided	Disagreed
Australia	65%	9%	26%
Canada	80%	-	20%
Denmark	68%	-	14%
Finland	93%	-	7%
Germany	77%	13%	10%
Hong Kong	62%	19%	19%
Japan	80%	10%	10%
Korea	57%	10%	33%
Namibia	80%	20%	-
New Zealand	86%	-	14%
Poland	71%	21%	7%
South Africa	87%	9%	4%
Saudi Arabia	73%	-	27%
Singapore	92%	-	8%
Sweden	75%	-	25%
Switzerland	91%	-	9%
UK	61%	15%	24%
USA	59%	17%	24%
Ethiopia	40%	32%	28%

Positive view is notable with regard to the role of colleges in realizing the goals of EE as evidenced by the responses given to statement No. 40 that states that “as information and communication technologies are developing faster, the role of higher education in realizing the goals of environmental education is insignificant” to which 71.11% agreed and 26.67% disagreed. This could imply that 1/4th of the teachers who believe that colleges other than information sources are more important for environmental awareness.

The study also revealed that the majority of the respondents show strong support for action-oriented strategy for EE as 71.11% of them agreed to the statement “environmental knowledge should be constructed, generated and initiated by the students themselves” (Statement No 45). Further, 68.89% agreed to the statement “environmental teaching and learning should be based on standardized outcomes” (Statement No 46), a strategy which encourage students to be active recipients. The mean score for EE attitude for the 45 teacher participants is 39.6 (range of 34-51). This is equal to 3.3 (above average) in a five-point scale. This indicates that respondents generally have positive attitudes towards EE and it conforms with the findings of Melaku (1994).

The descriptive analysis revealed that the mean scores of the male teachers, <30years aged teachers, teachers with literate parents, urban teachers, non-native teachers, post graduate teachers, teachers with <8 years teaching experience, urban college teachers, government college teachers and EE qualified teachers is above the total mean score and is marginally higher than their respective counterparts’ mean score and it implies that they possessed with positive attitude towards EE (Table 51). An independent-samples t-test conducted to compare the dependent variable level of teachers’ attitudes towards EE scores with independent variables (Gender, Parents’ literacy, Residence location, Nativity, College location and Environmental Education Qualification) revealed nativity having statistically significant differences between the scores of native (M=38.17, SD=3.06) and non-native (M=41.23, SD=4.46) teachers [$t(43) = -2.722, p = 0.009$]. Likewise location of college too have significant influence as seen by the differences between rural (M=37.79, SD=3.38) and urban (M=40.41, SD=4.09) teachers ($t(43) = -2.101, p = 0.042$). This implies that non-native and urban teachers have greater positive attitudes towards EE as a subject (Table 52).

Table 51. Mean Scores and SD of Teachers' Attitudes towards Environmental Education

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	39.63	19	3.40	0.78
	Female	39.58	26	4.52	0.89
Age	<30	41.92	12	5.04	1.45
	31-40	38.47	19	3.55	0.81
	>41	39.14	14	3.06	0.82
Parents literacy	Literate	40.21	28	4.54	0.86
	Illiterate	38.59	17	2.90	0.70
Residence location	Rural	38.50	14	3.98	1.06
	Urban	40.10	31	4.04	0.72
Nativity	Native	38.17	24	3.06	0.62
	Non-native	41.24	21	4.46	0.97
Educational Qualification	PG	40.88	8	4.76	1.68
	M.Phil	38.64	11	3.20	0.97
	Ph.D	39.62	26	4.17	0.82
Teaching experience	<8 years	39.92	26	4.57	0.90
	9-10 years	38.25	8	3.54	1.25
	>11 years	39.82	11	3.03	0.91
College location	Rural	37.79	14	3.38	0.90
	Urban	40.42	31	4.10	0.74
Type of college	Government	40.44	9	4.98	1.66
	Aided	39.69	16	4.74	1.19
	Self-finance	39.15	20	3.01	0.67
EE Qualification	Yes	40.40	15	4.22	1.09
	No	39.20	30	3.96	0.72
	Total	39.60	45	4.04	0.60

Table 52. Independent Sample “t”- test on scores of Teachers’ Attitudes towards EE

Independent variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	19	39.63	3.40	43	0.044	0.965
	Female	26	39.58	4.52			
Parents’ literacy	Literate	28	40.21	4.54	43	1.319	0.194
	Illiterate	17	38.59	2.90			
Residence location	Rural	14	38.50	3.98	43	1.234	0.224
	Urban	31	40.10	4.04			
Nativity	Native	24	38.17	3.06	43	2.722	0.009*
	Non-native	21	41.24	4.46			
College location	Rural	14	37.79	3.38	43	2.101	0.042*
	Urban	31	40.42	4.10			
EE Qualification	Yes	15	40.40	4.22	43	0.938	0.354
	No	30	39.20	3.96			

*Significant at 0.05 level

One-way ANOVA performed on scores of teachers’ attitudes towards EE as the dependent variable against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed no significant differences were found among respondents. Because, these group of teachers have same level of attitude towards EE subject (Table 53).

Table 53. One-way ANOVA on scores for Teachers' Attitudes towards Environmental Education

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	91.432	45.716	3.061	0.057
	Within Groups	42	627.368	14.937		
	Total	44	718.800			
Educational Qualification	Between Groups	2	23.226	11.613	0.701	0.502
	Within Groups	42	695.574	16.561		
	Total	44	718.800			
Teaching Experience	Between Groups	2	17.817	8.909	0.534	0.590
	Within Groups	42	700.983	16.690		
	Total	44	718.800			
Type of College	Between Groups	2	10.590	5.295	0.314	0.732
	Within Groups	42	708.210	16.862		
	Total	44	718.800			

4.2.14 Teachers' Actual Practice of Environmental Education

What are the teachers' pedagogical practices for teaching EE in college settings?

Hypothesis - 13: No significant difference in the teachers' teaching practices of EE with respect to their demographic and personal data.

One section of the survey asked respondents to rate how often they practice EE activities related to three areas; 1) teaching of EE Statements 48-54 in the questionnaire); 2) involvement in extracurricular activities in colleges (Statements 55-61 in the questionnaire); and 3) involvement in community activities (Statements 62-68 in the questionnaire).

The mean score of the 45 participants for the 21 statements is generally good which is 3.39 (between sometimes and often) in the range of 1 (never) to 5 (usually). The average response for each statement ranged from 2.31 for statement No 59 which

says “I write articles about the environment to be read during the flag ceremony” to 4.24 for statement No 48 which says “I present environmental knowledge/concepts in class”.

EE should aim primarily at influencing student decision making and teaching approach should incorporate, beside classroom activities, action at home, educational institutions and community levels (Ballantyne & Packer, 1996; Ballantyne, 1999). Even though teachers’ practice of EE is generally inadequate, the rank order of statements based on mean responses revealed that teachers emphasize most on classroom activities. The result also showed that respondents are reluctant to conduct extracurricular activities related to EE than engaging them in community based environmental actions. One concern here is that extracurricular activities in colleges, which are very important strategies to support EE are neglected by the teachers and that undermine the successful implementation of EE programs in colleges.

Activities that are most frequently practiced by the teachers include presenting environmental concepts in class, evaluating the curriculum and text book of the EE subject with regard to environmental issues, introducing students to some general ways of solving certain environmental problems and guiding them to apply such methods to other problems, guiding students to explore local environmental problems and solutions, teach the local community about environmental issues and bringing interesting pictures on environmental issues and show to the students. The least frequently practiced activities include organizing and leading environmental clubs, contributing articles concerning environmental issues to regional and/or national media, creating links between colleges and environmental NGOs or government offices, gathering posters concerning environmental issues and displaying them in the college campus, promoting desirable environmental ethics among students and writing articles on environmental issues to be read during flag ceremonies (Table 54).

Table 54. Rankings of EE Practices

Code*	Statements	Modal response	Mean	Rank
48	I present environmental knowledge/concepts in class	5	4.24	1
54	I evaluate the curriculum and text book of the subject I teach with regard to environmental issues	5	3.96	2
50	I introduce my students to some general ways of solving certain environmental problems and guide them to apply such methods to other problems	4	3.84	3
49	I guide students to explore local environmental problems and solutions consciously	4	3.82	4
65	I give quick and positive response when I am asked to contribute money for environmental protection	5	3.80	5
68	With regard to environmental behavior, I attempt to be a role model for the community in my lifestyles	3	3.69	6
52	I read in class interesting articles about environmental issues that I get from books, newspapers, magazines etc.	3	3.65	7
66	I teach the local community about environmental issues	4	3.62	8
53	I bring interesting pictures on environmental issues and show to my students	5	3.58	9
56	I organize question and answer program on environmental issues	3	3.42	10
61	I plant trees in the college compound	5	3.39	11
64	I actively participate in local community organizations working for the environment	3	3.38	12
51	I assign students to bring some materials from the local environment to be used for teaching	3	3.36	13
63	I actively participate in environmental actions of the community of which I am a member	5	3.31	14
60	I conduct local researches concerning environmental issues	5	3.27	15
55	I organize and lead environmental clubs in colleges	5	3.13	16
58	I gather posters concerning environmental issues and stick them in the college campus so that students can learn	3	3.11	17
62	I contribute articles concerning environmental issues to regional and/or national mass media	1	3.02	18
57	I create links between my college and NGOs and government offices which work for the protection of the environment	1	2.73	19
67	I use the institution to which I belong to promote the desirable environmental ethic	1	2.62	20
59	I write articles about the environment to be read during the flag ceremony	1	2.31	21

*The statements are coded as numbered in the questionnaire

The descriptive analysis revealed that the mean raw scores of the male teachers, >41years aged teachers, teachers with illiterate parents, rural teachers, non-native teachers, Ph.D holding teachers, teachers with 9-10 years teaching experience, rural college teachers, government college teachers and EE qualified teachers is above the total mean score. Their score is also marginally higher than their counterpart's score and hold higher number of EE classroom practices (Table 55).

Table 55. Mean Scores and SD of scores for Teachers' Teaching Practices of EE

Independent Variable	Category	Mean	N	Std. Deviation	Std. Error of Mean
Gender	Male	78	19	15.94	3.66
	Female	65.96	26	18.05	3.54
Age	<30	62.00	12	17.32	5.00
	31-40	71.16	19	17.81	4.08
	>41	78.64	14	16.43	4.39
Parents literacy	Literate	70.57	28	17.98	3.40
	Illiterate	71.82	17	18.64	4.52
Residence location	Rural	75.00	14	13.34	3.56
	Urban	69.26	31	19.73	3.54
Nativity	Native	69.71	24	17.10	3.49
	Non-native	72.57	21	19.36	4.22
Educational Qualification	PG	67.00	8	18.91	6.69
	M.Phil	62.27	11	17.00	5.13
	Ph.D	76.00	26	17.09	3.35
Teaching experience	<8 years	67.38	26	17.34	3.40
	9-10 years	85.38	8	15.29	5.40
	>11 years	69.27	11	17.69	5.33
College location	Rural	73.07	14	17.49	4.68
	Urban	70.13	31	18.48	3.32
Type of college	Government	79.22	9	19.04	6.35
	Aided	70.19	16	16.83	4.21
	Self-finance	68.05	20	18.30	4.09
EE Qualification	Yes	73.40	15	17.64	4.56
	No	69.87	30	18.41	3.36
	Total	71.04	45	18.03	2.69

An independent-samples t-test conducted to compare the scores relating to the level of teachers' practices for teaching EE with independent variables (Gender, Parents' literacy, Residence Location, Nativity, College Location and EE Qualification) revealed gender having statistically significant differences; the male teachers had higher scores (M=78.00, SD=15.94) than female teachers (M=65.96, SD=18.05)[$t(43) = 2.319$, $p = 0.025$]. This implies that male teachers showed higher number of EE teaching practices in college settings (Table 56).

Table 56. Independent Sample “t”- test on score for Teachers’ Teaching Practices of EE

Independent Variables	Category	N	Mean	SD	D.F	t	Sig.
Gender	Male	19	78	15.94	43	2.319	0.025*
	Female	26	65.96	18.05			
Parents literacy	Literate	28	70.57	17.98	43	0.223	0.824
	Illiterate	17	71.82	18.64			
Residence location	Rural	14	75.00	13.34	43	0.989	0.328
	Urban	31	69.26	19.73			
Nativity	Native	24	69.71	17.10	43	0.527	0.601
	Non-native	21	72.57	19.36			
College location	Rural	14	73.07	17.49	43	0.502	0.618
	Urban	31	70.13	18.48			
EE Qualification	Yes	15	73.40	17.64	43	0.615	0.542
	No	30	69.87	18.41			

*Significant at 0.05 level

Table 57. One-way ANOVA of scores for Teachers' Teaching Practices of EE

Independent variable	Source of variation	D.F	Sum of squares	Mean square (variance)	F	Sig.
Age	Between Groups	2	1790.171	895.085	3.003	0.060
	Within Groups	42	12517.741	298.041		
	Total	44	14307.911			
Educational Qualification	Between Groups	2	1615.729	807.865	2.673	0.081
	Within Groups	42	12692.182	302.195		
	Total	44	14307.911			
Teaching Experience	Between Groups	2	2025.700	1012.850	3.464	0.041*
	Within Groups	42	12282.211	292.434		
	Total	44	14307.911			
Type of College	Between Groups	2	792.968	396.484	1.232	0.302
	Within Groups	42	13514.943	321.784		
	Total	44	14307.911			

*Significant at 0.05 level

One-way analysis of variance performed on the scores for teachers' teaching practices of Environmental Education as the dependent variable against four independent variables (Age, Educational Qualification, Teaching Experience and Type of College) revealed statistically significant difference for independent variable teaching experience ($F(2, 42) = 3.464, p = 0.041$) when comparing all the participants' EE practices. Tukey post-hoc test for the mean difference of teachers' concerns scores revealed that there was a statistically significant difference among the lower scores of <8 years ($67.38 \pm 17.34, p = 0.033$) group when compared with the higher scores of 9-10 years (85.38 ± 15.29) group (Table 57). This implies that only teachers having 9-10 years of teaching experience holds greater level of teaching practices with regard to EE as a subject.

4.2.15 Teachers' Awareness-Attitude-Practice linkage

The long dominant focus of EE research on individual behavior change has contributed, at least in part, to the persistent but ill-founded assumption of many EE and

interpretation programs that an increase in environmental awareness will produce a change in attitude that will lead directly to more environmentally responsible behavior (Heimlich & Ardoin, 2008). An analysis of the relationships among the teachers' awareness, attitudes and practice of environmental issues and EE showed a moderate positive correlation between awareness and attitudes. However, their awareness and attitudes did not provide the platform for their actual practice as it is associated with neither of them (Table 58).

Table 58. Pearson's Product Moment Correlation

		Awareness	Environmental Attitude	EE Attitude	EE Practices
Awareness	Pearson Correlation				
	Sig. (2-tailed)				
	N	45			
Environmental Attitude	Pearson Correlation	0.550			
	Sig. (2-tailed)	0.000*			
	N	45	45		
EE Attitude	Pearson Correlation	0.436	0.606		
	Sig. (2-tailed)	0.003*	0.000*		
	N	45	45	45	
EE Practices	Pearson Correlation	-0.103	0.027	-0.019	
	Sig. (2-tailed)	0.502	0.860	0.901	
	N	45	45	45	45

** Correlation is significant at the 0.01 level (2-tailed).

4.2.16 Teachers' Information Sources on Environmental Issues and EE

What are the sources of information for teachers about environmental issues and EE?

Given six important sources of information for environmental issues and EE, teachers were asked to rate the degree to which each has been useful for their knowledge, attitude and skills. The five response options were 'greatly useful', 'considerably useful', 'somewhat useful', 'little useful' and 'not useful' with points 5, 4, 3, 2 and 1, respectively. The responses were used to rank the different experiences. The results are summarized in Table 59.

The overall rank showed that electronics media was the most important source of information followed by personal reading and in-service training. However, personal reading was ranked highest by teachers residing in both urban and rural. Likewise, teachers belonging to literate parental family, teachers with more than >11 years of teaching experience, teachers with 9-10 years of teaching experience and teachers working in urban colleges showed that it is their most important source of information.

For EE program to succeed in colleges, the fundamental ideas and practical procedures underpinning it should be incorporated into wider pre-service and in-service teachers' professional learning (Kennelly, Taylor and Jenkins, 2008). Against this, trainings (both pre-service and in-service), workshops (conferences) and print media were ranked low in the list of information sources. This suggests that teachers lack sufficient training to implement EE programs in colleges.

The low rank of pre-service training is particularly important because it indicates that teachers' college studies insufficiently prepared them for their environmental teaching. This result agrees with the result of the studies done by Ballantyne (1999), Tarabula et. al. (2004) and Cutter-Mackenzie & Smith (2003) who reported that pre-service training inadequately prepared teachers for teaching EE. When in-service trainings and workshops were important to fill this gap (Ham, Rellergert Taylor & Krumpel, 1987/88; Aklilu, 2009) it is unfortunate that they are not serving this purpose as they were also ranked low.

Table 59. Rankings of the different experiences that have been useful for the teachers' knowledge, attitudes and skills about environmental issues and EE

Rank by Independent Variable	Category	Experiences (sources of information)						
		Pre-service training	In-service training	Workshops/ Conferences	Personal reading	Electronics media	Print media	Others
Gender	Male	6	5	3	2	1	4	7
	Female	4	1	6	2	3	5	7
Age	<30	6	1	4	3	2	5	7
	31-40	5	6	3	2	1	4	7
	>41	6	4	1	2	3	5	7
Parents' literacy	Literate	6	4	3	1	2	5	7
	Illiterate	3	1	4	6	2	5	7
Residence location	Rural	3	4	5	1	2	6	7
	Urban	6	3	4	1	2	5	7
Nativity	Native	6	3	1	4	2	5	7
	Non-native	6	3	4	2	5	1	7
Educational Qualification	PG	5	1	6	3	2	4	7
	M.Phil	5	4	1	3	2	6	7
	Ph.D	6	4	3	2	1	5	7
Teaching experience	<8 years	6	2	4	3	1	5	7
	9-10 years	4	5	3	1	2	6	7
	>11 years	6	4	3	1	2	5	7
College location	Rural	3	6	4	2	1	5	7
	Urban	6	2	4	1	3	5	7
Type of college	Government	6	4	3	2	1	5	7
	Aided	6	4	5	2	3	1	7
	Self-finance	1	4	3	5	2	6	7
EE Qualification	Yes	6	4	3	2	1	5	7
	No	6	2	4	3	1	5	7
Overall Rank		6	3	4	2	1	5	7

4.2.17 Students' Feelings about their Competence to Learn Environmental Education

To what extent do students feel competent in and prepared for learning EE?

Participants were also asked to rate whether they feel competent to learn five different aspects that are related to the general aims of environmental education. The alternatives provided were excellent, very good, good, fair and poor with points 5, 4, 3, 2 and 1, respectively. The responses were used to rank the students' feelings about their competence to learn EE. The results are summarized in Table 60.

The analysis of the ranks by the various categories of the independent variables further showed that there are similarities in feelings among the different groups of students. Result shows that students felt relatively most competent in acquiring awareness, knowledge and attitude towards environment. At the same time, they felt least competent in acquiring skills and taking actions towards environmental issues. The only difference observed is that students with ages 19-23 years, students belonging to urban area, third year students, students above fifth year, agricultural students, aided college students, post graduate and research students felt competent in acquiring knowledge and understanding about the environment than acquiring awareness and sensitivity to the environment.

Table 60. Rankings of the Students' Feelings about their Competence to Learn EE

Rank by Independent Variable	Category	Acquiring awareness and sensitivity to the environment	Acquiring knowledge and understanding about the environment	Acquiring attitudes and values towards the environment	Learning skills in identifying and solving environmental problems	Acquiring a sense of responsibility through participation and action
Gender	Male	1	2	3	4	5
	Female	1	2	3	4	5
Age	<18	1	2	3	5	4
	19-23	2	1	3	4	5
	>24	2	3	1	5	4
Parents' literacy	Literate	1	2	3	4	5
	Illiterate	1	2	3	4	5
Residence location	Rural	1	2	3	4	5
	Urban	2	1	3	4	5
Nativity	Native	1	2	3	4	5
	Non-native	1	2	3	4	5
Year of Study	First Year	1	2	3	5	4
	Second Year	1	2	3	4	5
	Third Year	2	1	3	4	5
	Fourth Year	1	2	3	4	5
	Above Fifth Year	3	1	2	4	5
Type of Course	Agricultural	4	1	3	2	5
	Arts & Science	1	2	3	4	5
	Engineering	1	2	3	4	5
	Polytechnics	1	2	3	4	5
	Teacher Education	1	2	3	4	5
Type of College	Government	1	2	3	4	5
	Aided	3	1	2	4	5
	Self-Finance	1	2	3	4	5
Type of Programme	Under Graduate	1	2	3	4	5
	Post Graduate	2	1	3	4	5
	Research	4	1	5	2	3
	Diploma	1	2	3	4	5
Overall Rank		1	2	3	4	5

4.2.18 Teachers' Feelings about their Competence to Teach Environmental Education

To what extent do teachers feel competent in and prepared for teaching EE?

Participants were also asked to rate whether they feel competent to teach five different aspects that are related to the general aims of EE. The alternatives provided were excellent, very good, good, fair and poor with points 5, 4, 3, 2 and 1, respectively. The responses were used to rank the teachers' feelings about their competence to teach EE. The results are summarized in Table 61.

Table 61. Mean Scores of Responses for the Various Aspects of EE

Code*	Statements	Mean	Rank
76	Developing awareness and sensitivity to the environment	3.98	1
77	Developing knowledge and understanding about the environment	3.91	2
78	Developing attitudes and values towards the environment	3.77	3
79	Teaching skills in identifying and solving environmental problems	3.68	4
80	Developing a sense of responsibility through participation and action	3.66	5
Total		3.8	

*The statements are coded as numbered in the questionnaire

The analysis of the ranks by the various categories of the independent variables further showed that there are similarities in their feelings among the different groups of teachers (Table 62). They felt relatively most competent in developing awareness and sensitivity to the environment and least competent in developing a sense of responsibility through participation and action. There are a few differences observed that is male teachers, teachers with ages greater than 41 years, teachers belonging to rural area, teachers with 9-10 years of teaching experience, teachers working in the rural colleges and government college teachers felt competent in developing knowledge and understanding about the environment than developing awareness and sensitivity to the environment. Another difference is teachers with M.Phil qualification felt competent in developing attitude and values towards the environment than developing awareness and sensitivity to the environment.

Table 62. Rank of teachers' competence to teach the various aspects of EE

Rank by Independent Variable	Category	Aspects of Environmental Education				
		Developing awareness and sensitivity to the environment	Developing knowledge and understanding about the environment	Developing attitude and values towards the environment	Teaching skills in identifying and solving environmental problems	Developing a sense of responsibility through participation action
Gender	Male	2	1	3	4	5
	Female	1	3	2	4	5
Age	<30	1	3	2	5	4
	31-40	1	2	3	5	4
	>41	2	1	4	3	5
Parents' literacy	Literate	1	2	3	4	5
	Illiterate	1	2	3	5	4
Residence location	Rural	2	1	3	4	5
	Urban	1	2	3	5	4
Nativity	Native	1	2	3	5	4
	Non-native	1	2	3	4	5
Educational Qualification	PG	1	2	3	4	5
	M.Phil	2	3	1	4	5
	Ph.D	1	2	3	4	5
Teaching experience	<8 years	1	2	3	5	4
	9-10 years	2	1	4	3	5
	>11 years	1	2	3	4	5
College location	Rural	4	1	3	2	5
	Urban	1	2	3	5	4
Type of college	Government	3	1	4	2	5
	Aided	1	2	3	5	4
	Self-finance	1	3	2	5	4
EE Qualification	Yes	1	2	4	3	5
	No	1	2	3	5	4
Overall Rank		1	2	3	4	5

4.2.19 Learning Environmental Education: Opportunities and constrains for students

In order to ascertain the extent to which students benefited from various factors for EE, they were given a list of four facilitating factors for which they were asked to rate against five options (greatly important, considerably important, somewhat important, little important and not important, coded 5, 4, 3, 2 and 1, respectively). The responses given to these statements were used to rank these factors and are presented in Table 63.

Table 63. Rankings of the various opportunities for EE learning

Rank by Independent Variable	Category	Government Policy	The curriculum	The text books and teaching aids	The college management	Others
Gender	Male	1	2	3	4	5
	Female	1	4	3	2	5
Age	<18	1	4	3	2	5
	19-23	1	3	4	2	5
	>24	4	3	1	2	5
Parents' literacy	Literate	1	4	3	2	5
	Illiterate	1	4	3	2	5
Residence location	Rural	1	4	3	2	5
	Urban	1	3	4	2	5
Nativity	Native	1	4	3	2	5
	Non-native	1	4	3	2	5
Year of Study	First Year	1	4	3	2	5
	Second Year	1	3	4	2	5
	Third Year	1	2	4	3	5
	Fourth Year	2	4	3	1	5
	Above Fifth Year	3	1	2	4	5
Type of Course	Agricultural	1	3	4	2	5
	Arts & Science	1	4	2	3	5
	Engineering	1	3	4	2	5
	Polytechnics	1	3	2	4	5
	Teacher Education	4	3	2	1	5
Type of College	Government	1	4	3	2	5
	Aided	2	4	1	3	5
	Self-Finance	1	2	4	3	5
Type of Programme	Under Graduate	1	4	3	2	5
	Post Graduate	1	2	3	4	5
	Research	1	4	2	3	5
	Diploma	1	3	2	4	5
Overall Rank		1	4	3	2	5

The result indicated that the government policies are the most important enhancing factors followed by the college management, textbooks and teaching aids and the curriculum. It is not surprising that government policies are ranked highest because, obviously, they are the most reliable and regulatory guidelines for implementing successful EE programme for any educational system. What is surprising is that curriculum was ranked almost unanimously last by all the categories of students. This is a major concern because without understanding the meaning and purpose of higher education curriculum cross-curricular themes like EE cannot be implemented successfully.

An analysis done to investigate the extent to which the different obstacles hinder the respondents' EE activities revealed that time constraints, lack of funding, lack of training and heavy workload were the first four factors that constrained their learning activities. Whereas the low emphasis given to EE in the curriculum, lack of teaching resources, lack of college support and lack of students' commitment were the last four factors (Table 64).

Table 64. Rankings of the various obstacles that hinder students' EE activities

Rank by Independent Variable	Category	Time constraints	Lack of teaching materials	Lack of training	Heavy workload	Lack of college support	Lack of commitment	The less emphasis given to EE	Lack of funding
Gender	Male	1	6	4	5	7	8	3	2
	Female	1	5	4	3	7	8	6	2
Age	<18	1	5	4	3	7	8	6	2
	19-23	1	6	3	4	7	8	5	2
	>24	2	5	3	4	6	8	7	1
Parents' literacy	Literate	1	6	4	3	7	8	5	2
	Illiterate	1	4	3	5	7	8	6	2
Residence location	Rural	1	6	3	5	7	8	4	2
	Urban	1	6	4	3	7	8	5	2
Nativity	Native	1	6	4	3	7	8	5	2
	Non-native	1	6	3	4	7	8	5	2
Year of Study	First Year	1	5	3	4	7	8	6	2
	Second Year	1	6	5	4	7	8	3	2
	Third Year	1	6	5	4	7	8	3	2
	Fourth Year	3	6	2	4	7	8	5	1
	Above Fifth Year	1	4	3	5	7	8	6	2
Type of Course	Agricultural	2	6	5	3	8	7	4	1
	Arts & Science	1	5	3	4	7	8	6	2
	Engineering	1	6	4	2	7	8	5	3
	Polytechnics	1	6	4	5	7	8	3	2
	Teacher Education	3	6	1	4	7	8	5	2
Type of College	Government	2	6	3	4	7	8	5	1
	Aided	2	6	5	3	7	8	4	1
	Self-Finance	1	6	3	4	7	8	5	2
Type of Programme	Under Graduate	1	6	3	4	7	8	5	2
	Post Graduate	2	6	4	3	7	8	5	1
	Research	2	3	4	5	6	8	7	1
	Diploma	1	6	4	5	7	8	3	2
Overall Rank		1	6	3	4	7	8	5	2

4.2.20 Teaching Environmental Education: Opportunities and Constraints

What are the opportunities and constraints for the teaching EE?

In order to ascertain the extent to which teachers benefited from various factors for EE, they were given a list of four facilitating factors for which they were asked to rate against five options (greatly important, considerably important, somewhat important, little important and not important, coded 5, 4, 3, 2 and 1, respectively). Their responses to the statements were used to rank these factors, which are presented in Table 65.

Table 65 Rankings of the various opportunities for EE teaching

Rank by Independent Variable	Category	Opportunities				
		Government Policy	The curriculum	The text books and teaching aids	The college management	Others
Gender	Male	1	2	4	3	5
	Female	1	3	4	2	5
Age	<30	1	3	4	2	5
	31-40	2	3	4	1	5
	>41	1	2	4	3	5
Parents' literacy	Literate	1	2	4	3	5
	Illiterate	1	4	3	2	5
Residence location	Rural	1	2	3	2	5
	Urban	1	3	4	2	5
Nativity	Native	1	3	4	2	5
	Non-native	1	2	4	3	5
Educational Qualification	PG	1	3	4	2	5
	M.Phil	1	2	3	4	5
	Ph.D	1	2	4	3	5
Teaching experience	<8 years	1	3	4	2	5
	9-10 years	1	2	3	4	5
	>11 years	1	3	4	2	5
College location	Rural	1	2	4	3	5
	Urban	1	3	4	2	5
Type of college	Government	1	2	4	3	5
	Aided	1	2	4	3	5
	Self-finance	1	4	3	2	5
EE Qualification	Yes	1	2	4	3	5
	No	1	2	4	3	5
Overall Rank		1	2	4	3	5

The result indicated that the government policies are the most important enhancing factors followed by the curriculum, the college management and textbooks. It is surprising that government policies are ranked highest because, obviously, they are the most important and vital documents for successful implementation of any programme. What is surprising is that textbook was ranked last almost unanimously by all the categories of teachers. This is a major concern because, obviously, they are the immediate, easily accessible and readily available sources for teachers.

An analysis done to investigate the extent to which the different obstacles hinder the respondents' EE activities revealed that time constraints, lack of funding, heavy workload and the low emphasis given to EE in the curriculum were the first four factors that constrained their activities. Lack of teaching resources, lack of training, lack of teachers' commitment and lack of college support were the last four factors (Table 66). The present study results reflects the results of Ham and Swing (1987/88) and Ballantyne (1999) studies.

Table 66 Rankings of the various obstacles that hinder teachers' EE activities

Rank by Independent Variable	Category	Obstacles							
		Time constraints	Lack of teaching materials	Lack of training	Heavy workload	Lack of college support	Lack of commitment	The less emphasis given to EE	Lack of funding
Gender	Male	1	5	6	3	7	8	4	2
	Female	1	6	3	2	8	7	4	5
Age	<30	1	5	2	3	8	6	4	7
	31-40	1	3	4	5	7	8	6	2
	>41	3	5	7	4	6	8	2	1
Parents' literacy	Literate	1	4	5	2	8	7	6	3
	Illiterate	1	3	4	7	5	8	6	2
Residence location	Rural	2	4	6	8	5	7	3	1
	Urban	1	5	4	2	8		6	3

Rank by Independent Variable	Category	Obstacles							
		Time constraints	Lack of teaching materials	Lack of training	Heavy workload	Lack of college support	Lack of commitment	The less emphasis given to EE	Lack of funding
Nativity	Native	1	3	5	2	7	8	4	6
	Non-native	2	6	5	3	8	7	4	1
Educational Qualification	PG	1	6	2	3	8	7	4	5
	M.Phil	1	3	2	4	8	7	6	5
	Ph.D	1	5	6	3	7	8	4	2
Teaching experience	<8 years	1	5	4	3	8	7	6	2
	9-10 years	1	7	6	2	5	8	4	3
	>11 years	2	4	6	5	8	7	3	1
College location	Rural	2	4	6	1	7	8	5	3
	Urban	1	6	5	4	8	7	3	2
Type of college	Government	4	5	6	3	7	8	2	1
	Aided	1	2	3	4	8	7	6	5
	Self-finance	1	5	6	3	7	8	4	2
EE Qualification	Yes	1	5	7	4	6	8	3	2
	No	1	6	4	3	8	7	5	2
Overall Rank		1	5	6	3	8	7	4	2

The table 67 presents a summary of all demographic and personal variables regarding teachers' awareness, attitude and practices in terms of presence (yes) or absence (no) of statistically significant differences among the groups.

Gender studies revealed that, female students are having significantly higher level of environmental awareness, knowledge and self-efficacy than male students have. It is similar to the study published by Gunde & Parit (2015), and Hamidian & Salajegheh (2012). The reason behind this would be that in recent years, female students' gross enrollment ratio in higher education is relatively more than male students (UGC Annual Report, 2014-15) and also they are more studious having higher pass percentage in their

final exams. Improvement in literacy rate plays a crucial role in raising awareness of environmental challenges and shaping the attitudes and behaviours and that can make a difference. Hence, students of literate parents are having remarkably higher level of environmental awareness and environmental actions than the students of illiterate parents have. Here, literate parents having greater capability for parental teaching / guidance about environment through which they can help to promote awareness on environmental issues and the acquisition of environmental skills. It has been found that when parents are involved in their children's education, children have better grades and test scores, better attitudes and behavior (Brown, 1989; Peterson, 1989).

Rural students are having notably higher level of environmental awareness, social responsibility and inclination to environmental actions than urban students have. It agrees with the observations of Vashist (2001). Because, their rural lifestyle – in other words – utopian yearnings that will help them to improve the skill of interpretation on gathered environmental information and which leads the students to well aware about their environment. Rural students to favour protecting environment because their leisure often involves greater interaction with nature and their families usually rely on the land for agriculture and livestock (Severino, 2015). It was seen that non-native students possess better environmental awareness than their urban counterparts do. It is obvious that those who coming from outside will have better level of interest in understanding their new locality and further there is a possibility that community / area from which they come have a better environmental consciousness.

The age-wise result shows that >24 years students have appreciably higher level of environmental awareness and sense of social responsibility. Age possibly will help the students to foster their sense of responsibility and "proactive citizenship," so that when they become adults they will make choices based on the perspective they could develop in course of growing up. The results relating to 'Year of study' indicates that above fifth year students are good in environmental awareness and self-efficacy, fourth year students in attitudes and environmental actions, and third year students in knowledge.

The results find that agricultural students are good in environmental awareness, attitudes, knowledge, while teacher educator students good in self-efficacy. It was seen that arts and science students were good in environmental actions. In general, agricultural

stream have greater scope to learn environmental information than those from other streams because their curriculum were framed upon environmental ideas. Arts and science students find more free hours to participate in the environmental activities, which is restricted to students of other disciplines.

‘Type of college’ studies revealed that government college students are good in environmental awareness, attitudes, knowledge and self-efficacy, while aided college students are good in social responsibility. Government college students are possibly having better liberty in engaging environment related activities than students of other type of colleges because for them liberty is minimal and forced compliance to curriculum is higher.

The ‘type of programme’ study also revealed that research scholars are better in environmental knowledge, self-efficacy and environmental actions; on the other hand postgraduate students are good in attitude. Those who completed their undergraduate degree and joined higher studies are well aware about their environment because these are the people who probably would have got enough practical exposure on environmental issues in their college days.

Table 67. Summary of the Presence (Yes) and Absence (No) of significance difference among all Demographic variables with respect to awareness, knowledge, attitude, self-efficacy and actions across all student groups

Variables	Awareness	Knowledge	Attitude	Self-efficacy	Social responsibility	Actions
Gender	Yes	Yes	No	Yes	No	No
Age	Yes	No	No	No	Yes	No
Parents literacy	Yes	No	No	No	No	Yes
Residence location	Yes	No	No	No	Yes	Yes
Nativity	Yes	No	No	No	No	No
Year of Study	Yes	Yes	Yes	Yes	No	Yes
Type of Course	Yes	Yes	Yes	Yes	No	Yes
Type of College	Yes	Yes	Yes	Yes	Yes	No
Type of Programme	Yes	No	Yes	Yes	No	Yes

Table 68 presents a summary of all demographic and personal variables regarding teachers' awareness, attitude and practices in terms of presence (yes) or absence (no) of statistically significant differences among the groups.

Table 68 Summary of the Presence (Yes) and Absence (No) of significant differences among all demographic variables with respect to awareness, attitude and practices across all teacher groups

Variables	Awareness	Environmental Attitude	EE Attitude	EE Practices
Gender	No	No	No	Yes
Age	No	No	No	No
Parents' literacy	No	No	No	No
Residence location	No	No	No	No
Nativity	No	No	Yes	No
Educational Qualification	No	No	No	No
Teaching experience	No	No	No	Yes
College location	No	No	Yes	No
Type of college	No	No	No	No
EE Qualification	Yes	No	No	No

Teachers can play an important role in educating their students about environment which is possible only when the teachers themselves have the necessary level of environmental objectives. In terms of gender, it was seen that male teachers are better in practices in EE teaching. This is because male teachers are having greater scope and exposure to perform environment related activities, while for female teachers the college management restricts that type of exposure in general.

In terms of 'nativity', the results indicate that non-native teachers are having positive attitudes towards environmental education than their counterparts. It is not a good indicator that most native teachers are lesser aware of the main dimensions of environmental education that involves mentoring the students towards more sustainable future. Regarding 'Teaching experience' the results show that those teachers having 9-10 years teaching experience show better EE practices in the classroom, possibly because of exposure and understanding they have

acquired in their long years in teaching profession. The study relating to ‘College location’ revealed that urban college teachers are having higher level of positive attitude towards EE subject, possibly because college in urban settings have better infrastructure for teaching environmental education while such facilities are minimal in colleges in rural settings. The results of analysis of the impact of E qualification revealed that those who have qualification in EE subject have higher level of environmental awareness; in fact, good teaching depends on good subject knowledge and excellent pedagogical skills.

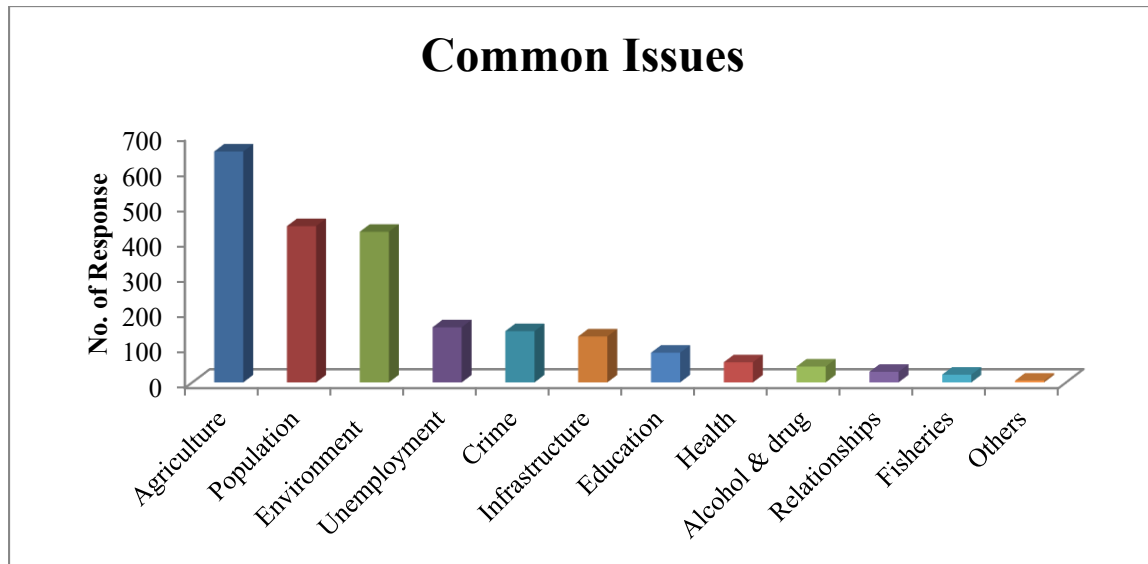
4.2.21 Single most important common and environmental issues for Tamil Nadu government

Those interviewed were asked to state the single most important common issue for Tamil Nadu government need to focus in the future. The largest numbers of respondents referred to farming and agriculture (29.75%), over population (20.14%) and the environment (19.41%) are the three most serious common issues of Tamil Nadu government. These three issues are very closely interconnected and inter-dependent each other. It means any changes in one tend to adversely affect others respectively (Table 69, Figure 5).

Table 69. Rank order of the various common and environmental issues facing Tamil Nadu

Common Issues	No. of Response	Percentage (%)	Rank
Farming and agriculture	653	29.75	1
Over population	442	20.14	2
The environment	426	19.41	3
Unemployment	156	7.11	4
Crime	145	6.61	5
Infrastructures (Roads, Railways, Airports, etc)	130	5.92	6
Education	84	3.83	7
Health	57	2.60	8
Alcohol and other drugs	45	2.05	9
Bilateral and multilateral relations	30	1.37	10
Fisheries	22	1.00	11
Others	5	0.23	12

Figure 5. Percentage representations of Tamil Nadu government’s common issues



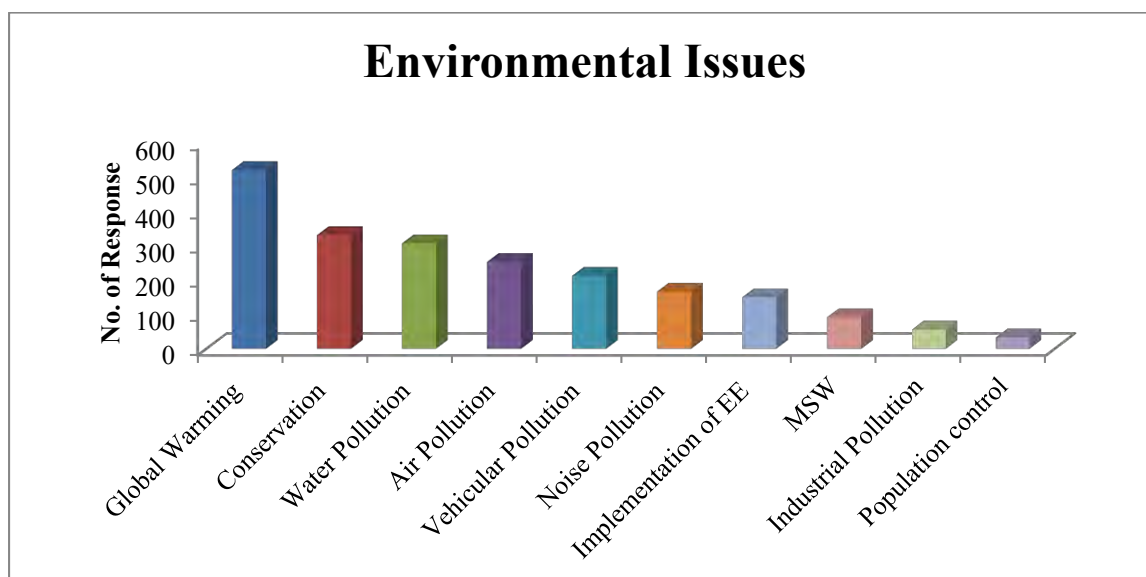
The respondents were then shown a list of twenty-three environmental issues and asked which of these they regarded as the single most important issue for Tamil Nadu government in the next few years. The results were shown as global warming (23.74%), Environmental conservation (15.13%) and water pollution (14.03%) is the three environmental issues for the government (Table 70, Figure 6).

Table 70. Rank order of the various environmental issues for Tamil Nadu government

Environmental Issues	No. of Response	Percentage (%)	Rank
Global Warming	521	23.74	1
Conservation	332	15.13	2
Water Pollution	308	14.03	3
Air Pollution	254	11.57	4
Vehicular Pollution	213	9.70	5
Noise Pollution	167	7.61	6
Implementation of EE	150	6.83	7
MSW	92	4.19	8
Industrial Pollution	56	2.55	9
Population control	33	1.50	10

Environmental Issues	No. of Response	Percentage (%)	Rank
Bio Medical Waste Management	22	1.00	11
Marine Pollution	12	0.55	12
Waste water treatment	10	0.46	13
Ground water Pollution	9	0.41	14
Enforcement of Environmental Laws	8	0.36	15
Creating Environmental Awareness	5	0.23	16
Sustainable Development	2	0.09	17
Deforestation/Forest Fire	1	0.05	18
Hazardous & Toxic Waste Management	0	0.00	19
Pesticides	0	0.00	19
Natural Disaster/Chemical Accidents	0	0.00	19
Energy Production	0	0.00	19
Mining	0	0.00	19
Others	0	0.00	19

Figure 6. Percentage representations of top ten environmental issues



4.3 Secondary Findings

Environmental awareness is widely defined. Among other things, awareness includes incorporating knowledge of contemporary issues affecting nature locally and globally, discovering which actions can make a difference in your local environments, and self-awareness concerning personal environmental philosophies. The growing concern with environmental issues and their impact on general awareness is one of the most noticeable phenomena of the last two decades. Giolitto et al. (1997) drew a conclusion that the development of awareness of the necessity to protect the nature and the environment and of the complexity both of the environment and the interactions between man and nature. The present study revealed that surprisingly students having better environmental awareness than their teaching faculties especially with reference to their overall awareness, perception on locality and level of concern towards local environmental conditions. This is not good sign for achieving the objectives of EE programme because teachers are instrumental for any successful programme, it is difficult when they are in dearth of environmental awareness.

The attitudinal study indicates that respondents generally have positive attitudes towards environment which confirms the findings of Arcury & Christianson (1993); Widegren (1988). Promoting positive attitudes to the environment is essential if pupils are to value it and understand their role in safeguarding it for the future. Encouraging the development of the attitudes and personal qualities like appreciation of, and care and concern for the environment and for other living things, independence of thought on environmental issues, a respect for the beliefs and the opinions of others, a respect for evidence and rational argument and tolerance and open-mindedness. The results show that teachers having higher level of pro-environmental and lower level of anthropocentric attitudes than their students. These findings will have particular importance to those teachers that they have a desire to foster social responsibility within their students. It also revealed that relatively same number of both students and teachers' respondents have taken neutral stand on environmental attitude.

Knowledge used to gain experiences and a basic understanding of the environment and its problems. The present environmental study finds that Looking at

perceptions on state of the environment, a large majority of respondents perceived deterioration in air quality due to rapid increase in vehicular movement, water quality by industrial wastes, and land quality because of dumping untreated solid wastes. The same findings were noticed in TERI environmental survey, 2014. Furmon (1998) also supports this finding by observing that there is a positive relationship between environmental knowledge and the development of pro-environmental attitudes.

In general, a large topic of interest within the EE domain is establishing how personal traits or lifestyle factors contribute to a person's environmental attitudes and behaviors. A general attitude can be defined as something, which "must be perceived by the individual as connected in some meaningful way to a specific situation to serve as a basis for an evaluative reaction in that situation" (Prislin & Ouellette, 1996). Ajzen (2001) reviewed the ability of attitudes to predict intentions and overt behavior; according to the theory of planned behavior, people act in accordance with their intentions, while intentions in turn are influenced by attitudes toward the behavior. Prislin & Ouellette (1996) found that highly embedded attitudes toward preservation of the environment were more strongly related to behavioral intentions than low-embedded attitudes were. The concept of embeddedness involves how deeply an attitude lies within cognition, and how much that attitude is supported by similar beliefs and experiences of the individual. Results of their research offered evidence that embeddedness levels influence behavioral intentions and actions. "Consequently, the more elements with which an attitude is connected, the broader the scope of situations to which the attitude is potentially applicable" (Prislin & Ouellette, 1996). Due to these findings, the present EE course partially makes environmental issues more understandable and relevant to students. The activation of greater environmental awareness should also strengthen the link between pro-environmental attitudes and behaviors. In this context, in this study, it is shown that students taking a course on EE displaying a positive pro-environmental attitudes and environmental awareness, but lagging in environmental actions.

Chapter-V
Conclusions and Recommendation

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

India's economic growth over the past 30 years, at 6.2% per annum, has been twice that of the world. The World Bank (2013) report reveals that during 1995 to 2010, India has become one of the fast progressing countries in the world, in addressing its environmental issues and improving its environmental quality. The Indian Government is also committed to reducing the intensity of greenhouse gas emissions by 20–25 percent by 2020 against a 2005 baseline, and to adding 30,000 MW of renewable energy capacity (World Bank, 2013). Still, India has a long way to go to reach environmental quality similar to that in developed economies. Pollution remains a widespread major challenge, threat to human and environmental health and an opportunity for India. However, several studies indicate that India like many developing countries already equipped with environmental policies, legal frameworks and economic instruments, regarded as highly sophisticated by international standards (Huber et al., 1998; Fujisaki et al., 1997) yet face the worsening of environmental conditions. Since, Tamil Nadu incorporated environmental education (EE) as part of their curriculum and it is mandatory for all the students irrespective of their curriculum to learn that. Therefore, it is important to know the level of EE objectives being achieved as evident from appropriate changes among the future generation and their practices towards environmental protection and sustainable development. In this context, the present study is intended to understand the environmental awareness, knowledge, attitudes and practice among college students and teachers. The present study was undertaken in Coimbatore among students of different courses and classes, and teachers who are handling the subject. During the study, data was collected from more than 2500 students and teachers.

The study conclude that firstly, even though there are indications that teachers were deficient in awareness and understanding of several issues related to the environment in general and EE in particular, they held strong pro-environmental beliefs and positive attitudes towards EE. Nevertheless, the teachers felt that they are incompetent to teach EE especially in influencing students' attitudes and behavior and in

training them in environmental problem solving skills. Some of the explanations for these shortcomings are that teacher's pre-service training inadequately prepared them for teaching EE and not less importantly, they have not received sufficient in-service training, which limited the quality of their overall EE practices. It is evident that the mass media (both electronics and print) and personal reading are main information sources for teachers on environmental issues and EE.

Secondly, it is evident that teachers' actual practice of EE is generally low though they are not ignorant of their roles to promote the subject and do not lack any commitment to it. Most of their practices are limited to routine classroom activities. Extracurricular activities in colleges and out-of-college activities seem to be grossly neglected. The study also showed that teachers have not used all the opportunities that help enhancing their EE efforts and for that reason, the students were exposed to minimal actions towards environmental protection. Invariably, both teachers and students felt that government policies very crucial for successful implementation of EE curriculum in the higher education sector and they too agreed that time constraints and lack of funding are the major obstacles for achieving EE programme goals.

Thirdly, teachers differed statistically significantly in overall environmental awareness with respect to their EE qualification, EE attitudes with respect to their nativity and college location and EE practices with reference to their gender and teaching experience. However, no statistically significant differences were found in the teachers' environmental attitude with reference to their demographic and personal variables. Likewise analysis of data on students' revealed that, statistically significant differences were found in the students awareness, knowledge, attitude, self-efficacy, social responsibility and their actions towards environmental protection. The study has illustrated that, in the specific context of the participants in this study, there is clear evidence that EE is poorly understood and determined by EE teachers in Coimbatore district. EE gets only fringe position in the teachers' practice as it is neither a priority subject nor it is implemented in ways that might make significant difference in the students' environmental consciousness or actions. This study concludes that if EE teachers are to bring about much needed change in the EE as laid down by the policy reforms imposed by the Supreme Court of India, more need to be done to enable, inspire

and support them to do so. By not prioritizing EE teachers' pedagogical needs and strengthening the higher Education curricula itself, ambitious policy reforms have little meaningful impact. Field experience is one of the most effective learning tools for environmental issues. This expands education out of the scope of the textbook mode of teaching and into the realm of hands-on learning in the field, where the teacher acts as a catalyst to interpret what the student observes or discovers in his/her own environment (river/forest/wetlands/hill/mountain/polluted sites/flora and fauna). The UGC as well have prioritized this; however, the present study found that students were altogether ignorant about this intention because teachers were much lagging in promoting such outdoor practices. Thus in brief, this study reveals a major gap between policy, practice and implementation, which unless seriously addressed will throttle the hopes and expectations of effective EE in higher education and pin down the subject to the realms of rhetoric rather than reality.

5.2 Recommendations

As citizens of this planet, we have the responsibility to live in ways that guarantee the conducive setting for the life of future generations. Educators, additionally, have the civic and ethical responsibilities to develop positive awareness, knowledge, and attitudes towards to environment among future citizens. As stated by Palmer (1998) EE will enable students *“not just to hold a store of relevant concepts, facts, and figures, but also to critically evaluate issues and situations in the light of informed understanding”* and successful implementation of EE programs will esteem educators as change agents.

EE is currently in the curriculum in all schools and higher educational institutions in all states of India. There is interest among public policy makers, in local communities, the private sector, and local governments to develop effective EE programs to make it equipped to address local environmental concerns. However, concerns on the current practice of EE have also been expressed from several of those who are involved. An essential component of program development is a valid evaluation tool and an effective evaluation is essentially to measure the utility or success of a program in terms achieving its set objectives. The instrument utilized in this study investigated the levels of most common EE objectives. The study has brought out some of salient drawbacks of

current EE practice. In order to refine and utilize the instrument further, it is recommended that the study undergo a more rigorous statistical analysis beyond the scope of this investigation to determine relationships among the dependent variables and the participating groups. Since the present study did not dwell into the socio-economic status of respondents, it is recommended that future studies need to be extended so as to consider the role of such variables on respondents' environmental objectives / perspectives.

While research in the field of EE and has focused on students who have completed their schooling, little is known about their EE objectives in the long term, i.e. after completing their higher education, joining the workforce, or establishing a family. Future research could examine the changes in levels of awareness, knowledge, attitude, actions and self-efficacy on the student and teacher population over time to evaluate the results of the EE programs they were exposed to.

It was found that gaining environmental knowledges through outdoor experiences is almost fully neglected in the Coimbatore colleges due to various reasons. It is advised that this gap need to be addressed by the institutions and the authorities on an urgent basis. It would be worthy if attempts on developing and employing special contemporary environmental dimensions through co-curricular activities (or) by forming separate department/club for raising environmental consciousness and appropriate skill among the youngsters. Already existing environmental clubs should be made more active and functional to make the students to be more sensitized by celebrating commemorative days and spreading innovations about alternatives for ubiquitous materials such as plastic covers. EE should not be relegated to the status of a subject to pass the course; rather it should become part of their life's philosophy. It can be achieved through the help of NGOs who are working on environmental issues, social activists, government and social work professionals.

Pre-service teacher training programs should be reviewed in the context of EE so that they would adequately prepare teachers for EE teaching. Short-term training on contemporary environmental issues and EE should be organized for teachers on an intermittent basis. Such training should focus on experienced teachers, female teachers,

urban teachers and teachers in other academic areas other than natural sciences and social studies. The contents should emphasize on extracurricular activities and community based environmental actions. EE programs should be widely disseminated through the mass media in which teachers are target audiences. Teachers should be encouraged to use all the opportunities available to improve their EE skills. The college management should play its coordinating role more committed in enhancing EE, since it is they who decide upon the quality of their teachers and consequently the students. That would include, besides providing for training, provision of good quality teaching resources and funding and allotting quality time for in-service and exposure programs.

Finally, the present study recommends that EE as a subject necessarily should be considered as an independent one, but compulsory in Indian higher education system.

References

References

- Ajzen, I. (2001). Nature and operation of attitudes. *Annu. Rev. Psychol*, 52, 27-58.
- Aklilu, D. (1998). Educators' Views about the Use and Protection of Natural Resources in Ethiopia: The Case of Teachers and School Administrators. *The Ethiopian Journal of Education*, 18 (2), 41-61.
- Arcury, T., & Christianson, E. (1993). Rural-urban differences in environmental knowledge and actions. *The Journal of Environmental Education*, 25, 19-25.
- Athman, J., & Monroe, M. (2000). *Elements of effective environmental education programs*. Retrieved November 12, 2017 from http://general.utpb.edu/FAC/keast_d/Tunebooks/pdf/Athman%20and%20Monroe%20Article.pdf
- Baez, A. V. (1987). *Education and Conservation Strategy*. In A. V. Baez, G. W. Knamiller & J. C. Smyth (Eds.), *The Environment and Science and Technology Education*, 8, 37-46. Oxford, U.K.: Permagon Press for ICSU Press.
- Ballantyne, R. (1999). Teaching Environmental Concepts, Attitudes and Behavior through Geography Education: Findings of an International Survey. *International Research in Geographical and Environmental Education*, 8(1), 40-58.
- Ballantyne, B. R., & Packer, J. M. (1996). Teaching and Learning in Environmental Education: Developing Environmental Conceptions. *The Journal of Environmental Education*, 27(2), 25-32.
- Ballard, M., & Pandya, M. (1990). *Essential learnings in environmental education*. Troy, OH: North American Association for Environmental Education.
- Barnett, J., Matthew, R., & O'Brien, K. (2010). *Global Environmental Change and Human Security: An Introduction*. In R. Matthews, J. Barnett, B. McDonald & K. O'Brien (Eds.), *Global Environmental Change and Human Security*, 1-32. Cambridge, Massachusetts: Massachusetts Institute of Technology.
- Barrett, B. F. D., Kuroda, A., & Miyamoto, K. (2002). Ecological Modernization, Environmental Knowledge and Social Change: Attitudes and Behavior of Young People in Japan. *International Research in Geographical and Environmental Education*, 11(3), 237-261.

- Barrow, C. (2012). *Socioeconomic Adaptation to Environmental Change; Towards Sustainable Development*. In J. Matthews, P. Bartlein, K. Briffa, A. Dawson, A. Vernal, T. Denham, S. Fritz & F. Oldfield (Eds.), *The Sage Handbook of Environmental Change*, 2, 426-446. London: Sage Publications Ltd.
- Barta, P., & Pokharel, K. (2009). *Megacities Threaten to Choke India*, Wall Street Journal. Retrieved from <http://online.wsj.com/article/SB124216531392512435.html>
- Bennett, J. (2012). *Little green lies: an expose of twelve environmental myths*. Ballan, Victoria: Connor Court Publishing.
- Brown, P. C. (1989). Involving Parents in the Education of Their Children. ERIC Digest. ERIC Identifier: ED308988. Retrieved from <https://www.ericdigests.org/pre-9212/parents.htm>
- Brown, L. (2011). *World on the Edge: How to prevent environmental and economic collapse*. Washington DC: Earthscan.
- Bryner, G. (2011). *Protecting the Global Environment*. Colorado, U.S. A.: Paradigm Publishers.
- Buchcic, E., & Grodzinska-Jurczak, M. (2004). Environmental Education in Polish Primary Schools. *International Research in Geographical and Environmental Education*, 13(3), 264- 268.
- Bussey, M., Inayatullah, S., & Milojevic, I. (2008). *Alternative Educational Futures: Pedagogies for Emergent Worlds*, 235-252. Rotterdam: Sense Publishers.
- Carson, R. (1964). *Silent Spring* (Colonial ed.). London: Readers Union.
- Census of India. (2011). *Size, Growth Rate and Distribution of Population*. New Delhi: Government of India, Retrieved from http://www.censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter3.pdf.
- Center for Environment Education. (2007-2008). Annual Report. In Center for Environment Education (Ed.). Ahmedabad: Center for Environment Education.
- Center for Environment Education. (2012). The Green Teacher, Retrieved November 2, 2012, from <http://www.greenteacher.org/>

- Chambers, B. (1999). Environmental Education and Primary Geography. *International Research in Geographical and Environmental Education*, 8(1), 90-93.
- Chhokar, K., & Chandrasekharan, S. (2006). *Approaches to Environmental Education for Sustainability in India*. In J. Chi-Kin Lee, Williams, M (Ed.), *Environmental and Geographical Education for Sustainability: Cultural Contexts*, 359. New York: Nova Science Publishers.
- Chhokar, K., & Pandya, A. (2005). *Samvardhan: An Experiment in Education for Sustainable Development*. In A. o. t. U. L. f. a. S. Future (Ed.), *The Declaration-Bi-Annual Report* (Vol. 7).
- Conca, K., & Dabelko, G. (Eds.). (2004). *Green Planet Blues: Environmental Politics, From Stockholm to Johannesburg* (Third ed.). Colorado: Westview Press.
- Cuff, D., & Goudie, A. (2009). *The Oxford Companion to Global Challenge*. New York: Oxford University Press.
- Cutter-Mackenzie, A. (2003). *Eco-Literacy: The "Missing Paradigm" in Environmental Education*. PhD, Central Queensland University, Brisbane.
- Cutter-Mackenzie, A. (2009). *Ecoliteracy: The "Missing Paradigm" in Environmental Education*. Saarbruken, Germany: Lambert Academic Publishing.
- Deveall, B., & Sessions, G. (1985). *Deep Ecology: Living as if Nature Mattered*. Salt Lake City: Peregrine Smith Books.
- Devi, R. M., & Baboo, S. S. (2012). Land use and land cover change detection for three decades: Case study for Coimbatore area. *International Journal of Engineering Research and Applications*, 2(1), 1013-1028.
- Diamond, J. (2005). *Collapse: How Societies Choose to Fail or Survive*. Australia: Allen Lane -Penguin Books.
- Dunlap, R., & Van Liere, K. (1978). The new environmental paradigm, a proposed measuring instrument. *The Journal of Environmental Education*, 9, 10-19.
- Dunlap, R., & Van Liere, K. (1984). Commitment to the dominant social paradigm and concern for environmental quality. *Social Science Quarterly*, 65, 1013-1028.

- Dunlap, R., Van Liere, K., Mertig, A., & Jones, R. (2000). Measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of Social Issues*, 56, 425-442.
- Eames, C., Cowie, B., & Bolstad, R. (2008). An Evaluation of Characteristics of Environmental Education Practice in New Zealand Schools. *Environmental Education Research*, 4(1), 35-51.
- Edwards, A. (2010). *Thriving Beyond Sustainability: Pathways to a Resilient Society*. Gabriola Island, Canada: New Society Publishers.
- Ehrampoush, M. H., & Baghiani Moghadam, M. H. (2005). Survey of knowledge, attitude and practice of Yazd University of medical sciences students about solid waste Disposal and Recycling. *Iranian J Env Health Sci. Eng.*, 2 (2), 26-30.
- Ernesto, L.V. (2004). *Awareness, knowledge, and attitude about environmental education: responses from environmental specialists, high school instructors, students, and parents*. (Doctoral dissertation). Retrieved from <http://stars.library.ucf.edu/cgi/viewcontent.cgi?article=1177&context=etd>
- Fien, J. (2006). A Letter from the Future: UNESCO and the Decade of Education for Sustainable Development. *Australian Journal of Environmental Education*, 22(1), 63-70.
- Fien, J., & Trainer, T. (1993). Education for sustainability. In J. Fien (Ed.), *Environmental Education: A Pathway to Sustainability*. Geelong, Victoria: Deakin University.
- Fujisaki, Shigeaki and others (1997), Hattentojojo koku no kankyo ishiki (Environmental Awareness in Developing Countries: Case of China and Thailand), Tokyo, Institute of Developing Economies.
- Furman, A. (1998). "A Note on Environmental Concern in developing Country: Results from an Istanbul Survey," *Environment and Behavior*, 30, 520–534.
- Gadgil, M. (2007). *Social Change and Conservation*. In J. Pretty, A. Ball, T. Benton, J. Guivant, D. Lee, O. D. W., M. Pfeffer & H. Ward (Eds.), *The Sage Handbook of Environment and Society*, 485-500. London: Sage Publications Ltd.

- Gigliotti, L. (1992). Environmental attitudes: 20 years of change? *The Journal of Environmental Education*, 24, 15-26.
- Gordon, K. (1995). *New Science: A New World View*. In: John Fien (Ed.): Teaching for a Sustainable World. Brisbane: Griffith University. From: website <http://www.environment.gov.au/education/publications/tsw/modules/module10.html>
- Gornall, J., Wiltshire, A., & Betts, R. (2012). *Anthropogenic Drivers of Environmental Change*. In J. Matthews, P. Bartlein, K. Briffa, A. Dawson, A. Vernal, T. Denham, S. Fritz & F. Oldfield (Eds.), *The Sage Handbook of Environmental Change* (Vol. 1, pp. 517-536). London: Sage Publications Ltd.
- Gough, A. (1997). *Education and the environment: policy, trends and the problems of marginalisation*. Australian Education Review No. 39. Melbourne, Australia: The Australian Council for Educational Research Ltd.
- Goueli, S. (2003). *Environmental Education in an Egyptian University: The Role of Teacher Educators*. PhD, University of Alberta, Alberta, Canada.
- Gough, A. (2006). A Long, Winding and (Rocky) Road to Environmental Education for Sustainability in 2006. *Australian Journal of Environmental Education*, 22(1).
- Govind, H. (1989). Recent Developments in Environmental Protection in India: Pollution Control. *Ambio*, 18(8), 429-433.
- Gredler, M. E. (2001). *Learning and instruction: theory into practice*. 4th Edition. Columbus, OH: Merrill Prentice Hall.
- Gross, M. (2015). *Plastic waste is all at sea*. *Current Biology*, 23(4): 135-137.
- Guha, R. (2000). *Environmentalism: A Global History*. New Delhi: Oxford University Press.
- Gunde, R. V., & Parit A. S. (2015). Environmental Awareness of the College Students with respect to Sex and Faculty. *The International Journal of Indian Psychology*, 2(2), 56-62.
- Haigh, M. (2008). *The Sattvic Choice*. In Bussey M., Inayatullah S. & Milojevic` I. (Eds.), *Alternative Educational Futures*, 235-252. Rotterdam: Sense Publishers.

- Ham, S. H., & Sewing, D. R. (1987/88). Barriers to Environmental Education. *Journal of Environmental Education*, 19(2), 17-24.
- Hamidian, A., & Salajegheh, A. (2012). Investigation on Environmental Knowledge, Responsibility and Ethics of Students of Higher Education Institutes, Experiences from Iran.
- Hart, P. (2003). *Teachers' thinking in environmental education*. New York, USA: Peter Lang Publishing Inc.
- Hausbeck, K., Milbrath, L., & Enright, S. (1992). Environmental knowledge, awareness and concern among 11th grade students: New York. *The Journal of Environmental Education*, 24, 27-34.
- Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: a literature review, *Environmental Education Research*, 14:3, 215-237.
- Hernandez, O., & Monroe, M. (2000). *Thinking about behavior*. In B. Day & M. Monroe (Eds.), *Environmental education & communication for a sustainable world. Handbook for international practitioners*, 17-22. Washington, DC: Academy for Educational Development.
- Huber, Richard, Jack Rultenbeek and Ronaldo Seroa da Motta (1998), "Instrumentos de mercado para la politica ambiental en América Latina y Caribe: lecciones de once países", Discussion Paper, No. 381 S, Washington, D.C., World Bank.
- Human Development Report Office. (2011). *Human Development Index*, Retrieved October 30, 2012, from <http://hdr.undp.org/en/statistics/>
- Hungerford, H. R., & Volk, T. L. (1990). Changing Learner Behavior through Environmental Education. *Journal of Environmental Education*, 21(3), 8-21.
- Hunter Lovins, L., & Cohen, B. (2011). *Climate Capitalism: Capitalism in the Age of Climate Change*. New York: Hill and Wang.
- India Brand Equity Foundation (IBEF). (2013). Tamil Nadu - blend of Tradition and Technology. Aranca research analyze communicate. Retrieved from <http://www.ibef.org/download/tamil-nadu-august-2013.pdf>

- Infield, M. (1988). Attitudes of a rural community towards conservation and a local conservation area in Natal, South Africa. *Biological Conservation*, 45, 21-46.
- International Union for Conservation of Nature and Natural Resources (IUCN). (1980). *World Conservation Strategy: Living Resource Conservation for Sustainable Development*, Retrieved October 31, 2012, from <http://data.iucn.org/dbtw-wpd/edocs/WCS-004.pdf>
- IUCN. (1971). *Learning to Change the Future*, Retrieved November 25, 2012, from http://cmsdata.iucn.org/downloads/cec_history_30sept08_draft.pdf
- Joshi, M. (2005). *ESD in India: Current practices and Development plans*. Paper presented at the International Conference on Education for Sustainable Development. Kuching, Sarawak, Malaysia, Sarawak Development Institute, Kuching, Sarawak, Malaysia.
- Kamdar, M. (2007). *Planet India*. New York: Scribner.
- Kaur, A., & Bhati, M. S. (2012). Environmental Education in Teacher Education. *Indian Streams Research Journal*, 2(4), 1-4.
- Kemp, D. (2004). *Exploring Environmental Issues: An integrated approach*. London, U.K.: Routledge.
- Kennelly, J., Taylor, N., & Jenkins, K. (2008). Listening to Teachers: Teacher and Student Roles in the New South Wales Sustainable Schools Program. *Environmental Education Research*, 14(1), 53-64.
- Khirwadkar, A., & Pushpanadam, K. (2007). Education for Sustainable Development: Implications for Teacher Education. *International Forum of Teaching and Studies*, 3(3), 5-13.
- Khoshoo, T. N. (1987). *Environmental Education: the Indian Experience*. In A. V. Baez (Ed.), *The Environment and Science and Technology Education*, 8, 25-26. Oxford: ICSU Press.
- Khoshoo, T. N. (2010). Introduction. In U. D. Gupta (Ed.), *My life in my words*, 1-6. New Delhi: Penguin Books Ltd.

- Khoshoo, T. N., & Moolakkattu, J., S. (2009). *Mahatma Gandhi and the Environment: Analysing Gandhian Environmental Thought*. New Delhi, India: The Energy and Resources Institute (TERI).
- Krapivin, V. F., & Varotsos, C. A. (2007). *Globalization and Sustainable Development: Environmental Agendas*. Chichester, U.K.: Praxis Publishing Ltd.
- Kyburz- Graber, R., Rigendinger, L., Hirsch Hadorn., G & Werner Zentner, K. (1997a). A socio- ecological approach to interdisciplinary environmental education in senior high schools. *Environmental Education Research*, 3(1): 17–28.
- Kyburz- Graber, R., Rigendinger, L., Hirsch Hadorn, G & Werner Zentner, K. (1997b). Sozio- ökologische Umweltbildung (Hamburg, Krämer).
- Larijani, M., & Yeshodhara, K. (2008). Empirical study of Environmental Attitude among Higher Primary School Teachers of India and Iran. *Journal of Human Ecology*, 24(3), 195-200.
- La Trobe, H., & Acott, T. (2000). A modified NEP/DSP environmental attitude scale. *The Journal of Environmental Education*, 32, 12-20.
- Lee, C. K., & Williams, M. (2001). Researching Environmental Education in the School Curriculum: An Introduction for Students and Teacher Researchers. *International Research in Geographical and Environmental Education*, 10(3), 218-244.
- Lindstone, J.. & Stoltman, J, (2008). Editorial Research Paradigms and Reflections in Geographical and Environmental Education. *International Research in Geographical and Environmental Education*, 17(3), 195-98.
- Litledyke, M. (1997). Science Education for Environmental Education? Primary Teacher Perspectives and Practices. *British Educational Research Journal*, 23(5), 641-659.
- Luce, E. (2006). *In Spite of the Gods*. London, U.K.: Little, Brown.
- Madsen, P. (1996). *What can universities and professional schools do to save the environment?* In J. B. Callicott and F. J. da Rocha (Eds.), *Earth Summit Ethics: toward a reconstructive postmodern philosophy of environmental education*, 71-91. NY: Albany State University of New York Press.

- Mallet, M. (2017). *River of life, river of death: The Ganges and India's future*, Oxford University Press.
- Matthews, J., Bartlein, P., Briffa, K., Dawson, A., Vernal, A., Denham, T., Oldfield, F. (2012). *Background to the Science of Environmental Change*. In J. Matthews, P. Bartlein, K. Briffa, A. Dawson, A. Vernal, T. Denham, S. Fritz & F. Oldfield (Eds.), *The Sage Handbook of Environmental Change*, 1, 1-34. London: Sage Publications Ltd.
- Mazur, L., & Miles, L. (2009). *Conversations with Green Gurus*. West Sussex, U.K.: John Wiley & Sons Ltd.
- McKeown, R., Hopkins, C., Rizzi, R., & Chrystalbridge, M. (2002). *Education for Sustainable Development Toolkit*, Retrieved February 12, 2016, from <http://esdtoolkit.org>
- Melaku, G. (1994). An Investigation into the Integration of Environmental Education into Social Studies Course in Some Selected Teacher Training Institutes (TTIs) of Ethiopia. Unpublished Master's Thesis. Addis Ababa University.
- Micro Small Medium Enterprise (MSME). (2012). Brief Industrial Profile of Coimbatore District 2012-13. MSME – Development Institute, Chennai. Retrieved from http://dcmsme.gov.in/dips/IPS%20coimbatore%202012_t.pdf
- Mohanraj, R., Sathishkumar, M., Azeez, P. A., & Sivakumar, R. (2000). Pollution Status of Wetlands in Urban Coimbatore, Tamilnadu, India, *Bull. Environ. Contam. Toxicol*, 64, 638-643.
- Monroe, M., Day, B., & Grieser, M. (2000). *GreenCOM weaves four strands*. In B. Day & M. Monroe (Eds.), *Environmental education & communication for a sustainable world. Handbook for international practitioners*, 3-6. Washington, DC: Academy for Educational Development.
- Morrone, M., Mancl, K., & Carr, K. (2001). Development of a metric to test group differences in ecological knowledge as one component of environmental literacy. *The Journal of Environmental Education*, 32, 33-42.

- Nagra, V. (2010). Environmental education awareness among school teachers. *The Environmentalist*, 30(2), 153–162.
- National Council for Teacher Education. (2005). Environmental Education Curriculum Framework for Teachers and Teacher Educators. New Delhi, India: NCTE.
- National council of Educational Research and Training. (2005). *National Curriculum Framework*, Retrieved November 24, 2017, from <http://www.ncert.nic.in/html/pdf/schoolcurriculum/framework05/Currilular%20Areas.pdf>
- National Education Policy. (1986). *Statement made by Minister of Human Resource Development*, Retrieved November 25, 2015, from http://www.ncert.nic.in/oth_anoun/npe86.pdf
- National Curriculum framework, (2005). Retrieved from <http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf>
- National Institute of Urban Affairs. (NIUA). (2006). Appraisal of City Development Plan Coimbatore. India Habitat Centre, New Delhi. Retrieved from http://jnnurm.nic.in/wp-content/uploads/2010/12/Coimbatore_NIUA.pdf
- National Survey Sample Organization. (2012). *66th round of National Sample Survey*, Retrieved October 29, 2012, from http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=31
- Ndaruga, A. M., & Irwin, P. R. (2003). Cultural Perceptions of Wetlands by Primary School Teachers in Kenya. *International Research in Geographical and Environmental Education*, 12(3), 219-230.
- NEETF (1998). *The national report card on environmental knowledge, attitudes and behaviors: the seventh annual survey of adult Americans*. National Environmental Education and Training Foundation. (ERIC Document Reproduction Service No. ED433214)
- Newmark, W. D., Leonard, N. L., Sariko, H. I., & Gamassa, D. G. M. (1993). Conservation attitudes of local people living adjacent to five protected areas in Tanzania. *Biological Conservation*, 63, 177-183.

- Nielsen, R. (2005). *The Little Green Handbook: a guide to critical global trends*. Melbourne, Australia: Scribe Publications Pty Ltd.
- Odihi, J. (2000). Environmental Education: Beckoning Roads for Brunei Darussalam. *International Research in Geographical and Environmental Education*, 9 (3), 197-209.
- Orr, D. W. (1992). *Ecological Literacy: Education and the Transition to a Postmodern World*. Albany: State University of New York.
- Orr, D. W. (2002). Four Challenges of Sustainability. *Conservation Biology*, 16(6), 1457-1460.
- Orr, D. W. (2007). *Ecological Design and Education*. In J. Pretty, A. Ball, T. Benton, J. Guivant, D. Lee, D. W. Orr, M. Pfeffer & H. Ward (Eds.), *The Sage Handbook of Environment and Society*, 209-224. London: Sage Publications Ltd.
- Palanivel, M., Elayaraja, T., Ganeshmoorthy, D., Jagadeeswaran, N., & Kalaiselvi, K. (2003). *Impact of foundry units on Coimbatore environment*. Proceedings of the Third International Conference on Environment and Health, Chennai, India, December 15-17. Chennai: Department of Geography, University of Madras and Faculty of Environmental Studies, York University, 322 – 327.
- Palmer, J. (1998). *Environmental Education in the 21st Century: Theory, Practice, Progress and Promise*. London: Routledge.
- Palmer, J. (2002). *Environmental Education in the 21st Century: Theory, Practice, Progress and Promise*. Routledge.
- Papadimitriou, F. (2004). Geographical and Environmental Education in South-Eastern Europe: Geopolitical Developments and Educational Prospects. *International Research in Geographical and Environmental Education*, 3(1), 56-60.
- Parthasarthy, M. A. (1987). *Range, Opportunities and Applicability of Non-formal Environmental Education*. In A. V. Baez, G. W. Knamiller & J. Smyth (Eds.), *The Environment and Science and Technology Education*, 8, 349-354. Oxford, U.K.: Permagon Press for ICSU Press.

- Peterson, D. (1989). Parent Involvement in the Educational Process. ERIC Digest Series Number EA 43. ERIC Identifier: ED312776. Retrieved from <https://www.ericdigests.org/pre-9213/parent.htm>
- Pragatheesh, A., & Jain, P. (2013). *Environmental Degradation of the Coimbatore Wetlands in the Noyyal River Basin*. EIA Resource and Response Centre (ERC), Nilgiri, Tamil Nadu, India.
- Prasanyaa, T. (2011). Awareness towards global warming among higher secondary students of Coimbatore district. *The Indian journal of Environmental Education*, 11, 17-21.
- Pretty, J., Ball, A., Benton, T., Guivant, J., Lee, D., Orr, D. W., Ward, H. (2007). *Introduction to Environment and Society*. In J. Pretty, A. Ball, T. Benton, J. Guivant, D. Lee, D.
- Prislin, R., & Ouellette, J. (1996). When it is Embedded, it is Potent: Effects of General Attitude Embeddedness on Formation of Specific Attitudes and Behavioral Intentions. *Personality and Social Psychology Bulletin*, 22(8).
- W. Orr, M. Pfeffer & H. Ward (Eds.), *The Sage of Handbook of Environment and Society*. London: Sage Publications Ltd.
- Priyadarshini, L. E., & Annakodi, R. (2013). Environmental Awareness of Secondary Students in Coimbatore. *Indian Journal of Applied Research*, 3(12), 172-173.
- Rajagopalan, R. (2011). *Environmental Studies: From crisis to cure* (Second ed.). New Delhi: Oxford University Press.
- Rajendran, S. (2014). Drought mitigation in Tamil Nadu, *Economic and political weekly*, 49(5). Retrieved from <http://www.epw.in/journal/2014/25/reports-states-web-exclusives/drought-mitigation-tamil-nadu.html>
- Rangarajan, M. (Ed.). (2009). *Environmental Issues in India: A Reader*. New Delhi, India: Dorling Kindersley (India) Pvt. Ltd.

- Ravindranath, M. J. (2000). *Living Traditions*. In D. Yencken, J. Fien & H. Sykes (Eds.), *Environment, Education and Society in the Asia-Pacific: local traditions and global discourses*, 99-112. London, U.K.: Routledge.
- Ravindranath, M. J. (2002a). *India*. In J. Fien, D. Yencken & H. Sykes (Eds.), *Young people and the environment: an Asia-Pacific perspective*, 65-77. Netherlands: Kluwer Academic Publishers.
- Ravindranath, M. J. (2007). Environmental education in teacher education in India: experiences and challenges in the United Nation's Decade of Education for Sustainable Development. *Journal of Education for Teaching: International research and pedagogy*, 33(2), 191 - 206.
- Reginald, J., Mahendiran, C., Suresh Kumar, S., & Pramod, P. (2007). Birds of Singanallur Lake, Coimbatore, Tamil Nadu. *Zoos' Print Journal*, 22(12), 2944–2948.
- Rii, H.U. (2000). The Place of Geography and Environmental Education in the Korean School Curriculum. *International Research in Geographical and Environmental Education*, 9(1), 67-70).
- Samuel, H.R. (1993). Impediments to Implementing Environmental Education. *Journal of Environmental Education*, 25(1), 26-29.
- Sarabhai, K. (1995). *Strategy for Environmental Education: An Approach for India*. Paper presented at the North American Association for Environmental Education, Washington D.C., U.S.A.
- Sarabhai, K. (2000). Strategies in Environmental Education. Retrieved from <http://www.ceeindia.org/newintra/papers/Strategies%20in%20Environmental%20Education.htm>
- Sarabhai, K., Jain, S., & Raghunathan, M. (2002). India. Retrieved from https://pub.iges.or.jp/contents/eLearning/ee/pdf/case_studies_india.pdf
- Sarabhai, K. (2007). Thirty years after Tbilisi. [Editorial]. *Journal of Education for Sustainable Development*, 1(2), 169-170.

- Sarabhai, K. (2008). The Ahmedabad Declaration 2007: A call to Action. [Conference declaration]. *Journal of Education for Sustainable Development*, 2(1), 87-88.
- Sarabhai, K., Raghunathan, M., & Kandula, K. (2000). *Status Reports: India*, 127-143. Ahmedabad, India: Center for Environmental Education.
- Sarathi, J. N., Karthik, R., Logesh, S., SrinivasRao, K., & Vijayanand, K. (2011). *Environmental issues and its impacts associated with the textile processing units in Tiruppur, Tamilnadu*. 2nd International Conference on Environmental Science and Development, IPCBEE Vol. 4, IACSIT Press, Singapore. Retrieved from <http://ipcbec.com/vol4/26-ICESD2011D068.pdf>
- Sarker, A.H.M.R., & Røskoft, E. (2010). Human attitudes towards conservation of Asian elephants (*Elephas maximus*) in Bangladesh. *International Journal of Biodiversity and Conservation*, 2(10), 316-327.
- Schleicher, K. (1989). Beyond Environmental Education: The Need for Ecological Awareness. *International Review of Education*, 35(3), 257-281.
- Selby, D. (2006). The Firm and Shaky Ground of Education for Sustainable Development. *Environment Education Research*, 30(2), 351-365.
- Severino Bento-Silva, José & Andrade, Wbaneide & Ramos, Marcelo & Souto, Medeiros & Albuquerque, Ulysses & Ferraz, Elba & Souto, Wedson & Araújo, Elcida. (2015). Students' Perception of Urban and Rural Environmental Protection Areas in Pernambuco, Brazil. *Tropical Conservation Science*, 8, 813-827.
- Sharma, V. M. (2010). *Environmental Pollutions: Ancient Solutions in the Light of Sanskrit Literature*. In K. R. Gupta (Ed.), *Environmental Education in India*, 169. New Delhi, India: Atlantic Publishers and Distributors (P) Ltd.
- Shiva, V. (2005). *India Divided: Diversity and democracy under attack*. New York: Seven Stories Press.
- Sivamoorthy, M., Nalini, R., & Kumar, C. (2013). Environmental Awareness and Practices among College Students. *International Journal of Humanities and Social Science Invention*, 2(8), 11-15.

- Smyth, J. (2008). *Environment and education: a view of a changing scene*. In A. Reid & W. Scott (Eds.), *Researching Education and the Environment: Retrospect and Prospect*. Oxon: Routledge.
- Sokoli, N., & Doka, D. (2004). Environmental Education in Albanian Elementary and High Schools. *International Research in Geographical and Environmental Education*, 13(1), 67- 72.
- Srivastava, L. (2009). *Securing India's Energy Future: What Does the World Have to Worry About?*, In N. Stacey, G. Boggs, B. Campbell & W. Steffen (Eds.), *Prepare for Impact: When People And Environment Collide In The Tropics*, 33-37. Darwin, Australia: Charles Darwin University Press.
- Supreme Court of India. (2003). *M C Mehta-Petitioner versus Union of India and Ors – respondents*, Retrieved November 20, 2016, from <https://indiankanoon.org/doc/700245/>
- Tarabula-Fiertak, M., Gajus- Lankamer, E., & Wojcik, A. M. (2004). Environmental Teaching in Higher Education. *International Research in Geographical and Environmental Education*, 13(3), 284-290.
- Taylor, N., Nathan, S., & Coll, R. K. (2003). Education for Sustainability in Regional New South Wales, Australia : An Exploratory Study of Some Teachers' Perceptions. *International Research in Geographical and Environmental Education*, 12 (4), 291-311.
- The Energy and Resources Institute (TERI), (214). TERI environmental survey 2014, The Energy and Resources Institute, Darbari Seth Block, India Habitat Centre, Lodhi Road, New Delhi – 110003, India. www.teriin.org
- Tracana, B., Ferreira, C., Carvalho, S. & Ferreira. E. (2008). Analyzing the Theme of Pollution in Portuguese Geography and Biology Text Books. *International Research in Geographical and Environmental Education*, 17(3), 199-210.
- Tilbury, D. (1994). The International Development of Environmental Education: A Basis for a Teacher Education Model? *International Journal of Environmental Education and Information*, 13(1).

- University Grants Commission. (2004). *Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education*, Retrieved from <https://www.ugc.ac.in/oldpdf/modelcurriculum/prepage.pdf>
- University Grants Commission. (2014). Annual report 2014-2015, Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/document-reports/Part1.pdf
- U. S. Bureau of Census. (2009). *World Population: 1950-2050*. Retrieved May 6, 2015, from <http://www.census.gov/ipc/www/idb/worldpopgraph.php>
- UNDESD. (2007). UN Decade of Education for Sustainable Development: The First Two Years. *Journal of Education for Sustainable Development*, 1(1), 117-126. doi: 10.1177/097340820700100120
- UNEP. (1972). *Declaration of the United Nations Conference on the Human Environment*, Retrieved November 25, 2009, from <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=97&ArticleID=1503>
- UNEP. (2012a). *GEO 5- Global Environmental Outlook: Environment for the future we want*: UNEP.
- UNEP. (2012b). *Global Environment Outlook 5: Summary for Asia and the Pacific Region on the Eve of Rio+20*. Retrieved November 12, 2012, from http://www.unep.org/geo/pdfs/geo5/RS_AsiaPacific_en.pdf
- UNESCO, & UNEP. (1977). *Tbilisi Declaration Retrieved March 15, 2017*, Retrieved from <http://www.gdrc.org/uem/ee/tbilisi.html>
- UNESCO-UNEP. (1992). UNCED: The Earth Summit. *Connect*, 17(2), 1-8.
- UNESCO. (1975). *International Workshop on Environmental Education: The Belgrade Charter*, Retrieved June 15, 2014, from <http://unesdoc.unesco.org/images/0001/000177/017772eb.pdf>
- UNESCO (1978). *Intergovernmental Conference on Environmental Education, Tbilisi, USSR, 14-20 October 1977, Final Report*. Paris.
- UNESCO. (1992). *Agenda 21*, Retrieved November 15, 2017, from http://agenda21conspiracy.com/Agenda_21_hidden.html

- UNESCO. (2002). *Education for Sustainability, From Rio to Johannesburg: Lessons Learnt from a Decade of Commitment*. Paris: UNESCO.
- UNESCO. (2005c). *United Nations Decade of Education for Sustainable Development*, Retrieved November 22, 2017, from <http://unesdoc.unesco.org/images/0014/001416/141629e.pdf>
- UNESCO. (2007). *The Ahmedabad Declaration*, Retrieved November 1, 2012, from http://portal.unesco.org/geograpJhy/en/ev.php-URL_ID=9451&URL_DO=DO_TOPIC&URL_SECTION=201.html
- Vandana, S. (2005). *India Divided: Diversity & Democracy Under Attack*. Retrieved from https://archive.org/details/India.Divided_Diversity_and_Democracy_Under.Attack
- Varma, P. (2005). *Being Indian*. New Delhi: Penguin Books.
- Vashist, K. N. (2001). A study on awareness attitude and behavior related to environment with reference to education and other correlates in selected industrial areas of Himachal Pradesh. PH.D. thesis, submitted to Himachal Pradesh University.
- Wali, M. (1987). *A Holistic View of Human Ethics*. In A. V. Baez, G. W. Knamiller & J. Smyth (Eds.), *The Environment and Science and Technology Education*, 8, 27-28. Oxford: ICSU Press.
- Weiner, M. (1991). *The child and the state in India: child labor and education policy in comparative perspective*. Princeton: Princeton University Press.
- Widegren, O. (1988). The new environmental paradigm and personal norms. *Environment and behavior*, 30, 75-100.
- Wojcik, A. M. (2004). Informal Environmental Education in Poland. *International Research in Geographical and Environmental Education*, 13(3), 291-298.
- World Bank. (2003). *WDR 2003 : Sustainable Development in a Dynamic World: Transforming Institutions, Growth, and Quality of Life*, Retrieved November 11, 2012, from http://wdronline.worldbank.org/worldbank/a/c.html/world_development_report_2003/abstract/WB.0-8213-5150-8.abstract

- World Bank. (2010). *Development and Climate Change*. Retrieved November 11, 2013, from http://wdronline.worldbank.org/worldbank/a/c.html/world_development_report_2010/abstract/WB.978-0-8213-7987-5.abstract
- World Bank. (2012). *India: World development indicator*, Retrieved June 4, 2012, from <http://data.worldbank.org/country/india>
- World Bank. (2013). *World Development Indicators*. Retrieved from <http://databank.worldbank.org/data/download/wdi-2013-ebook.pdf>
- World Commission on Environment and Development. (1987). *Our Common Future (The Brundlant Report)*. Oxford: Oxford University Press.
- World Commission on Environment and Development. (2004). *Towards Sustainable Development*. In K. Conca & G. D. Dabelko (Eds.), *Green Planet Blues: Environmental Politics From Stockholm To Johannesburg* (3rd ed.). Colorado and Oxford Westview Press.
- World Wide Fund (WWF). (2008). *Living Planet*, Report 2008 Retrieved October 30, 2016, from http://assets.panda.org/downloads/living_planet_report_2008.pdf
- Yale University. (2012). *Environmental Performance Index*, Retrieved October 14, 2015, from <http://epi.yale.edu/>
- Yencken, D., Fien, J., & Sykes, H. (Eds.). (2002). *Environment, Education and Society in the Asia-Pacific: Local traditions and global discourses*. New York, U.S.A.: Routledge.
- Yenice, N., Saracaloglu, A. S., & Karacaoglu, O. C. (2008). The Views of the Classroom Teacher Candidates Related to Environmental Science Course and the Environmental Sensibility. *Asia- Pacific Forum on Science Learning and Teaching*, 9(1).
- Young, Z. (2002). *A New Green Order? The World Bank and the Politics of the Global Environment Facility*. London: Pluto Press.
- Yuvaraj, D., Alaguraja, P., Sekar, M., Muthuveeran, P., & Manivel, M. (2010). Analysis of drinking water problem in Coimbatore City Corporation, Tamilnadu, India using Remote Sensing and GIS tools. *International Journal of Environmental Sciences*, 1(1), 72-76.

Appendices

Student Questionnaire

Dear Student,

This questionnaire is prepared to study the student's awareness, knowledge, attitudes, and behaviours of Environmental education for the purpose of my doctorate thesis on Environmental Education (EE) in Higher Education, with special focus to different college settings in Coimbatore region. I would appreciate it if you make it convenient for me by completing the questionnaire carefully.

Please take about 20-30 minutes of your valuable time to answer this questionnaire. I assure that your responses will be kept completely confidential; however, by filling out this questionnaire you are consenting to the use of the results. Please be aware that you are under no obligation to answer any question(s).

Thank you in advance!

I. General Information: Please put a “√” mark that applies to you.

Gender	: Male/Female
Age	: -----
Parents Literacy	: Literate/Illiterate
Residence Location	: Rural/Urban
Native Place	: District
Year of Study	: 1 st , 2 nd , 3 rd , 4 th
Type of Course	: Agriculture/Arts & Science/Engineering/ Polytechnic/Teacher Education
Type of College/Institution	: Government/Aided/Self-finance
Type of Programme	: UG/PG/Research/Diploma

- Turn Page -

II. A) Please indicate how often you have had following experiences by putting a “√” mark on the option that best represents you.

S.No	STATEMENTS	Never	Seldom	Often	Very Often
1.	Participating in outdoor trekking experiences such as nature trips, bird watching, etc.				
2.	Having your parents or grandparents encourage you to care for the environment				
3.	Having a teacher encourage you to care for the environment				
4.	Watching television programs with an environmental message				
5.	Reading books or magazines with an environmental message				

B) Please indicate how you feel local environmental issues (Coimbatore) have become since you have lived here.

S.No	STATEMENTS	Much Worse	Worse	Better	Much Better
6.	The water quality in your local streams, rivers, and lakes.				
7.	The level of pollution or waste produced by nearby business centres, public places, houses and industries.				
8.	The misuse of chemicals such as fertilizers and pesticides.				
9.	The state/level of air quality in your area.				
10.	The population of wild/domestic animals, birds and trees.				
11.	The present status of human-animal conflict.				
12.	The steps taken by the government/non-government organizations on environmental protection.				
13.	The rate of population growth in your local community.				
14.	The overall environmental state of Coimbatore district.				

C) Please indicate how concerned you are about the following environmental issues in Coimbatore.

S.No	STATEMENTS	Not at all concerned	Somewhat concerned	Concerned	Very concerned
15.	Water pollution from industries and urban development.				
16.	The conditions of agricultural land and nature preserves.				
17.	Air pollution.				
18.	Unlimited development of city area.				
19.	Solid waste management.				
20.	Endangered species.				

III. Please indicate how much you agree or disagree with following statements.

S.No	STATEMENTS	Strongly Disagree	Disagree	Agree	Strongly Agree
21.	We are approaching the limit of the number of people the Earth can support.				
22.	Humans have the right to modify the natural environment to suit their needs.				
23.	When humans interfere with nature it often produces disastrous consequences.				
24.	Science and technology can overcome any environmental problem.				
25.	Humans are severely abusing the environment.				
26.	The Earth has plenty of natural resources if we just learn how to develop them.				
27.	Plants and animals have as much right as humans to exist.				
28.	The balance of nature is strong enough to cope with the impacts of modern industrial nations.				
29.	Despite our special abilities humans are still subject to the laws of nature.				
30.	The so-called "ecological crisis" facing humankind has been greatly exaggerated.				
31.	The Earth has very limited room and resources.				
32.	Humans were meant to rule over the rest of nature.				
33.	The balance of nature is very delicate and easily upset.				
34.	Maintaining economic growth is more important than protecting the natural environment.				
35.	If things continue on their present course, we will soon experience a major ecological catastrophe.				
36.	I am very well informed about environmental issues in Coimbatore.				

S.No	STATEMENTS	Strongly Disagree	Disagree	Agree	Strongly Agree
37.	I pay very little attention as environmental issues are reported by the news media, including radio, TV, newspapers, and magazines.				
38.	Tribal people know a lot about environmental issues.				
39.	Environmental education is as important as any other curriculum in college.				
40.	There is a lot I, as an individual, can do to protect the environment in my community.				
41.	I perceive myself as very concerned about environmental issues in my community.				
42.	I am willing to pay extra taxes to protect the environment in my community.				
43.	I would be willing to appreciate the government, if they reassess the existing policies to protect the environment in my community.				
44.	One person can influence how environmental problems and issues are resolved.				
45.	Personally, working as an individual and on your own, can influence the solution of environmental issues.				

IV. Please indicate how much you agree or disagree with following statements.

S.No	STATEMENTS	Strongly Disagree	Disagree	Agree	Strongly Agree
46.	The use of powerful people is the most effective way to influence how environmental problems and issues are resolved.				
47.	Personally, working with others, can influence the solution of environmental issues.				
48.	Chance determines how environmental problems and issues are solved.				
49.	You can influence the resolution of environmental issues in your community using action strategies.				

V. Please put a “√” mark on “Yes or No” to indicate which actions you have taken on behalf of environmental issues. If you choose Yes, also indicate how effective you feel this action was.

S.No	ACTIONS	Yes	No	Not at all effective	Slightly effective	Fairly effective	Very effective
50.	Wrote a letter to the newspaper						
51.	Attended a meeting						
52.	Made a formal submission						
53.	Read or sought information						
54.	Wrote a letter to an organization or public official						
55.	Telephone a public official						
56.	Took part in a protest						
57.	Complained to the company/person causing the damage						
58.	Joined an action group						
59.	Signed a petition						
60.	Contributed money to an environmental cause						
61.	Other (specify) _____						
62.	None of the above						

VI. Do you Agree or Disagree with each of the following statements?

S.No	STATEMENTS	Disagree	Agree
63.	Pollution in Coimbatore rivers and streams comes mainly from Industries.		
64.	Most storm water drains and road sewage gutters drain directly into streams, rivers and ponds.		
65.	Rapid increase in vehicular movement is one of the serious threats to Coimbatore environment.		
66.	The most effective way to save an endangered plant & animal is to establish a large enough nature reserve for it to live and reproduce.		
67.	As the population in an area increases, the potential for pollution decreases.		
68.	Plastic carry bags are serious threat to effective solid waste management.		
69.	Most water for human consumption in Coimbatore comes from river water dams and lakes.		
70.	Each summer the government is sprayed with the same bug killer to control mosquitoes. After many years of spraying the same product the mosquitoes will likely become resistant to the spray.		

- Turn Page -

VII. How do you rate your competence in learning the following aspects of environmental education? Put a “√” mark in the appropriate box.

S.No	STATEMENTS	Excellent	Very Good	Good	Fair	Poor
71.	Acquiring awareness and sensitivity to the environment					
72.	Acquiring knowledge and understanding about the environment					
73.	Acquiring attitudes and values towards the environment					
74.	Learning skills in identifying and solving environmental problems					
75.	Acquiring a sense of responsibility through participation and action					

VIII. How important are the following in enhancing your environmental education activities? Put a “√” mark in the appropriate box.

S.No	ITEMS	Greatly Important	Considerably Important	Somewhat Important	Little Important	Not Important
76.	Government policy					
77.	The curriculum					
78.	The textbooks and teaching aids					
79.	The college management					
80.	Others (please specify)					

IX. To what extent do the following obstacles hinder your environmental education activities? Put a “√” mark in the appropriate box.

S.No	OBSTACLES	Greatly	Considerably	Somewhat	Little	Not at all
81.	Time constraints					
82.	Lack of teaching resource materials					
83.	Lack of training					
84.	Heavy workload					
85.	Lack of college support					
86.	Lack of teachers' commitment					
87.	The less emphasis given to environmental education in the curriculum					
88.	Lack of funding					
89.	Others (please specify)					

X. Which would you think will be the **single most important issues for Tamil Nadu government in the next few years? Put a “√” mark in the appropriate box.**

90) Common Issues

S. No	IMPORTANT ISSUES	Response
1.	Farming and agriculture	
2.	Over population	
3.	Education	
4.	Health	
5.	Fisheries	
6.	Crime	
7.	Unemployment	
8.	Infrastructures (Roads, Railways, Airports, etc)	
9.	The environment	
10.	Alcohol and other drugs	
11.	Bilateral and multilateral relations	
12.	Others (please specify)	

91) Environmental issues.

S. No	ENVIRONMENTAL ISSUES	Response
1.	Natural Resources and Environmental Conservation	
2.	Water Pollution	
3.	Ground water Pollution	
4.	Marine Pollution	
5.	Waste water treatment	
6.	Air Pollution	
7.	Vehicular Pollution	
8.	Global Warming	
9.	Noise Pollution	
10.	Sustainable Development	
11.	Implementation of Environmental Education	
12.	Natural Disaster/Chemical Accidents	
13.	Deforestation/Forest Fire	
14.	Energy Production	
15.	Hazardous & Toxic Waste Management	
16.	Bio Medical Waste Management	
17.	Municipal Solid Waste Management	
18.	Pesticides	
19.	Mining	
20.	Industrial Pollution Control	
21.	Enforcement of Environmental Laws	
22.	Creating Environmental Awareness	
23.	Human Resources Management (Population)	
24.	Others (please specify)	

THANK YOU

மாணவர்களின் கருத்தறிய விடப்படும் கேள்வித்தாள் (Students Questionnaire)

அனைவருக்கும் வணக்கம்.

கீழ்க்காணும் வினாப்பட்டியல் கோவை மாவட்டத்தில் உள்ள கல்லூரி மாணவர்களின் சுற்றுச்சூழல் கல்வி (Environmental Education) மற்றும் அவர்களின் விழிப்புணர்ச்சி (Awareness), மனப்பாங்கு (Attitude), செயல்பாடு (Behaviour) மற்றும் அறிவை (Knowledge) சோதிப்பதாக அமைந்துள்ளது. இந்த அனைத்து தகவல்களும் எனது முனைவர் பட்டத்திற்காக (Ph.D) சேகரிக்கப்படுகிறது. இதற்கான மிகச் சிறந்த பதில்களை உங்களின் சிந்தனைக்கு ஏற்றாற்போல் கவனமாகவும், வெளிப்படையாகவும் அளித்தால் அவை எம் ஆய்விற்கு மிகவும் பயனுள்ளதாக அமையும் என்பதில் ஐயமில்லை.

இந்த வினாநிரல்களைப் படித்து நிரப்ப சராசரியாக 20-30 நிமிடங்களே போதுமானதாகும். உங்களின் பதில்கள் மிகவும் ரகசியமாக வைக்கப்படும் என்று உறுதியளிக்கிறேன். நீங்கள் அளிக்கும் பதில்களில் சரி அல்லது தவறு என்று எதுவுமில்லை. எனவே தாங்கள் தயங்காமல் தங்களுக்குச் சரி எனப்பட்ட பதில்களை அளிக்கவும்.

நன்றி!

I உங்களைப் பற்றிய சில பொதுத்தகவல்கள் : உங்களுக்கு ஏற்ற பதிலில் '✓' குறியிடவும்
(அ) கோடிட்ட இடங்களை நிரப்பவும்.

1. பாலினம் : ஆண் / பெண்
2. வயது : _____
3. பெற்றோர் கல்வித் தகுதி : தாய் (படித்தவர் / படிக்காதவர்)
தந்தை (படித்தவர் / படிக்காதவர்)
4. வசிப்பிடம் : கிராமம் / நகரம்
5. சொந்த ஊர் / மாவட்டம் : _____
6. பட்டத்தின் பெயர் (Degree) : _____
7. எந்த ஆண்டு : முதலாம் / இரண்டாம் / மூன்றாம் / நான்காம்
8. கல்லூரி / நிறுவனத்தின் இணைப்பு : _____ பல்கலைக்கழகம்
9. கல்லூரி / நிறுவனத்தின் வகை : அரசு / அரசு உதவி பெறும் / தனியார்

II (A). கீழ்க்காணும் நிகழ்வுகளில் உங்கள் அனுபவத்தைக் குறித்து அதற்கான இடத்தில் '✓' குறியிட்டு காண்பிக்கவும்.

வ. எண்.	நிகழ்வுகள்	என்றுமே இல்லை	அபூர்வமாய்	அடிக்கடி உண்டு	எப்பொழுதும் உண்டு
1.	இயற்கை சார்ந்த வெளிப்புறச் சுற்றுலாக்கள் மற்றும் பறவைகளை காணும் நீண்ட நடை, பயிற்சிகளை மேற்கொண்ட அனுபவம்				
2.	உங்கள் தாய் தந்தையரோ பாட்டன் பாட்டிமாரோ சுற்றுச்சூழலை பேணிக்காத்தல் பற்றி அறிவுறுத்திய அனுபவம்				
3.	உங்கள் ஆசிரியப் பெருமக்கள் சுற்றுச்சூழலைப் பேணிக்காத்தல் பற்றிக் கூறிய, ஊக்கப்படுத்திய அனுபவம்				
4.	தொலைக்காட்சியில் சுற்றுச்சூழல் சார்ந்த நிகழ்ச்சிகளைப் பார்த்த அனுபவம்				
5.	சுற்றுச்சூழல் சார்ந்த புத்தகங்களையோ (அ) நாள் / வார / மாத இதழ்களையோ படித்த அனுபவம்				

II (B). நீங்கள் வசிக்கும் ஊரில் (கோவை) சுற்றுச்சூழல் பிரச்சனைகள் எவ்வாறு உள்ளது என்பதை '✓' குறியிட்டு காண்பிக்கவும்.

வ. எண்.	நிகழ்வுகள்	மிக மோசம்	மோசம்	நன்று	மிக நன்று
6.	உள்ளூர் ஓடைகள், ஆறுகள், குளங்கள், ஏரிகள் போன்ற நீர்நிலைகளிலுள்ள நீரின் தரம்.				
7.	தொழிற்சாலைகள், வீடுகள், அலுவலகங்கள் மற்றும் விவசாய நிலங்களில் இருந்து வெளியேற்றப்படும் கழிவுகளால் ஏற்படும் சுகாதாரச் சீர்கேடுகள்				
8.	உரங்கள் மற்றும் பூச்சிக் கொல்லிகளின் அதீதப் பயன்பாடு				
9.	ஊரில் காற்றின் தரம்				
10.	விலங்குகள், பறவைகள் மற்றும் மரங்களின் எண்ணிக்கை				
11.	மனிதனுக்கும் விலங்குகளுக்கும் இடையேயான பூசல்				
12.	சுற்றுச்சூழல் பாதுகாப்பிற்காக அரசு மற்றும் அரசு அல்லாத நிறுவனங்கள் எடுத்த நடவடிக்கைகள்				
13.	மக்கள் தொகைப் பெருக்கம்				
14.	ஓட்டு மொத்தமாக கோவை மாவட்டத்தின் இன்றைய சுற்றுச் சூழல் நிலை				

II (C). பின்வரும் சுற்றுச்சூழல் சார்ந்த கோவை மாவட்டத்திலுள்ள பிரச்சனைகளில் நீங்கள் எத்தகைய ஆர்வம் உள்ளவர் என்பதை '✓' குறியிட்டு காட்டவும்.

வ. எண்.	நிகழ்வுகள்	சுத்தமாக ஆர்வமில்லை	சில நேரங்களில் மட்டும்	ஆர்வமுண்டு	மிகுந்த ஆர்வமுண்டு
15.	தொழிற்சாலைகள், விவசாயம் சார்ந்த மற்றும் நகர்ப்புற மேம்பாட்டினால் நீர்நிலைகளின் சீர்கேடுகள் பற்றி				
16.	நன்னீர் நிலைகள் மற்றும் பாதுகாக்கப்பட்ட இயற்கை வளங்களின் நிலைப் பற்றி				
17.	காற்று மாசுபாடு பற்றி				
18.	மிதமிஞ்சிய நகர்ப்புற வளர்ச்சி பற்றி				
19.	திடக்கழிவு மேலாண்மைப் பற்றி				
20.	அருகிவரும் உயிரினங்கள் பற்றி				

III பின்வரும் வாக்கியங்களை நீங்கள் எந்த அளவிற்கு ஏற்கிறீர் (அ) மறுக்கிறீர்கள் என்பதை '✓' குறியிட்டு காட்டவும்.

வ. எண்.	நிகழ்வுகள்	ஆழமாக மறுக்கிறேன்	மறுக்கிறேன்	ஏற்கிறேன்	ஆழமாக ஏற்கிறேன்
21.	பூமி அதிகபட்சமாக தாங்கக்கூடிய அளவிற்கு மக்கள் தொகைப் பெருக்கத்தை நாம் நெருங்கிக் கொண்டிருக்கிறோம்.				
22.	தங்களது தேவைக்கேற்ப இயற்கைச் சூழலை மாற்றி அமைக்கும் உரிமை மனிதனுக்கு உண்டு.				
23.	இயற்கை நிகழ்வுகளில் மனிதன் தலையிடும் போதெல்லாம் அது கரும் எதிர் விளைவுகளைக் கொணரும்.				
24.	அறிவியல் தொழில்நுட்ப வளர்ச்சி எத்தகைய சுற்றுச் சூழல் பிரச்சனைகளையும் சரிசெய்து விடும்.				
25.	மனிதர்கள் தேவையில்லாமல் சுற்றுச்சூழலைக் கெடுக்கிறார்கள்				
26.	சரியான மேம்படுத்தும் வழிமுறைகளை நாம் அறிந்திருந்தால் இயற்கை ஒரு வரப்பிரசாதமாகும்.				
27.	செடி, கொடி, விலங்குகள் அனைத்துக்கும் மனிதனைப் போலவே இங்கு வாழ உரிமை உண்டு.				
28.	தொழிற்சாலைகள் சார்ந்த நாடுகளின் முன்னேற்றத்தினால் ஏற்படும் பாதிப்புகளுக்கு ஈடு கொடுக்கும் அளவிற்கு இயற்கை சமநிலை பலமாகத்தான் உள்ளது.				
29.	மனித குலத்திற்கு பல்வேறு சிறப்பு அம்சங்கள் இருந்தாலும் அனைவரும் இயற்கை நியதிகளுக்கு கட்டுப்பட்டே ஆக வேண்டும்.				

30.	இயற்கைச் சீரழிவுகள் என்பதே மிகவும் மிகைப்படுத்தப்பட்ட விஷயங்களாகும்.				
31.	பூமியின் அனைத்து வளங்களும் ஒரு வரையறைக்கு உட்பட்டவையே				
32.	மனிதன் என்பவன் இயற்கையை ஆள்வதற்காகவே படைக்கப்பட்டான்				
33.	இயற்கைச் சமநிலை என்பது மிகவும் இலகுவானது. அது சுலபமாக பாதிப்பிற்கு உள்ளாகிவிடும்.				
34.	இயற்கைச் சூழலை பாதுகாப்பதைவிட, பொருளாதார முன்னேற்றமே மிக முக்கியமானதாகும்.				
35.	இன்றைய சூழ்நிலையே நீடித்துக் கொண்டிருப்பினால் வரும் காலங்களில் மனிதர்கள் மிகக் கடுமையான இயற்கைப் பேரழிவை எதிர்கொள்வார்கள்.				
36.	கோவை மாவட்டத்தின் சுற்றுச்சூழல் பாதிப்புகள் பற்றி நான் நன்கு அறிவேன்				
37.	தொலைக்காட்சி, வானொலி மற்றும் செய்தித் தாள்களில் வரும் சுற்றுச் சூழல் சார்ந்த செய்திகளுக்கு நான் முக்கியத்துவம் தருவதில்லை.				
38.	மலைவாழ் மற்றும் பழங்குடியின மக்களுக்கு சுற்றுச்சூழல் சார்ந்த பிரச்சனைகள் நன்றாகத் தெரியும்.				
39.	பள்ளிக்கூடங்களில் மற்ற பாடத்திட்டங்களுக்கு இணையாக சுற்றுச்சூழல் கல்விக்கும் முக்கியத்துவம் தர வேண்டும்.				
40.	சுற்றுச்சூழல் சார்ந்த பிரச்சனைகளுக்கு தனிமனிதனாக என் சமூகத்திற்காக என்னால் நிறைய நன்மைகள் செய்ய இயலும்.				
41.	என் சமூகத்தில் உள்ள சுற்றுச்சூழல் சார்ந்த பிரச்சனைகளில் அக்கறை உள்ளவன் நான் என்று உணர்கிறேன்.				
42.	சுற்றுச்சூழல் பாதுகாப்பிற்காக புதிய வரிகளை (Taxes) இட்டால் கூட நான் விருப்பத்துடன் ஏற்றுக் கொள்வேன்..				
43.	சுற்றுச்சூழல் பாதுகாப்பிற்காக அரசாங்கம் ஏற்கனவே உள்ள சுற்றுச்சூழல் கொள்கைகளைப் பரிசீலித்து மறு ஆய்வு செய்தால் ஏற்பேன்.				
44.	சுற்றுச்சூழல் பிரச்சனைகளுக்குத் தீர்வுகாண்பதில் தனிமனிதராய்த் தாக்கத்தை ஏற்படுத்த இயலும்.				
45.	உங்கள் பார்வையில் தனித்தும், சொந்தமாகவும் ஒருவன் சுற்றுச் சூழல் பிரச்சனைகளுக்குத் தீர்வு காண்பதில் முக்கியப் பங்கு வகிக்க இயலும்.				

IV. பின்வரும் வாக்கியங்களை நீங்கள் எந்த அளவிற்கு ஏற்கிறீர் (அ) மறுக்கிறீர்கள்

வ. எண்.	நிகழ்வுகள்	ஆழமாக மறுக்கிறேன்	மறுக்கிறேன்	ஏற்கிறேன்	ஆழமாக ஏற்கிறேன்
46.	சுற்றுச்சூழல் பிரச்சனைகளுக்கும் அதன் தீர்வுகளுக்கும் சமூகத்தில் உள்ள பிரபலமான பிரமுகர்களை (Popular Personalities) பயன்படுத்திக் கொள்வதே சிறந்த வழியாகும்.				
47.	என் பார்வையில், பிறருடன் சேர்ந்து தீர்வு காண்பதே சுற்றுச்சூழல் பிரச்சனைகளுக்கு உன்னதமான வழியாகும்.				
48.	நாம் எடுக்கும் நடவடிக்கைகளே சுற்றுச்சூழல் பிரச்சனைகளுக்கும் சீர்கேடுகளுக்கும் தீர்வாக அமையும்.				
49.	சிறந்த செயல் வழி நுணுக்கங்களைப் (action strategies) பயன்படுத்தி சுற்றுச்சூழல் பிரச்சனைகளை உங்களால் தீர்க்கமாகத் தீர்க்க இயலும்.				

V. சுற்றுச்சூழல் சார்ந்த பிரச்சனைகளுக்கான தீர்வாக நீங்கள் செய்த பின்வரும் செயல்களில் ஆம் (அ) இல்லை என்பனவற்றில் எது ஏற்படையதோ அதை ‘✓’ குறியிட்டு காட்டவும். மேலும், ஆம் என்றால் அச்செயல் எந்தளவிற்கு பலன் அளித்தது என்பதையும் ‘✓’ குறியிட்டு காட்டவும்.

வ. எண்.	நிகழ்வுகள்	ஆம்	இல்லை	பலன் ஏதுமில்லை	சுமாரான பலன்	நல்ல பலன்	மிகச் சிறந்த பலன்
50.	நாளிதழ்களுக்கு கடிதம் எழுதினேன்						
51.	கருத்தரங்குகளில் கலந்து கொண்டேன்						
52.	நிர்வாக ரீதியிலான முறையீடு						
53.	தேவையான தகவல்களை திரட்டியுள்ளேன்.						
54.	அரசு நிறுவனங்களுக்கோ அல்லது அரசு அதிகாரிகளுக்கோ கடிதம் எழுதி உள்ளேன்.						
55.	அரசு அதிகாரிகளுக்கு தொலைபேசியில் தொடர்பு கொண்டிருக்கிறேன்.						
56.	போராட்டங்களில் பங்கேற்றுள்ளேன்.						
57.	சீர்கேடுகள் ஏற்படுத்திய நிறுவனம் / நபரின் மீது புகார் செய்துள்ளேன்.						
58.	போராட்டக் குழுவில் சேர்ந்துள்ளேன்.						
59.	புகார் மனுவில் கையொப்பமிட்டுள்ளேன்.						
60.	சுற்றுச்சூழல் சார்ந்த நோக்கங்களுக்காக பணம் கொடுத்துள்ளேன்.						
61.	மற்றும் பிற (எழுதவும்)						
62.	மேற்கண்ட எதுவுமில்லை						

VI. பின்வரும் வாக்கியங்களை ஏற்கிறீர்களா? (அ) மறுக்கிறீர்களா ?

வ. எண்.	நிகழ்வுகள்	மறுக்கிறேன்	ஏற்கிறேன்
63.	கோவை மாவட்டத்தில் ஓடும் ஆறுகள் மற்றும் ஓடைகளின் சீர்கேட்டிற்கு தொழிற்சாலை கழிவுகளை காரணம்		
64.	பெரும்பாலான வெள்ளநீர் வடிகால் குழாய்களும், சாலையோர கழிவு நீர் குழாய்களும் நேரடியாக ஓடைகள், நதிகள் மற்றும் குளங்களில் கலக்கின்றன.		
65.	கோவையின் சுற்றுச்சூழல் சீர்கேட்டிற்கு பெருகிவரும் அபரிமிதமான வாகனப் பெருக்கமே முக்கிய காரணமாகும்.		
66.	அருகிவரும் அரியவகை உயிரினங்களைக் (endangered plant & animal) காக்க தேவையான அளவு இயற்கை வாழிடங்களை (Natural Reserve sites) தோற்றுவிப்பதே சிறந்த வழியாகும்.		
67.	ஒரு பகுதியில் மக்கள் தொகைப் பெருகப் பெருக சுற்றுச்சூழல் சீர்கேடுகள் அங்கே குறைகின்றன.		

68.	சிறந்த திடக்கழிவு மேலாண்மைக்கு முட்டுக்கட்டையாய் இருப்பது மக்காத குப்பைகள் (Plastic carry bags)		
69.	கோவையின் பெரும்பாலான குடிநீர் தேவையானது ஆறுகளின் அணைகள் மற்றும் ஏரிகள் மூலமே பூர்த்தி செய்யப்படுகிறது.		
70.	அரசு ஒரே வகையான கொசு ஒழிப்பான்களைப் பயன்படுத்துவதால் சிலவருடங்களில் கொசுக்கள் எதிர்ப்புத் தன்மையைப் பெற்று விடுகின்றன.		

VII. கல்லூரியில் சுற்றுச்சூழல் கல்வியை கற்றதினால் உங்களில் ஏற்பட்ட மாற்றங்களை எவ்வாறு வகைப்படுத்துவாய் என்பதை '✓' குறியிட்டு காட்டவும்.

வ. எண்.	நிகழ்வுகள்	பாராட்டுக்கு உரியது	மிக நன்று	நன்று	பரவாயில்லை	மோசம்
71.	சுற்றுப்புறம் பற்றிய விழிப்புணர்வு (Awareness) மற்றும் நுண்ணுணர்வு (Sensitivity)					
72.	சுற்றுப்புறம் பற்றிய பொது அறிவு (Knowledge) மற்றும் புரிந்து கொள்ளும் திறன் (Understanding)					
73.	சுற்றுப்புறம் பற்றிய மனப்பாங்கு (Attitude) மற்றும் மதிப்பு கொடுக்கும் தன்மை (Values)					
74.	சுற்றுப்புறச் சூழல் சார்ந்த சீர்கேடுகளை பிரித்து அறியும் (Identifying) மற்றும் தீர்க்கும் திறன் (Solving)					
75.	சுற்றுப்புறத்தை காப்பதில் பங்கு கொள்ளல் (Participation) மற்றும் செயலாற்றுதல் (Action) மூலம் நீங்கள் காட்டும் பொறுப்புணர்வு					

VIII. பின்வரும் முக்கிய காரணிகள் உங்களின் சுற்றுச்சூழல் கல்வியை வளர்ப்பதில் எந்தளவுக்கு பெரும்பங்காற்றுகின்றன என்பதை '✓' குறியிட்டு காட்டவும்.

வ. எண்.	காரணிகள்	மிக முக்கியம்	முக்கியம்	குறைந்த முக்கியத்துவம்	மிக குறைந்த முக்கியத்துவம்	முக்கியமில்லை
76.	அரசுக் கொள்கைகள் (Govt. Policies)					
77.	கலைப் பாடத்திட்டம் (Curriculum)					
78.	பாடப் புத்தகம் (Text Book)					
79.	கல்லூரி நிர்வாகம் (Management)					
80.	மற்றும் பிற (குறிப்பிடவும்)					

IX. பின்வரும் காரணிகள் உங்களின் சுற்றுச்சூழல் கல்வியை எந்தளவுக்கு பாதிக்கின்றன என்பதை '✓' குறியிட்டு காட்டவும்.

வ. எண்.	தடைகள்	அதிகமாக பாதிக்கிறது	பாதிக்கிறது	குறைவாக பாதிக்கிறது	மிக குறைவாக பாதிக்கிறது	பாதிப்பதில்லை
81.	நேரமின்மை					
82.	கற்பித்தலுக்கான அத்தியாவசியப் பொருட்களின் குறைபாடு					
83.	போதுமான பயிற்சியின்மை					
84.	அதிகமான வேலைப்பளு					
85.	கல்லூரி நிர்வாகத்தின் ஒத்துழைப்பின்மை					
86.	ஆசிரியர்களிடத்தில் அர்ப்பணிப்பு உணர்வு இன்மை					
87.	கலைப்பாடத்திட்டத்தில் சுற்றுச்சூழல் கல்விக்கு குறைந்த முக்கியத்துவம்					
88.	போதுமான நிதியின்மை					
89.	மற்றும் பிற (குறிப்பிடவும்)					

X. a) பின்வரும் பிரச்சனைகளில் எந்த மூன்று தமிழக அரசிற்கு வருங்கால சவால்களாக அமையும் என்பதை '✓' குறியிட்டு காட்டவும்.

வ. எண்.	முக்கியப் பிரச்சனைகள்	✓ குறியிடவும்
90.	வேளாண்மை மற்றும் விவசாயம்	
91.	அபரிமித மக்கள் தொகைப் பெருக்கம்	
92.	கல்வி	
93.	சுகாதாரம்	
94.	கடல்வளம்	
95.	சமூகக் குற்றங்கள்	
96.	வேலையின்மை	
97.	உள்கட்டமைப்பு வசதிகள்	
98.	சுற்றுச்சூழல்	
99.	போதைப்பொருள்	
100.	உள்நாட்டு மற்றும் வெளிநாட்டு உறவுகள்	
101.	மற்றும் பிற (குறிப்பிடவும்)	

X. b) பின்வரும் சுற்றுச்சூழல் சார்ந்த பிரச்சனைகளில் தமிழக அரசின் மூன்று தலையாய எதிர்கால பிரச்சனைகளாக அமையும் என்பதை (✓) குறியிட்டு காட்டவும்.

வ. எண்.	முக்கியப் பிரச்சனைகள்	✓ குறியிடவும்
102.	இயற்கை வளங்கள் மற்றும் சுற்றுச்சூழல் பாதுகாப்பு	
103.	நீர் மாசுபாடு	
104.	நிலத்தடி நீர்மாசுபாடு	
105.	கடல் மாசுபாடு	
106.	கழிவு நீர்சுத்திகரிப்பு	
107.	காற்று மாசுபாடு	
108.	வாகனங்களினால் ஏற்படும் மாசுபாடு	
109.	புவி வெப்பமயமாதல்	
110.	ஒலி மாசுபாடு	
111.	மீள்நடெழும் வளர்ச்சி (Sustainable Development)	
112.	சுற்றுச்சூழல் கல்வியை நடைமுறைப் படுத்துதல்	
113.	இயற்கை பேரழிவுகள் / செயற்கை விபத்துக்கள்	
114.	காடுகள் அழிப்பு / காட்டுத் தீ	
115.	எரிசக்தி உற்பத்தி (மின்சாரம்)	
116.	ஆபத்தான நச்சுக்கழிவு மேலாண்மை	
117.	மருத்துவ உயிரிக் கழிவு மேலாண்மை	
118.	நகர்ப்புற திடக்கழிவு மேலாண்மை	
119.	பூச்சிக் கொல்லிகள்	
120.	சுரங்கம்	
121.	தொழிற்சாலை மாசுக் கட்டுப்பாடு	
122.	சுற்றுச்சூழல் சார்ந்த சட்டங்களை நிறைவேற்றுதல்	
123.	சுற்றுச்சூழல் விழிப்புணர்ச்சியை ஏற்படுத்துதல்	
124.	மனித வள மேம்பாடு (மக்கள் தொகை)	
125.	மற்றும் பிற (குறிப்பிடவும்)	

நன்றி !

Teacher Questionnaire

Dear Faculty,

This questionnaire is prepared to study the teacher's awareness, attitudes, knowledge and practice of Environmental Education for the purpose of my doctorate thesis on Environmental Education (EE) in Higher Education, with special focus to different college settings in Coimbatore region. I would appreciate it if you make it convenient for me by completing the questionnaire carefully.

Please take about 20-30 minutes of your valuable time to answer this questionnaire. I assure that your responses will be kept completely confidential; however, by filling out this questionnaire you are consenting to the use of the results. Please be aware that you are under no obligation to answer any question(s).

Thank you in advance!

I. General Information: Please put a "√" mark that applies to you.

1. Gender : Male/Female
2. Age :
3. Parents' Literacy : Literate/Illiterate
4. Residence Location : Rural/Urban
5. Native Place : District
6. Educational Qualification : UG/PG/M.Phil/Ph.D/others specify.....
7. Teaching Experience :Years.....Months
8. Type of College :
8. College/Institution Location : Rural/Urban
9. College/Institution affiliated by : University
10. Qualification in Environmental Education? : Yes/No
If 'Yes' put "√" mark on the relevant level : Diploma/BA/B.Sc/MA/M.Sc/M.Phil/Ph.D

- Turn Page -

II. A) For the following 10 questions choose the best answer and circle the letter of your choice.

1. The overall consequence of rapid population growth is:
 - A. disputes over access to resources
 - B. limited quality of life
 - C. increased social costs of food production
 - D. malnutrition

2. Climate change from human influences results in all of the following except:
 - A. A shifting of climate zones.
 - B. An increase in species diversity and the productivity of ecosystems.
 - C. An increase in extreme weather events.
 - D. Negative impacts on human health

3. Which of the following is wrong?
 - A. Adoption of new technologies is not necessarily a cause of environmental damage.
 - B. Market changes always promote the sustainable use of resources.
 - C. Human migration causes considerable damage to the environment.
 - D. Demographic changes tend to increase pressure on the environment.

4. Which of the following is wrong about economic growth in relation to the environment?
 - A. Economic growth intensifies over appropriation of resources.
 - B. Economic growth can bring investments in environmental improvement and cleaner technologies.
 - C. Economic growth reduces land cover change.
 - D. Economic growth results changes in production and consumption patterns.

5. Which of the following is true about sustainable development?
 - A. It is a process of change with the future in mind.
 - B. It is similar to sustainable economic growth.
 - C. It is preserving the earth's resources for the use of future generations.
 - D. It is a development model which can only be practiced by the developed nations of the world.

6. Which of the following is the logical sequence for the rise of environmental education?
 - A. Environmental concern → Industrialization and urbanization → Environmental crisis → Environmental education
 - B. Industrialization and urbanization → Environmental crisis → Environmental concern → Environmental education
 - C. Environmental crisis → Industrialization and urbanization → Environmental concern → Environmental education
 - D. Environmental crisis → Environmental concern → Industrialization and urbanization → Environmental education

7. The ultimate goal of environmental education is:
- A. Awareness about environmental problems.
 - B. Knowing how to improve environmental quality.
 - C. Possessing the necessary skills to protect the environment.
 - D. Taking decisions and actions in favor of the environment.
8. Decisions and actions by the different countries of the world can have international repercussions. This idea gave environmental education to have the following characteristics:
- A. Inter-disciplinarity
 - B. Totality
 - C. Global views
 - D. Cultural and gender perspectives
9. Environmental sustainability through environmental education is maintained best if one of the following approaches of teaching is applied.
- A. Teachers transmit knowledge and students are passive recipients
 - B. Teachers act as facilitators and students participate actively
 - C. Teachers play a collaborative inquirer role and students as active generators of new ideas
 - D. Students are active participants and teachers as passive listeners to the student's views
10. As far as environmental education is concerned which of the following is the best instructional resource?
- A. Video
 - B. The environment itself
 - C. Written materials
 - D. Museum

B) Please indicate how you feel local environmental issues have become since you have lived here (Coimbatore).

S. No	STATEMENTS	Much Worse	Worse	Better	Much Better
11	The water quality in your local streams, rivers, and lakes.				
12	The level of pollution or waste produced by nearby business centres, public places, houses and industries.				
13	The state/level of air quality in your area.				
14	The steps taken by the government/non-government organizations on environmental protection.				
15	The overall environmental state of Coimbatore district.				

C) Please indicate how concerned you are about the following environmental issues in Coimbatore.

S. No	STATEMENTS	Not at all concerned	Somewhat concerned	Concerned	Very concerned
16	Water pollution from industries and urban development.				
17	The conditions of agricultural land and nature preserves.				
18	Air pollution.				
19	Unlimited development of cities.				
20	Solid waste management.				

III. Please indicate the degree to which you agree or disagree with each statement below by putting a “√” mark in the appropriate box.

S. No	STATEMENTS	Strongly Agree	Mildly Agree	Unsure	Mildly Disagree	Strongly Disagree
21	We are approaching the limit of the number of people the earth can support					
22	Humans have the right to modify the natural environment to suit their needs					
23	When humans interfere with nature it often produces disastrous consequences					
24	Human ingenuity will insure that we do Not make the earth unlivable					
25	Humans are severely abusing the environment					
26	The earth has plenty of natural resources if we just learn how to develop them					
27	Plants and animals have as much right as humans to exist					
28	The balance of nature is strong enough to cope with modern industrial nations					
29	Despite our special abilities humans are still subject to the laws of nature					
30	The so-called “ecological crisis” facing human kind has been greatly exaggerated					
31	The earth is like a spaceship with very limited room and resources					
32	Humans were meant to rule over the rest of nature					
33	The balance of nature is very delicate and easily upset					
34	Humans will eventually learn enough about how nature works to be able to control it					
35	If things continue on their present course, we will soon experience a major ecological catastrophe					

IV. Please indicate the degree to which you agree or disagree with each statement below by putting a “√” mark in the appropriate box.

S. No	STATEMENTS	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
36	There is a pressing need for teachers to become better informed so that their students are given the most up-to-date information about environmental trends					
37	The methods teachers use to convey environmental content are less important than the curriculum as far as effective environmental education program is concerned					
38	Since environmental degradation is sometimes due to the absence of options for engaging in environmentally friendly activities, the role of environmental education for the solution of environmental problems is insignificant					
39	Since many people do not know the full consequences of their environmental actions, environmental education is important					
40	As information and communication technologies are developing faster, the role of higher education in realizing the goals of environmental education is insignificant					
41	Environmental education should be delivered across the curriculum (should be part of all the subjects taught)					
42	Environmental Education in higher education should be left to EE qualified teachers so that its implementation will become effective					
43	The focus of environmental education should be to promote the belief in the rights of humans to control nature and the capacity of science and technology to manage the effects of environmental degradation					
44	The focus of environmental education should be on how humans can live in harmony with nature					
45	Environmental knowledge should be constructed, generated and initiated by the students themselves					
46	Environmental teaching and learning should be based on standardized outcomes (predetermined knowledge and attitudes of the students)					
47	Teaching about the possibility of a major ecological catastrophe in the future will alert students for a responsible environmental action					

V. Please indicate how often you practice the following activities by putting a “√” mark in the appropriate box.

S. No	STATEMENTS	Usually	Often	Sometimes	Seldom	Never
48	I present environmental knowledge/concepts in class					
49	I guide students to explore local environmental problems and solutions consciously					
50	I introduce my students to some general ways of solving certain environmental problems and guide them to apply such methods to other problems					
51	I assign students to bring some materials from the local environment to be used for teaching					
52	I read in class interesting articles about environmental issues that I get from books, newspapers, magazines etc.					
53	I bring interesting pictures on environmental issues and show to my students					
54	I evaluate the curriculum and text book of the subject I teach with regard to environmental issues					
55	I organize and lead environmental clubs in colleges					
56	I organize question and answer program on environmental issues					
57	I create links between my college and NGOs and government offices which work for the protection of the environment					
58	I gather posters concerning environmental issues and stick them in the college campus so that students can learn					
59	I write articles about the environment to be read during the flag ceremony					
60	I conduct local researches concerning environmental issues					
61	I plant trees in the college compound					
62	I contribute articles concerning environmental issues to regional and/or national mass media					
63	I actively participate in environmental actions of the community of which I am a member					

S. No	Statements	Usually	Often	Sometimes	Seldom	Never
64	I actively participate in local community organizations working for the environment					
65	I give quick and positive response when I am asked to contribute money for environmental protection					
66	I teach the local community about environmental issues					
67	I use the institution to which I belong to promote the desirable environmental ethic					
68	With regard to environmental behavior, I attempt to be a role model for the community in my lifestyles					

VI. To what extent do you think have the following experiences been useful to your environmental & environmental education knowledge, attitude and skills? Put a “√” mark in the appropriate box.

S. No	Experiences	Greatly Useful	Considerably Useful	Somewhat Useful	Little Useful	Not Useful
69	Pre-service training					
70	In-service training					
71	Workshops/Conferences					
72	Personal reading					
73	Electronics media					
74	Print media					
75	Others (please specify)					

VII. How do you rate your competence to teach the following aspects of environmental education? Put a “√” mark in the appropriate box.

S. No	Statements	Excellent	Very Good	Good	Fair	Poor
76	Developing awareness and sensitivity to the environment					
77	Developing knowledge and understanding about the environment					
78	Developing attitudes and values towards the environment					
79	Teaching skills in identifying and solving environmental problems					
80	Developing a sense of responsibility through participation and action					

VIII. How important are the following in enhancing your environmental education activities? Put a “√” mark in the appropriate box.

S. No	Items	Greatly Important	Considerably Important	Somewhat Important	Little Important	Not Important
81	Government policy					
82	The curriculum					
83	The text books and teaching aids					
84	The college management					
85	Others (please specify)					

IX. To what extent do the following obstacles hinder your environmental education activities? Put a “√” mark in the appropriate box.

S. No	Obstacles	Greatly	Considerably	Somewhat	Little	Not at all
86	Time constraints					
87	Lack of teaching resource materials					
88	Lack of training					
89	Heavy workload					
90	Lack of college support					
91	Lack of commitment					
92	The less emphasis given to environmental education in the curriculum					
93	Lack of funding					
94	Others (please specify)					

X. Which would you think will be the single most important future issues for Tamil Nadu Government? Put a “√” mark in the appropriate box.

95) Common issues

S. No	IMPORTANT ISSUES	Response
1.	Farming and agriculture	
2.	Over population	
3.	Education	
4.	Health	
5.	Fisheries	
6.	Crime	
7.	Unemployment	
8.	Infrastructures (Roads, shipyard, airports)	
9.	The environment	
10.	Alcohol and other drugs	
11.	Bilateral and multilateral relations	
12.	Others (please specify)	

96) Environmental issues

S. No	ENVIRONMENTAL ISSUES	Response
1.	Natural Resources and Environmental Conservation	
2.	Water Pollution	
3.	Ground water Pollution	
4.	Marine Pollution	
5.	Waste water treatment	
6.	Air Pollution	
7.	Vehicular Pollution	
8.	Global Warming	
9.	Noise Pollution	
10.	Sustainable Development	
11.	Implementation of Environmental Education	
12.	Natural Disaster/Chemical Accidents	
13.	Deforestation/Forest Fire	
14.	Energy Production	
15.	Hazardous & Toxic Waste Management	
16.	Bio Medical Waste Management	
17.	Municipal Solid Waste Management	
18.	Pesticides	
19.	Mining	
20.	Industrial Pollution Control	
21.	Enforcement of Environmental Laws	
22.	Creating Environmental Awareness	
23.	Human Resources Management (Population)	
24.	Others (please specify)	

THANK YOU

Publications

AWARENESS, ATTITUDES AND PRACTICES OF ENVIRONMENTAL EDUCATION AMONG COLLEGE TEACHERS IN COIMBATORE DISTRICT, TAMIL NADU

3

Chandran. R
Ph.D. Scholar,
Salim Ali Centre for
Ornithology and Natural History,
Anaikatty,
Coimbatore.

P. A. Azeez
Senior Principal Scientist,
Salim Ali Centre for
Ornithology and Natural History,
Anaikatty,
Coimbatore.

INTRODUCTION

Increasing threats to the resources of Earth and to the health and stability of societies justify the urgent need for an environmentally informed citizenry for a sustainable future. Presently, there are many environmental issues and challenges that India confronts such as air and water pollution, solid waste disposal and the degradation and fragmentation of natural environment. The situation has become worse in the recent years due to the so-called "liberalization", "economic development" and "globalization". India is making progress in addressing these environmental issues. In 2003, The Honorable Supreme Court of India mandated Environmental Education (EE) / Environmental Science (EE) as a compulsory subject in all stages of Education system (Sonowal, 2009). The ultimate goal of EE is to promote development of responsible environmental behavior among the learning communities (Hungerford and Volk, 1990). The Intergovernmental Conference on Environmental Education (UNESCO, 1978) had recommended the primary goals of environmental education curriculum as

(a) awareness, (b) knowledge, (c) attitudes, (d) skills, and (e) participation. Earlier study in this field clearly showed that the students were good in their awareness and attitudes towards environmental education but they are less active in environmental protection (Ximing and Chunzhao, 2011). Ultimately, mending this behavioural gap rests in the hands of teaching community that train the upcoming generations' to become responsible and environmentally active citizens. Hence, the teachers must have a good understanding of environmental issues, desirable attitudes towards the environment in general and environmental education in particular and they should also be committed to act responsibly (Ernesto, 2014). Meantime, people also perceive that less competent teachers are the primary reason for students' substandard interest in EE learning and poor participation in environmental protection. Taking these vital cues into consideration, this study is conducted to assess the college teachers' awareness, attitude and practices of environmental education with reference to Coimbatore district, Tamil Nadu.

REVIEW OF RELATED LITERATURE

Research reports are very limited to this area in India and abroad because most of the available research reports were confined to evaluating the students' level of environmental awareness and knowledge. Unfortunately, till now no study was reported on EE teachers' level of Awareness, Attitudes and Practices (AAP) in this state. This study is the first of its kind looking at the teachers' competence in handling EE.

The publication from Center for Environment Education (2002) was an important one in the field of Environmental Education (EE) and Education for Sustainable Development (ESD) in India. Priya (2014) studied factors that are most important in explaining different levels of awareness concerning environmental problems and the level of awareness among college students with regard to the usage of plastic and its disposal, alternative for plastic, toilet usage, its use in the cultivation of saplings, rainwater harvesting and also their participation in environment related programmes in Coimbatore District. Priyadarshini and Annakodi (2013) conducted a study on the level of environmental awareness in secondary students in Coimbatore. Their investigation was done among 40 students studying in the ninth standard of a Government School located in a semi urban area of Coimbatore. The study showed post-test awareness of the students with respect their level of understanding of environmental issues much higher than their pre-test state.

STATEMENT OF THE PROBLEM

The problem of the study is study the teachers' awareness, attitude and practices

of environmental education in Coimbatore district, Tamil Nadu.

OBJECTIVES OF THE STUDY

The objective of the study was to explore the level of awareness, attitude and practices of Environmental Education during the period of 2013-2016 among college teachers, and to find variability in these aspects with respect their demographic status.

HYPOTHESES FOR THE STUDY

The hypothesis while taking up the study was that "there is no significant difference in Teachers' Awareness, Attitudes and Practices of EE with reference to demographic variables such as gender, age, resident location and nativity, teaching experience, educational qualification and EVS/EE subject qualification".

METHODOLOGY

A custom-made questionnaire was used for the study and the investigators have adopted the convenience sampling technique for collecting responses from college teachers in Coimbatore. From 38 colleges in Coimbatore, 41 EE teachers were contacted as a cross-sectional sample for the study. The survey tool, the questionnaire, consisted of 94 question/ items classified under 9 categories. But, in this present study, in view of hypothesis to be tested and the objectives, the investigators have taken only 5 important categories, i) Teachers' Environmental awareness, ii) EE subject awareness, iii) Environmental attitude, iv) EE subject attitude, and v) Teaching Practices. The questions were of three type namely, multiple choice, Likert scale items and alternative (Yes or No) items. Detailed instructions were given to the subjects before

filling their questionnaire. For establishing the validity the tool was given to a panel of academicians and language experts. Based on their opinion and guidance some of the items in the questionnaire were modified. The reliability of the tool was also established using split-half method and the result was 0.82. Based on the subjects responses scores were assigned based on scoring key. The collected data were then tabulated and analyzed with the help of SPSS software.

STUDY AREA

Coimbatore is the second largest district in Tamil Nadu with more than 3 million people and is known for its rich biodiversity and its resources. It is also a major business and educational hub in the south India

with several industries, educational and commercial institutions. For the study, the investigators have chosen colleges within the 30-40 km radius of the Coimbatore city. Of the selected colleges 17 were arts and science colleges, 11 engineering colleges, 5 polytechnic colleges, 3 teacher education colleges and 2 agriculture colleges.

RESULTS AND DISCUSSION

From the table 1, it is evident that majority of EE teaching faculties are females (63.41%), age group between 30-45 years (48.75%), residing in urban area (70.73%), possessing doctoral degree (53.66%), lesser than six year experience in the field of teaching (51.22%) and do not possess any EVS/EE related subject qualification (70.73%).

Table 1
Demographic status of the teachers

S. No	Variables	Category	No. Samples	Percentage (%)
1	Sex	Male	15	36.58
		Female	26	63.41
2	Age	<30	11	26.82
		30-45	20	48.78
		>46	10	24.39
3	Residence Location	Rural	12	29.27
		Urban	29	70.73
4	Nativity	Native	23	56.10
		Non-native	18	43.90
5	Educational Qualification	UG	3	7.32
		PG	6	14.63
		M.Phil.	10	24.39
		Ph.D.	22	53.66

S. No	Variables	Category	No. Samples	Percentage (%)
6	Teaching Experience	<6	21	51.22
		6-15	12	29.27
		15-25	4	9.76
		>25	4	9.76
7	EVS/EE qualification	Yes	12	29.27
		No	29	70.73

From the table 2, it could be seen that there is a significant difference ($t = 2.029$, $P = 0.049$) among EE teachers while looking at the overall AAP levels with respect to gender. No significant differences are noted in Teachers' Environmental Awareness, EE Awareness, Environmental Attitude, EE Attitude and their EE subject teaching practices. Male teachers are better in overall AAP level than female teachers. This may be due to male teachers applying wide range of teaching exposure techniques while handling the EE classes than female teachers.

Table 2
Difference among EE teachers' in various dimensions of EE teaching with respect to gender

Dimensions	Male		Female		t' value	p-value
	Mean	SD	Mean	SD		
Environmental Awareness	1.200	0.941	1.269	0.827	0.245	0.807
EE Awareness	2.400	0.736	2.730	1.401	0.846	0.403
EnvironmentalAttitude	52.733	4.620	50.230	6.166	1.364	0.181
EE Attitude	39.800	3.509	39.576	4.518	0.164	0.870
Teaching Practices	76.200	16.156	65.961	18.049	1.815	0.077
Overall difference	197.600	20.198	185.076	18.349	2.029	0.049*

Note: * significant @ 5% level

Table 3, shows that there is no significant differences among EE teachers while looking at their AAP levels with respect to their location of their residence (urban or rural). Urban teachers are better in overall AAP than those from rural areas are. This may be due to urban teachers are more directly exposed to environmental issues than their counterparts.

Table 6
Difference among EE teachers' in various dimensions of EE teaching with respect to their educational qualification

Dimensions	UG		PG		M.Phil		Ph.D		F-Ratio	p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Environmental Awareness	1.666	0.577	1.666	0.816	0.900	0.737	1.227	0.922	1.289	0.292
EE Awareness	2.666	0.577	3.666	1.211	2.000	1.490	2.590	0.959	2.721	0.058
Environmental Attitude	50.000	4.582	54.333	7.737	48.300	3.368	51.727	5.824	1.636	0.198
EE Attitude	38.333	1.527	42.333	4.966	38.300	3.164	39.727	4.355	1.336	0.278
Teaching Practices	73.666	20.744	57.666	21.369	65.400	14.198	74.409	17.250	1.748	0.174
Overall difference	192.333	22.678	186.333	24.614	179.600	14.400	194.772	19.544	1.481	0.236

Table 7 shows that there is no significant difference among EE teachers while looking at their AAP levels with respect to their teaching experience (number of years). 15 – 25 years experienced teachers are better in overall APA than other three group teachers are. This may be because they follow relatively better teaching practices while handling EE subject than their counterparts falling in other age groups.

Table 7
Difference among EE teachers' in various dimensions of EE teaching with respect to their teaching experience

Dimensions	<6 yrs		6-15 yrs		15-25 yrs		>25 yrs		F-Ratio	p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Environmental Awareness	1.238	.830	1.500	1.000	0.750	0.957	1.000	0.000	0.896	0.453
EE Awareness	2.904	1.410	2.250	0.965	2.500	0.577	2.250	0.957	0.905	0.448
Environmental Attitude	50.476	6.353	52.666	5.033	49.250	5.251	52.000	5.354	0.535	0.661
EE Attitude	40.285	4.659	38.083	3.579	40.250	2.872	40.500	3.696	0.813	0.495

Dimensions	<6 yrs		6-15 yrs		15-25 yrs		>25 yrs		F-Ratio	p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Teaching Practices	67.476	18.803	70.333	18.157	80.750	16.357	68.500	15.198	0.610	0.613
Overall difference	186.809	18.859	190.250	23.429	201.750	13.524	190.750	19.636	0.634	0.598

From the above table 8, it could be seen that there is a significant difference ($t = 2.081$, $P = 0.044$) among EE teachers in the overall AAP levels with respect to they having EVS/EE subject qualification or not. No significant differences are noted in Teachers' Environmental Awareness, EE Awareness, Environmental Attitude, EE Attitude and their EE subject teaching practices. Non-qualified teachers are better in overall APA levels than the

qualified teachers. This may be due to the non-qualified teachers' extra cautious approach while handling EE subject than the qualified group. Furthermore, it also perhaps suggests that the conventional courses do not inculcate a general value of the environment among the learners and most of the attitudes and awareness about environment is perhaps acquired by direct exposure to issues or through non-formal learning process in life.

Table 8
Difference among EE teachers' in various dimensions of EE teaching with respect to EVS/EE subject qualification

Dimensions	Qualified		Non-Qualified		't' value	p-value
	Mean	SD	Mean	SD		
Environmental Awareness	1.103	0.817	1.583	0.900	1.662	0.105
EE Awareness	2.551	1.270	2.750	1.055	0.476	0.637
Environmental Attitude	50.137	5.323	53.583	6.141	1.803	0.079
EE Attitude	39.069	3.963	41.083	4.358	1.439	0.158
Teaching Practices	68.862	17.876	71.750	18.533	0.466	0.644
Overall difference	185.689	20.012	199.250	16.085	2.081	0.044*

CONCLUSION

Environmental Education has been seen as a basic tool to contribute to the change in conceptions, values, and attitudes among people. Hence, it is getting attention from those concerned with the problem

of environmental conservation and sustainable environment. In present global scenario, still India has a long way to achieve environmental quality keeping in mind the welfare of billions of people. The children and youth of India have a major role to play

in realizing the importance of preserving the natural resources and in creating a better India. EE teachers' contributions are very crucial in keeping this objective alive and achievable. In general, teachers are considered instrumental in implementing successful curricula and inculcating values among the younger generation. The present study reveals that the teachers possess positive attitudes towards both environmental issues and environmental education though their awareness of environmental issues was low. Due to their inadequate EE qualifications and exposures, though an array of activities are adopted in EE teaching that were mostly restricted to classroom coaching and to

a lesser extent extracurricular and out of college activities. The present study suggests that teacher in the field of EE must not only have extensive awareness and understanding of environmental problems, but also they must be acquainted to a series of environmental activities. They must be committed "to initiate action, based upon knowledge and understanding". Preferably, teaching appointments for EE must be made from EVS/EE qualified candidates and opportunities should be provided to them for exposure to issues or to people who are directly involved in handling environmental issues. It would also be appropriate that the EE curriculum is also revamped with innovative approaches.

REFERENCES

- Center for Environment Education. (2002). *Environmental Education: Some Experiences from India*. Institute for Global Environmental Strategies, Japan.
- Ernesto, L. D. L. (2004). *Awareness, Knowledge, and Attitude about Environmental Education: Responses from Environmental Specialists, High School Instructors, Students, and Parents*. (Doctoral dissertation, University of Central Florida, Florida).
- Hungerford, H. R., & Volk, T. L. (1990). Changing Learner Behavior through Environmental Education. *Journal of Environmental Education*, 21(3), 8-21.
- Lavanya, E. & Annakodi, R. (2013). Environmental Awareness of Secondary Students in Coimbatore. *Indian Journal of Applied Research*, 3(12).
- Priya, K. (2014). A Study on Level of Environmental Awareness among College Students in Coimbatore District. *Online International Interdisciplinary Research Journal*, IV, March - Special Issue.
- Sonowal, C. J. (2009). Environmental Education in Schools: The Indian Scenario. *Journal of Human Ecology*. 28(1), 15-36.
- UNESCO. (1978). *Intergovernmental Conference on Environmental Education*. Tbilisi, USSR, 14-20 October 1977, Final Report, Paris.
- Ximing, S. & Chunzhao, L. (2011). Survey of environmental education (EE): Case study of higher education institutions in Ningbo. *Energy Procedia*, 5, 1820-1826.

Stray Dog Menace

Implications and Management

R CHANDRAN, P A AZEEZ

A study conducted among 10 Indian metro cities investigates the impact of municipal solid waste and animal birth control programme on stray dog population and its menaces. Its results show statistically strong and positive linkages among the variables such as human population, municipal solid waste, per capita solid waste, food waste, dog population and dogs per capita. People's general awareness and the efforts of municipalities are inadequate to control the dog menace.

Urbanisation is an ongoing transformation of traditionalistic rural economies to modern commercial or industrial ones. In 2010, India accounted for 11% of the world's urban population. The United Nations (UN) projects it to be 15% by 2030. In 2011, India's urbanisation was 31% with nearly 160 million people living in 53 metropolitan cities. At this rate if urbanisation goes on, in 2031, the urban population may reach 255 million living in 87 metropolitan cities and the overall urbanisation level would reach 50% by 2039 (NIUA 2011).

However, providing essential amenities to the growing urban population, in countries such as India, remains largely a hope. The high-speed urbanisation and spread of urban sprawl lead to extensive growth of slums and consequent poverty, unemployment, exploitation, inequalities, misery and low quality of human life. In effect, the present mode of urbanisation and paradigm of development innately promotes urban sprawls, slums, disparity and extensive public health and environmental issues, especially in thickly populated countries such as India. With development of cities, managing the solid waste has become a daunting challenge and the centralised facilities more often fail in delivering the expected level of service. Thus, the unconfined and unmanaged leftovers aid proliferation of stray dogs and other vermin including some of the dangerous vectors.

The domestic dogs are the most abundant terrestrial carnivores in the world (Young et al 2015; Vanak and Gompper 2009), almost 500 million dogs are there, and almost 75% of them are free-ranging, posing substantial threat to people as well as several wild species and livestock (Kumar and Paliwal 2015), especially the smaller and prey species. At times, it

is seen that free-ranging dogs hunt smaller species even if they do not consume the hunted, perhaps an expression of their hunting instinct and behaviour.

Domestic dog, *Canis familiaris*, one of the earliest domesticated species, could be in-house, stray or feral, progressively through a de-domestication process with potential for reversal, eminently portrayed, though much anthropomorphised, in the classic fiction *The Call of the Wild* by Jack London. It is projected that India's cities and towns are home to about 30 million stray dogs and eight million people are forced to take treatment for dog bites every year. The stray dog population in India is increasing day by day. Regrettably, 30%–60% of the dog-bite victims are children under the age of 15 in countries where rabies is endemic. A study from Bhutan shows children of 5–9 years as the most common victims, reporting 2.3 times more dog bites than expected (Tenzin et al 2011). In Bengaluru, it is reported that 45% of dog bites are of slum children (David 2007). Universally, children are the most vulnerable to attacks by the dogs, and the risk of injury to the head and neck is greater in them, adding to increased severity (WHO 2013) and medical complications and deaths.

As per the World Health Organization (WHO), world over there are more than 200 million stray dogs, 55,000 people die from rabies per year, and another 15 million receive post-exposure treatment to avert the disease, with 95% of the cases happening in Asia and Africa (Strand 2011). In 2012, the WHO states that 30% of world rabies case is reported from India (WHO 2009); 20,000 rabies cases each year, though the government officials and some experts dispute the figure (Clifton 2012). Yet, until now, no official and reliable data is available on stray dog population, dog bites and rabies cases or deaths in the country. But almost every day the newspaper reports are numerous about fatal dog attacks somewhere in the country.

Earlier studies have recommended establishment of a comprehensive national rabies control programme in each of the world's enzootic countries (Bourhy et al

R Chandran (chandran.r.123@gmail.com) is a research scholar at the Division of Environmental Impact Assessment, Sálim Ali Centre for Ornithology and Natural History, Anaikatty, Coimbatore, Tamil Nadu and P A Azeez (azeezpa111@gmail.com) is senior principal scientist at the same centre.

2010) for control of stray dog population or their universal vaccination for successful control of the dreadful disease. Street dogs would not be able to maintain their population density unless food and shelter are provided by man, with or without intent.

The uncontrolled procreation of dogs leads to overabundant population that results in dog-human conflicts, dog bites, road traffic accidents, other troubles due to their escalated fights, blind chase of one another on the roads, barking and soiling (Farnworth et al 2012; Massei and Miller 2013). Overpopulation of dogs and its impact on humans have raised serious conservation concerns in many parts of the world (Silva-Rodriguez and Sieving 2012; Sepúlveda et al 2014). Consequently, both the WHO and the World Organisation for Animal Health (OIE) recommend environment management, including steps to exclude dogs from sources of food, as an important means for stray dog population control. The same is also stressed by the Animal Welfare Board of India (AWBI) (Kharab 2015). In this context, the present study, on the basis of available secondary data, explores the impact/relationship of

municipal solid waste (MSW) and animal birth control (ABC) programmes on stray dog population in a few Indian cities.

Methodology

Secondary data from 10 fast-growing Indian cities—Ahmedabad, Bengaluru, Chennai, Coimbatore, Delhi, Hyderabad, Mumbai, Pune, Surat and Thiruvananthapuram—were collated. The population and literacy rate for each city was collected from the Census of India (2011). The MSW data was collected from the Central Pollution Control Board (CPCB) and the quantity of food waste in the same was derived at 10% of the total MSW. Dog population, total dog bites and dog bite/day in a given year was gleaned from India's leading dailies/magazine reports from 2011 to 2015. Data on ABC programmes undertaken by animal welfare organisations (AWOs) or local municipal bodies (LMBs) was gathered from the AWBI. Descriptive statistics and inter-correlations were done using Statistical Package for the Social Sciences (SPSS) (Version 20.0) for the variables for each city. All the data were accessed between 24 April 2015 and 17 September 2015.

Stray Dog Population

Linkages between the variables: The study shows (Table 1) that the overall city population has statistically significant positive correlation with MSW ($r = 0.956$, $p = 0.000$), food waste ($r = 0.956$, $p = 0.000$) and dog bites in a given year ($r = 0.932$, $p = 0.000$). MSW showed significant positive correlation with yearly dog bites ($r = 0.914$, $p = 0.000$) and per capita waste generation ($r = 0.662$, $p = 0.037$). Strong positive correlation was also seen between per capita waste production and dog population ($r = 0.654$, $p = 0.040$), dog/person and dog population ($r = 0.756$, $p = 0.011$), and food waste with yearly dog bites ($r = 0.914$, $p = 0.000$). Literacy rate of the people was negatively related with solid waste per capita ($r = 0.681$, $p = 0.030$) and dog population ($r = 0.815$, $p = 0.004$). However, the number of ABC centres and dog bites/day data did not show any significant relationships with other variables.

Of the cities we examined (Table 2), Mumbai has the highest population rate and Thiruvananthapuram has the lowest population rate. In MSW and food waste generation, Delhi ranks first, while Thiruvananthapuram is at the last position. With respect to the city population and the MSW generation rate, Hyderabad stands at the top followed by Chennai (Figure 1, p 60).

The per capita MSW generation is high in Hyderabad followed

Table 1: Metro Cities: Inter-correlations and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	Mean	SD
1 Population	1.00										7950033.00	5532703.7
2 Literacy rate	-0.24	1.00									89.20	2.82
3 MSW	0.96**	-0.41	1.00								3145.00	2360.1
4 Solid waste per capita	0.44	-0.68*	0.66*	1.00							.36	.12
5 Food waste	0.96**	-0.41	1.00**	0.66*	1.00						314.50	236.0
6 Dog population	0.33	-0.81**	0.49	0.65*	0.49	1.00					171907.00	163161
7 Dog/person	-0.26	-0.55	-0.10	0.32	-0.10	0.76*	1.00				.02	.02
8 Dog bites in a year	0.93**	-0.38	0.91**	0.47	0.91**	0.50	0.00	1.00			37013.40	29215.9
9 Dog bites per day	0.48	-0.18	0.46	0.13	0.46	0.53	0.25	0.62	1.00		176.00	180.4
10 ABC doing AWO/LBs	0.47	-0.15	0.59	0.50	0.59	0.08	-0.29	0.45	0.27	1.00	4.00	5.8

N=10, **Correlation is significant at the 0.01 level.

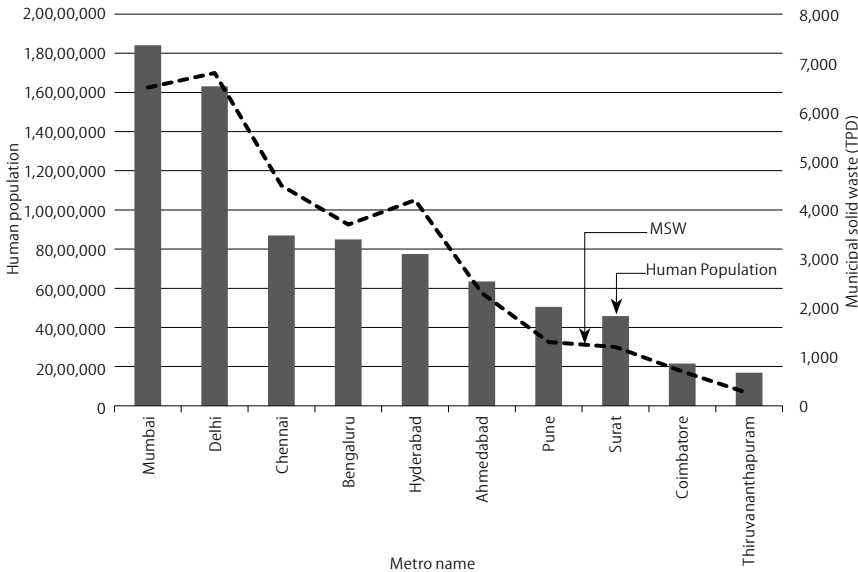
*Correlation is significant at the 0.05 level.

Table 2: Summarised Metro City Data

S.No	Name of Metro	Population*	Literacy Rate*	MSW (TPD)#	Solid Waste/Capita (Kg/day)	Food Waste (TPD)	Dog Population \$	Dog/Person	Dog Bite in a Year	Dog Bites Per Day	ABC Doing AWO/LBs!
1	Mumbai	1,84,14,288	90.78	6,500	0.353	650	95,000	0.005	90,000	220	4
2	Delhi	1,63,14,838	86.43	6,800	0.417	680	3,60,000	0.022	80,000	500	12
3	Chennai	86,96,010	90.35	4,500	0.517	450	80,000	0.009	38,454	100	17
4	Bengaluru	84,99,399	89.56	3,700	0.435	370	2,00,000	0.024	19,066	50	0
5	Hyderabad	77,49,334	82.92	4,200	0.542	420	5,00,000	0.065	52,264	120	2
6	Ahmedabad	63,52,254	89.53	2,300	0.362	230	3,00,000	0.047	41,141	500	1
7	Pune	50,49,968	91.42	1,300	0.257	130	40,000	0.008	12,731	35	2
8	Surat	45,85,367	88.97	1,200	0.262	120	19,070	0.004	14,478	45	0
9	Coimbatore	21,51,466	89.23	700	0.325	70	75,000	0.035	12,000	40	1
10	Thiruvananthapuram	16,87,406	93.24	250	0.148	25	50,000	0.030	10,000	150	1

*Census of India, 2011; #MSW study conducted by CPCB through; CIPET during 2010–11; \$ India's leading Newspaper Reports, 2011 to 2015; ! Animal Welfare Board of India.

Figure 1: Metro Population vs Municipal Solid Waste Generation



All the figures were formulated by the authors.

Figure 2: Solid Waste per Capita vs Dog per Person

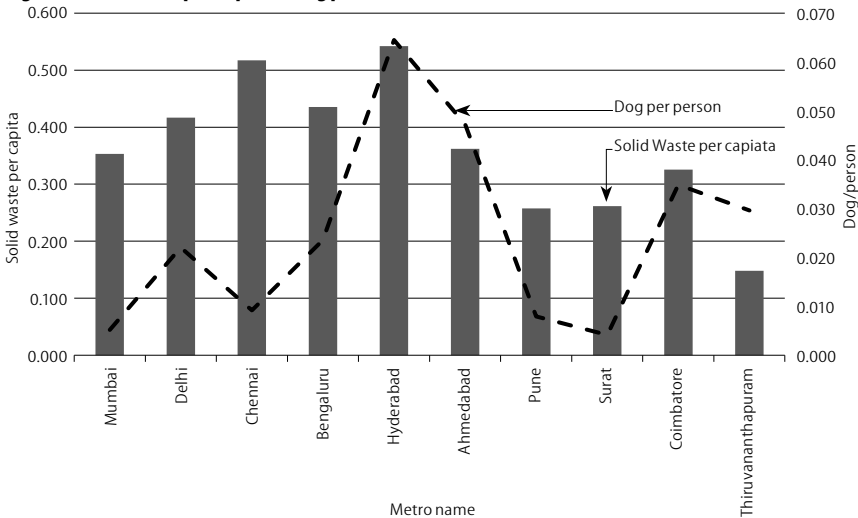
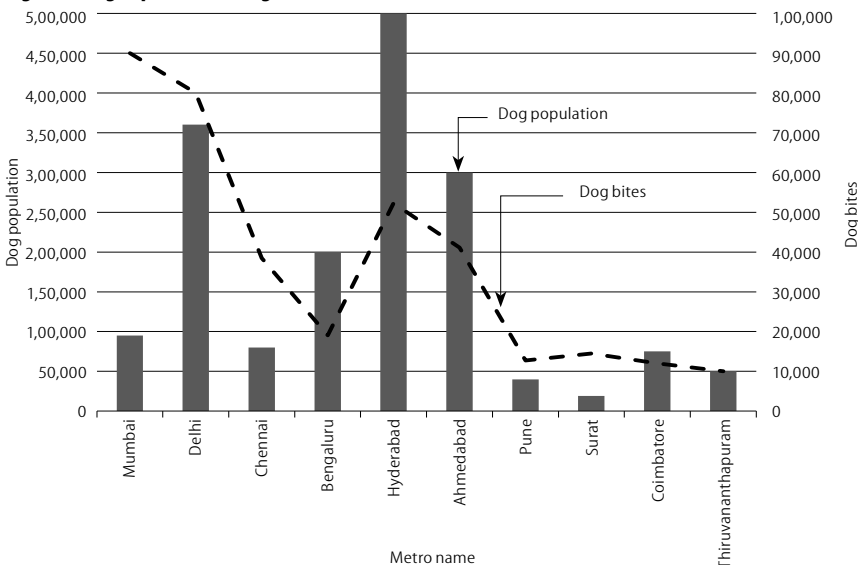


Figure 3: Dog Population vs Dog Bites in a Year



by Chennai and low in Thiruvananthapuram. The high per capita waste generation could be due to the lifestyle and not necessarily the living standards in these cities. It is tempting to conclude that the low per capita waste may be due to lower economic state of the city, but could also be more due to effective msW management and better public awareness. The number of stray dogs per capita is high in Hyderabad and low in Surat. It would be worthy to note that after the plague epidemics in Surat in the 1994 (Dutt et al 2006), there is a clear trend among common public as well as officials towards healthier waste management.

In relation to the per capita solid waste generation, the per capita number of dogs is higher in Thiruvananthapuram, followed by Ahmedabad and then Hyderabad, which indicate the higher probability of a person being bitten by dogs in these cities (Figure 2).

Hyderabad has the highest dog population and lowest is in Surat. In the case of dog bites, Mumbai occupied top rank in the chart and Thiruvananthapuram occupied the lowest rank. However, the frequency/occurrence of dog bites is high in Mumbai followed by Chennai and Surat with reference to their respective dog population (Figure 3).

The overall dog bites per day is high in Delhi and Ahmedabad, while it is very low in Pune. Proportionately bites/day are higher in Ahmedabad followed by Thiruvananthapuram in relation to their food waste generation (Figure 4, p 61).

Thiruvananthapuram has the highest literacy rate than any other metros in the list and the lowest rate is registered by Hyderabad. The quantity of msW generation is high in Delhi followed by Hyderabad with reference to their literacy rate (Figure 5, p 61). Chennai is the highest in number of authorised ABC centres and consequently, the effectivity of stray dog population control in a given year is higher in Chennai, followed by Delhi and Mumbai. Surprisingly such centres were absent in Bengaluru and Surat (Figure 6, p 61).

Availability of food: The high human population, the lifestyle, rapid urbanisation and expanding urban sprawl are

Figure 4: Food Waste Generation vs Dog Bites Per Day

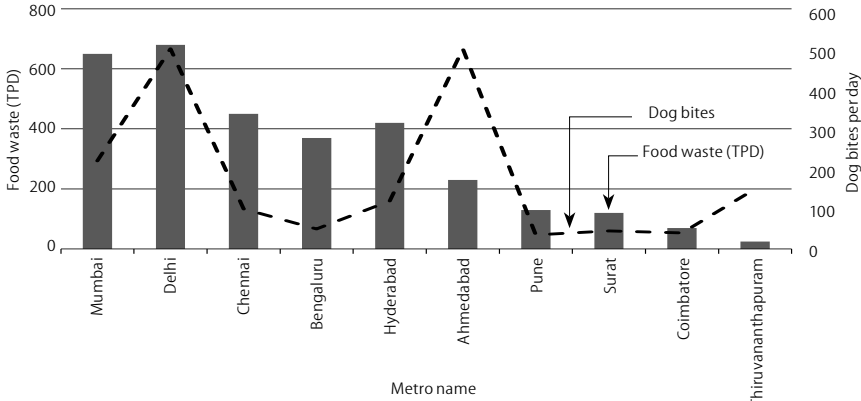


Figure 5: Municipal Solid Waste Generation vs Literacy Rate

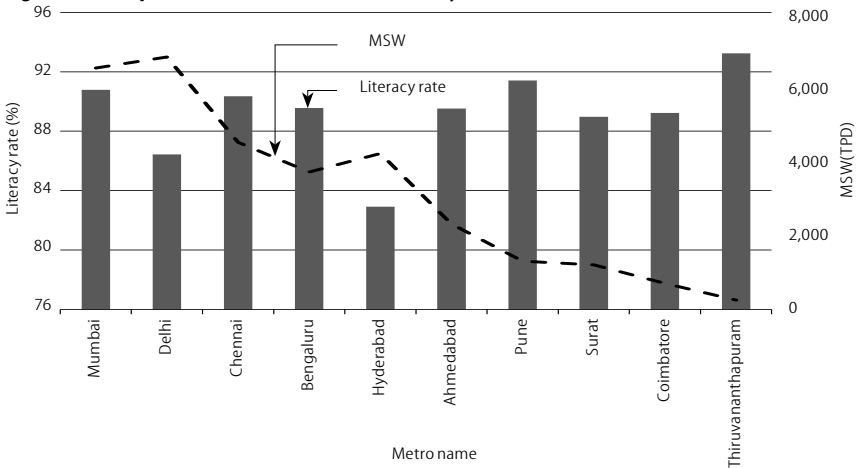
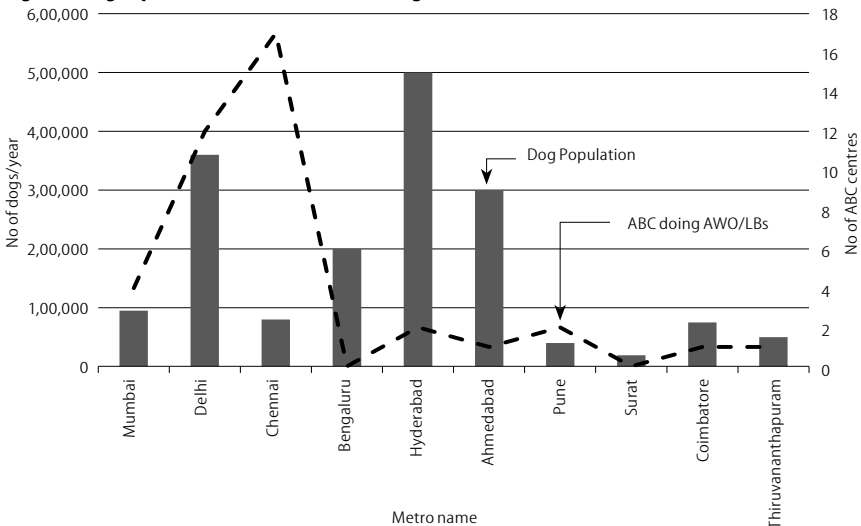


Figure 6: Dog Population vs AWOs/LBs Conducting ABC



responsible for the increase in the garbage generation and the unscientific and careless disposal of the same. It is a general scene in the country, more commonly in semi-urban locations, that people throw their domestic wastes, as well as other wastes from shops and trades, outside in a cavalier manner. Thus, the urban/semi-urban environment in India

has two features that encourage stray animal populations, exposed garbage dumping and slums. Approximately, 10%–50% of Indian msww is food and meat waste from homes, roadside eateries, vendors, hotels and restaurants, industries, slaughter houses and other commercial entities. The booming middle class and changing consumption patterns

are driving demands for meat in a country that had traditionally low meat intake and predominantly vegetarian food culture. This meat and poultry wastes along with some vegetarian wastes are the chief food sources for a flourishing stray dog population.

In many of the Indian cities, sale and use of carry bags less than 20 micron thickness and less than 8 × 12 inches in size are prohibited. Nevertheless, as the ban mostly fails to contain the use of plastic bags, people still extensively carry their daily food and other consumable items from the shops and throw the unused food waste in those plastic carry bags at public places or roadsides or sewers. Stray dogs are facultative scavengers and these leftovers provide ample source of food and support them to survive on the streets. Moreover, in Indian cities, stray dogs are also kept as free-roaming pets by slum-dwellers and homeless people, including ragpickers, who otherwise in Indian context, are doing yeoman service in recycling the solid wastes. In many places in the city metros, where there are some steps taken for domestic and municipal waste management, the garbage bins either are old, damaged or have failed in containing the solid wastes. Their dirty and unhygienic appearance encourages people to throw wastes from a distance rather than depositing them from close distance securely into the bins. Further, for the scarcity in the bins, only fewer streets are provided with sufficient garbage bins in clean and agreeable state. In the country not much care is given to clean the bins, no record of area-wise garbage generation is maintained, and no system for door-to-door garbage collection is in place in much of the places. Most of the civic bodies and private company/non-governmental organisations (NGOs) on contract for cleaning and transportation of garbage, have largely failed to deliver their objectives.

Furthermore, most of the municipalities are unable to provide the desirable level of conservancy services. Due to several such problems, the msww disposal has not been very effective in the country (Kansal et al 1998; Siddiqui et al 2006;

Kansal 2002). This condition is forcing residents to throw the litter arbitrarily on the roads or public places, which attracts stray dogs. Stray dogs also are at times supported by well-meaning people who provide them food out of sympathy, but in effect aggravate the risk from the dogs to the common public and vulnerable groups of the society. As the dogs turn to depend on meat and other leftovers, when they do not get sufficient food or when they feel incursion into their territories, they attack people, largely children as their soft targets. The blind faith of the authorities on centralised disposal and management mechanisms, in a corporate mode of operation, in a thickly populated and resource-stressed society like that of India has deteriorated the situation. Centralised mechanisms are effective in situations where the human habitations are clustered, and the producers of waste lesser in number, while in India, habitations are largely spread out and the population is high. Hence, in such situations, it is high time that the decentralised method of solid waste disposal is fostered, making people adopt household techniques for reduction of the quantity and effective disposal of wastes.

Availability of water: Water availability is another factor for the growing stray dog population. In spite of ever-growing civic water demand, the poorly managed urban water supply provides plenty of water for stray dogs. It has been estimated that water loss from the municipal water supply schemes in the country comes to at times more than a quarter (GOI 2011). From frequently breaching underground water connections, potholes, open drainages, leaking taps, stagnated rain or waste water, spillover from public water tanks and water tankers, water bowl maintained by dog lovers, and natural tanks (pond, lake and river) are water sources for the stray dogs. Discarded water bottles, other plastic containers, plastic pouches of filtered drinking water and other liquid products, widely available, just tossed around after partial consumption, a rough estimate showing more than 100 million in number, thrown all over the cities and towns in the country,

could also be an important source of water to dogs, other vermin and vectors. Dogs do not need to travel for long distances to satiate their thirst, as water would be available within a few footsteps.

Availability of shelter: Another important factor is the accessibility to shelters for resting as well as littering and caring the young ones for a couple of weeks. Rapid urbanisation ends up with real estate boom that indirectly enlarges derelict areas in the city and shady nooks and crannies to take shelter from the elements of nature mainly heat and cold. The shelters combined with streets/roads, as their territories that though flexible are defended, contribute to increasing the number of dogs and dog bites. The stray dogs, especially in groups, show possessive (towards food or other such items) and territorial aggression, chasing or challenging any intruder of its own kind or people, especially children who when frightened run prompting the chaser to intensify the pursuit and attack. It has been reported that, while in wild relatives of dogs such as wolves, there is a strong linear hierarchical structure in the group of socially bonded individuals leading to the formation of a pack (Boitani and Ciucci 1995), in stray or feral dogs the group hierarchy is more of aggregation, much looser and fluid with semi-open memberships, wherein individuals can “come and go with relative ease” (Haug 2005).

People sentiments: People’s sentiment is another important factor that determines the population and distribution of stray dogs in urban and semi-urban settings. Sympathy towards these animals is widespread (Bhatia 2015), especially among the better-off, explicit from the quite a lot of news in national newspapers. Justifications for that are overstretched occasionally arguing that the dogs are important in maintaining natural balance in garbage management (Sen 2015) and in controlling vermin such as rats. Some stray dogs are fed and collared by residents who value them as guards and as companions, although distant (Harris 2012). Such provisions, subsidising or caring, may be intentional or otherwise;

but intentional human care for the pups greatly reduces mortality in the early months of their life and leads to higher survival of the litter and consequent proliferation of the strays. People sympathise with these animals for various reasons, varied hues of kindness, values, ethics or other considerations.

These days, pet to stray dog conversion rate is high in Indian cities, while the reverse is much less. India’s burgeoning middle class, perhaps adopting western notions of pet ownership, and as a display of status in the society, rear pedigree dogs in their homes. Some people also keep many of them as guard dogs. However, it is said by many that several of the privileged pets at a later stage end up uncared and abandoned. They end up on the street, the cast-offs of breeders or owners who tire of the experiment, or the owners failing to care the animals after a while for various reasons. It is also, to an extent rightly, sympathised that “a tolerant, if not friendly attitude towards dogs can ensure their peaceful co-existence with us” (Majumdar et al 2014). But, the more-contextual issue is that how many of them and at what direct and indirect costs. The net result is as shown in a study from Mumbai that more than 70% of all animal bites are from stray dogs (Gogtay et al 2014). Moreover, from various corners of the country gruesome stories of dog bites are reported, too serious to play down by saying perhaps the public, especially the children, are not well-trained to be tolerant of the stray dogs and aware of their behavioural responses (Seligsohn 2014).

Chances of Dog Bites

In Indian cities, high-density vehicular movements with poorly maintained roads and widespread multi-shift work pattern, including duties during the night, high number of two-wheeler commuters are common. Stray dogs being on the streets have to survive the busy traffic and many dogs die in road accidents every day and many chase rash two-wheelers causing minor to major accidents (Dog News 2013), or people end up bitten by a stray dog. Dogs bite when they are scared, as mother dog to protect the pups, feel a sense of intrusion into their

territories or to guard their possessions and at the time of fight among themselves for limited territories and bitches. They are also known to attack on human interference such as throwing stones at them when they are sick, courting or attempting mating. There are high chances for dog bites when the streets and abandoned areas are not properly maintained or sufficiently lit.

Some of the studies also state that even climatic conditions or seasonal variations influence the dog's aggressiveness, especially during breeding season (August to January) (Pal et al 1998). Due to poor public awareness on stray dogs, people get panicky or run when a stray dog approaches them, triggering the chase instinct in dogs. Children love to play with dogs and at times, they are bitten by them because of unknown provocation (Chun et al 1982). Finally, surplus food in the surrounding with occasional starvation due to many reasons, instil wild behaviour in dogs, leading to attack on other animals. Such an avenue of food alters their behaviour, they would become less dependent on or accommodative to humans, at times growing aggressive towards them and other animals, even wild birds and small mammals.

AWBI and ABC

The AWBI, constituted under the Prevention of Cruelty to Animals Act, 1960 is the statutory body that ensures that animal welfare laws in the country are diligently followed, provides monetary aids to AWOs and advises the government on related issues. There are 122 recognised AWOs or LBS conducting ABC programmes in India. Our analysis reveals that the number of ABC centres are insignificant as per the dog population and dog-bite menace in most places in the country. In some pockets, they are effective, but their thin spread is a challenge across the country.

The number of ABC surgeries performed by the AWOs/LBS per day or month is inadequate to combat the growing stray dog hazard. Because of that, the board is struggling to rope in NGOs or others concerned with animal welfare to execute the National Rabies Control Programme

launched in Haryana in March 2015. Due to dearth of funds and outdated policies and execution, the government's two-pronged programme—to control their numbers through sterilisation and to prevent the spread of rabies—has been hanging fire. Rabies control efforts were limited to elimination of stray dogs until 2004. This was abandoned after the ban on killing of dogs as per court orders in 2005. The ban on killing dogs was followed by a perceptible increase in number of stray dogs and corresponding increase in dog bites and rabies cases in humans. This was followed by strong public opinion and pressure from civil society organisations for taking up immediate control measures. As per the Animal Birth Control (Dog) Rules notified in December 2001 under the Prevention of Cruelty to Animals Act, 1960 and the Supreme Court orders, killing stray dogs is prohibited except in special cases when they are terminally ill or rabid, certified by the competent authorities. Besides, stray dogs can only be removed from their habitats for neutering and vaccination against rabies. It is said that even while the acts and regulations relating to wildlife protection in India provide permission for culling dangerous animals, proscribing culling of stray dogs is making fun of legal system, environmentalism and human values (Faizy 2015).

It is also questioning the right of peaceful life for the common public. Culling or euthanasia has been a well-debated means of managing unwanted animal populations (James 2014; Ortega-Pacheco and Jiménez-Coello 2011). There are issues raised about culling that the vacant ecological space left free by removed animal will be occupied by immigrant individuals, which would be in effect applicable in case of birth control as well since the expanding ecological space provides for new generation, new recruits. In the former, the time span is shorter (weeks to months) if animals are present in the neighbourhood, while in the latter it is a bit longer (months). Both require continuity in action to avoid this problem, to eliminate the source of new recruitment to the locality. Objections to culling or euthanasia are based on real or

perceived cruelty to animals. Nevertheless, that technique remains an immediate means for controlling population in specific situations.

In consideration of the widespread incidence of dog attacks and public protest, the Government of Kerala took up the programme to eliminate the stray dogs (*Hindustan Times* 2015) in the state, a step which in effect, is only a partial solution (an end-of-pipe solution) since it does not address the dog menace from its root cause, that is, control of the reasons for their abundance and reducing the ecological space available for them. Nevertheless, in the case of stray dogs, other means are available; viable if conducted extensively and intensively, as legal, ethical views or perspectives of the vocal citizens and groups do not permit culling/euthanasia.

Even though ABC is a viable and worldwide used technique to overcome the worries from booming dogs on the streets, in India, being conducted on a small scale, its efficacy is doubtful. Moreover, the life span of a dog would be many years and the aggressor animal, if left free in the street, is a long-acting threat to public safety and health; a reason for its immediate removal from the scene. There are reports from the country of the ABC–Anti Rabies (AR) programme showing success and feasibility in controlling street dog population and incidences of rabies in dogs and humans (Krishna 2010; Anonymous 2003; Rajan 2013). In Jodhpur, it is reported that at the present rate of sterilisation, 13–18 years would be required to stabilise the population and that 40% sterilisation could maintain the population at the current levels (Tottona et al 2010). Some cities report success stories of ABC–AR programme in official records, although the reality would be a bit different. There are several loopholes in the ABC–AR programme, implemented in many Indian metros, which cause its failure. Insufficient infrastructure, logistics, man power, training and competence, kennels and surgical equipment, ill-adherence to pre- and post-operative procedures framed by AWBI and perhaps selection of inappropriate NGOs to execute the programmes are some of the explicit or implicit reasons.

In fact, the dearth of funds and outdated directives remain as the two major hurdles for the success of ABC-AR programme. Animal welfare experts say that the cost of sterilising dogs had increased with time and it may be more than ₹ 770 per dog, while government agencies stick to the decade-old estimate of ₹445 per dog. While, as per some reasonable estimates, the number of street dogs in India is between 25 million and 30 million, the more than 10-year-old scheme for dog sterilisation and vaccination has an annual budget of only ₹3.5 crore. Thus, controlling this large population by way of “Catch, Neuter and Release (CNR)” with such meagre budget (Chandra 2014) is a huge challenge. Further, these programmes also overlook one of the basic reasons for rise in stray dog population: food and shelter available for them ad libitum. It is a well-known ecological principle that in favourable environment, with plenty of food and other resources, and absence of predator or other control measures, the population of a species would increase.

Moreover, a rough calculation shows that a couple of dogs with a successful litter of two pups could rise to more than 100 after a couple of years. One breeding pair of stray dogs can give rise to 2,000 in their lifetime. That is what is happening in the case of most abundant carnivore on earth, the stray dogs, offered with plenty of resources and no predator or control measure as a check on their population. The civic bodies of all cities and suburban areas while being inept in neutering the animals for various reasons also show their inability in appropriate garbage/waste management resulting in the dog population explosion. People often tend to be more sympathetic towards street dogs rather than being sensible in dumping wastes as well as in being responsible pet owners. Such outlook is of high significance because often it is the lesser-privileged children who are bitten, mauled and at times killed by the stray dogs. It would be right that (i) appropriate legal amendments are made to manage the dog population; (ii) neutering and vaccination programme should be sufficiently funded, expanded to all over the country, and should continue

persistently for the coming years; (iii) each dog should be marked and the custodians be fixed, as provided by some of the local rules and regulations in the country; and (iv) common holding facilities, shelters or pounds (for kennelling for life) are established in each revenue units.

Conclusions and Policy Implications

Control of stray dog population by the ABC method has little or no impact on population densities, unless it is accompanied with a group of actions such as reducing the carrying capacity of the habitat (by excluding sources of food, shelter, and human acceptance) as well as reducing the recruitment of the stray dogs. Garbage breeds stray animals, vermin and vectors. One cannot solve stray dog problem until one solves the local garbage issue. The local municipalities and corporations and other concerned agencies must give priority to ABC-AR, MSW management, providing identity number to each dog and common facilities such as pounds. A total ban or deterrent penalty for those dumping food and meat materials openly in streets must be imposed. The municipalities and NGOs have to ensure collection and segregation of waste from each household and set scientific waste management facilities. Finally, there is a need for public education to create awareness on human's role in controlling stray dog population, how to behave towards street dogs, methods for self-protection against dogs and first aid for dog bites.

REFERENCES

- Anonymous (2003): “The Animal Birth Control Programme—Help in Suffering, Jaipur,” A Report of the Background, Methods and Results of the Help in Suffering Animal Birth Control Programme, Help in Suffering, Rajasthan, India, http://www.hsi.org/assets/pdfs/eng_abc_animal_birth_control.pdf.
- Bhatia, S (2015): “Should Stray Dogs Stay or Go? Gurgaon's Divided,” *Times of India*, <http://timesofindia.indiatimes.com/city/gurgaon/Should-stray-dogs-stay-or-go-Gurgaon-divided/article-show/46880128.cms>.
- Boitani, L and P Ciucci (1995): “Comparative Social Ecology of Feral Dogs and Wolves,” *Ethology, Ecology & Evolution*, Vol 7, pp 49–72.
- Bourhvi, H, A Dautry-Varsat, P J Hotez and J Salomon (2010): “Rabies Still Neglected After 125 Years of Vaccination,” *PLoS Neglected Tropical Diseases*, Vol 49, No 11, pp e839, doi:10.1371/journal.pntd.0000839.

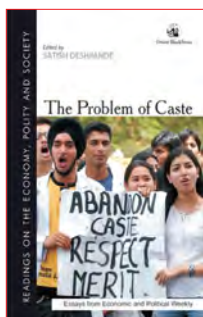
- Chandra, N (2014): “Anti-rabies Scheme Falters as India Is Overrun with 30 Million Stray Dogs,” Mail Online India, <http://www.dailymail.co.uk/indiahome/indianews/article-2597783/Anti-rabies-scheme-falters-India-overrun-30million-stray-dogs.html>.
- Chun, Y, J E Berkelhamer and T E Herold (1982): “Dog Bites in Children Less Than 4 Years Old,” *Paediatrics*, Vol 69, pp 119–20.
- Clifton, M (2012): “New Indian Data Cuts Worldwide Human Rabies Death Toll by 40%,” *Animal People*, <http://www.animalpeoplenews.org/anp/2012/07/03/newindiandatacutsworldwidehumanrabiesdeathtollby40/>.
- David, S (2007): “Bangalore: 45% of Stray Dog Victims Are Slum Children,” Quoting Dr B J Mahendra, Professor at Bangalore's Kempegowda Medical Institute and president of Association for Prevention and Control of Rabies in India (APCRI), <http://indiatoday.intoday.in/story/strayanimalsaresuicidalthreattoroadpeople/1-156195.html>.
- Dog News (2013): *The Digest of American Dogs*, Vol 29, No 34, pp 1–116, <http://www.indian-24news.com/india/stray-dogs-hound-two-wheeler-riders/38098-news>.
- Dutt, A K, R Akhtar and M McVeigh (2006): “Surat Plague of 1994 Re-examined,” *Southeast Asian Journal of Tropical Medicine and Public Health*, Vol 37, No 4, pp 755–60.
- Faizy, S (2015): “Know What Gandhi Said: There Should be Law to Kill Street Dogs (in Malayalam),” *Malayalam Vaarika*, Vol 19, No 18, pp 12–16, www.malayalamvaarika.com.
- Farnworth, M J, K A Blaszkak, E F Hiby and N K Waran (2012): “Incidence of Dog Bites and Public Attitudes towards Dog Care and Management in Samoa,” *Animal Welfare*, Vol 21, pp 477–78.
- Gogtay, N J, A Nagpal, A Mallad and K Patel (2014): “Demographics of Animal Bite Victims and Management Practices in a Tertiary Care Institute in Mumbai, Maharashtra, India,” *Indian Journal of Medical Research*, Vol 139, pp 459–62.
- GoI (2011): “Report of the Working Group on Urban and Industrial Water Supply and Sanitation for 12th Five Year Plan (2012–2017),” submitted to the Steering Group on Water Sector, Government of India.
- Harris, G (2012): “Where Streets Are Thronged with Strays Baring Fangs,” *The New York Times*, ASIA PACIFIC, New Delhi Journal, http://www.nytimes.com/2012/08/07/world/asia/india-stray-dogs-are-amenace.html?_r=0.
- Haug, L I (2005): “Dominance: The ‘Dirty’ Word,” The Association of Pet Dog Trainers Chronicle of the Dog, 1-800-PET-DOGS, http://4pawsu.com/dominance_haug.pdf.
- Hindustan Times (2015): “Bitten and Bruised by Stray Dogs, Kerala Cracks Down,” *Hindustan Times*, Thiruvananthapuram, <http://www.hindustantimes.com/india/bitten-and-bruised-by-stray-dogs-kerala-cracks-down/story-APBMeICja3BBLouhBl8POL.html>.
- Jack London (2008): *The Call of the Wild*, New York: Macmillan Publishers.
- James, W (2014): “Killing Wildlife: The Pros and Cons of Culling Animals (interview with Mary Pearl),” National Geographic, <http://news.nationalgeographic.com/news/2014/03/140305-culling-badgers-deer-bison-swans-ethics-conservation/>.
- Kansal, A, R K Prasad and S Gupta (1998): “Delhi Municipal Solid Waste and Environment—An Appraisal,” *Indian Journal of Environmental Protection*, Vol 18, No 2, pp 123–28.

- Kansal, A (2002): "Solid Waste Management Strategies for India," *Indian Journal of Environmental Protection*, Vol 22, No 4, pp 444–48.
- Kharab, R S (2015): "State-sponsored Killing of Dogs in India after Rabid Attacks," Worldcrunch, <http://www.worldcrunch.com/culture-society/state-sponsored-killing-of-dogs-in-india-after-rabid-attacks/c3519501/>
- Krishna, S C (2010): "The Success of the ABC-AR Programme in India," available at: <http://www.strays.in/wp-content/uploads/2011/07/The-Success-of-the-ABC-AR-Programme-in-India-D-R-Chinny-Prakash.pdf>.
- Kumar, A and R Paliwal (2015): "Feral Dogs of Spiti Valley, Himachal Pradesh: An Emerging Threat for Wildlife and Human Life," *Current Science*, Vol 108, No 10, pp 1799–1800.
- Majumdar, S S, A Chatterjee and A Bhadra (2014): "A Dog's Day with Humans: Time Activity Budget of Free-ranging Dogs in India," *Current Science*, Vol 106, No 6, pp 874–78.
- Massei, G and LA Miller (2013): "Nonsurgical Control for Managing Free-roaming Dog Populations: A Review of Products and Criteria for Field Applications," *Theriogenology*, Vol 80, pp 829–38.
- NIUA (2011): "India's Urban Demographic Transition: The 2011 Census Results (Provisional)," JNNURM Directorate, Ministry of Urban Development and National Institute of Urban Affairs, New Delhi, Government of India, <http://www.indiagovernance.gov.in/files/urbandemographic-transition.pdf>
- Ortega-Pacheco, A and M Jiménez-Coello (2011): "Debate For and Against Euthanasia in the Control of Dog Populations, Euthanasia—The "Good Death" Controversy in Humans and Animals," Josef Kure (ed), http://cdn.intechopen.com/pdfs/19620/InTechDebate_for_and_against_euthanasia_in_thecontrol_of_dog_populations.pdf.
- Pal, S K, B Ghosh and S Roy (1998): "Agonistic Behaviour of Free-ranging Dogs (*Canis familiaris*) in Relation to Season, Sex and Age," *Applied Animal Behaviour Science*, Vol 59, No 4, pp 331–48.
- Rajan, R (2013): "A Voice for Chennai's Street Dogs," *Hindu*, <http://www.thehindu.com/opinion/oped/a-voice-for-chennai-street-dogs/article480-0304.ece>.
- Seligsohn, Dinah (2014): "Dog Bite Incidence and Associated Risk Factors: A Cross-sectional Study on School Children in Tamil Nadu," Degree Project, Faculty of Veterinary Medicine and Animal Science, Department of Biomedical Sciences and Veterinary Public Health, Swedish University of Agricultural Sciences, <http://stud.epsilon.slu.se/6622/>.
- Sen, R (2015): "Kerala's Plans To Get Rid of Stray Dogs Could Bite It in the Butt," *F Living*, <http://www.firstpost.com/living/keralas-plans-get-rid-stray-dogs-bite-butt-2352266.html>.
- Sepúlveda, M A, R S Singer, E Silva-Rodríguez, P Stowhas and K Pelican (2014): "Domestic Dogs in Rural Communities around Protected Areas: Conservation Problem or Conflict Solution?," *PLoS ONE* Vol 9, No 1, pp e86152, doi:10.1371/journal.pone.0086152.
- Siddiqui, T Z, F Z Siddiqui and E Khan (2006): "Sustainable Development Through Integrated Municipal Solid Waste Management (MSWM) Approach: A Case Study of Aligarh District," Proceedings of National, Conference of Advances in Mechanical Engineering (AIME-2006), Jamia Millia Islamia, New Delhi.
- Silva-Rodríguez, E A and K E Sieving (2012): "Domestic Dogs Shape the Landscape-scale Distribution of a Threatened Forest Ungulate," *Biological Conservation*, Vol 150, pp 103–10.
- Strand, P (2011): "Global Stray Dog Population Is in Crisis: US Humane Relocation Is Not an Answer," National Animal Interest Alliance (NAIA) Animal Policy Review, <http://www.naiaonline.org/uploads/NewsletterFiles/An-PolRevSpring2011.pdf>.
- Tenzin, Dhand N K, T Gyeltshen, S Firestone, C Zangmo and C Dema et al (2011): "Dog Bites in Humans And Estimating Human Rabies Mortality In Rabies Endemic Areas Of Bhutan," *PLoS Negl Trop Dis* Vol 5, No 11, pp e1391, doi:10.1371/journal.pntd.0001391.
- Tottona, S C, A I Wandeler and J Zinsstag et al (2010): "Stray Dog Population Demographics in Jodhpur, India Following A Population Control/Rabies Vaccination Program," *Preventive Veterinary Medicine*, Vol 97, No 1, pp 51–7. doi:10.1016/j.prevetmed.2010.07.009.
- Vanak, A T and M E Gompper (2009): "Dogs *Canis familiaris* as Carnivores: Their Role and Function in Intraguild Competition," *Mammal Review*, Vol 39, No 4, pp 265–83.
- WHO (2009): "India's Ongoing War against Rabies," *Bulletin of the World Health Organization Past Issues*, Vol 87, No 12, pp 885–964, <http://www.who.int/bulletin/volumes/87/12/09-021209/en/>.
- (2013): "Animal Bites," Media Centre – fact sheets, <http://www.who.int/mediacentre/factsheets/fs373/en/#>.
- Young, J K, K A Olson, R P Reading, S Amgalanbaatar and J Berger (2015): "Is Wildlife Going to the Dogs? Impacts of Feral and Free-roaming Dogs on Wildlife Populations," *BioScience*, Vol 61, No 2, pp 125–32.

The Problem of Caste

Edited by

SATISH DESHPANDE



Pp xi + 425 Rs 595
ISBN 978-81-250-5501-3
2014

Caste is one of the oldest concerns of the social sciences in India that continues to be relevant even today.

The general perception about caste is that it was an outdated concept until it was revived by colonial policies and promoted by vested interests and electoral politics after independence. This hegemonic perception changed irrevocably in the 1990s after the controversial reservations for the Other Backward Classes recommended by the Mandal Commission, revealing it to be a belief of only a privileged upper caste minority – for the vast majority of Indians caste continued to be a crucial determinant of life opportunities.

This volume collects significant writings spanning seven decades, three generations and several disciplines, and discusses established perspectives in relation to emergent concerns, disciplinary responses ranging from sociology to law, the relationship between caste and class, the interplay between caste and politics, old and new challenges in law and policy, emergent research areas and post-Mandal innovations in caste studies.

Authors: Satish Deshpande • Irawati Karve • M N Srinivas • Dipankar Gupta • André Béteille • Rajni Kothari • Kumkum Roy • Sukhadeo Thorat • Katherine S Newman • Marc Galanter • Sundar Sarukkai • Gopal Guru • D L Sheth • Anand Chakravarti • Carol Upadhyaya • Ashwini Deshpande • Meena Gopal • Baldev Raj Nayar • Gail Omvedt • Mohan Ram • I P Desai • K Balagopal • Sudha Pai • Anand Teltumbde • Surinder S Jodhka • Ghanshyam Shah • Susie Tharu • M Madhava Prasad • Rekha Pappu • K Satyanarayana • Padmanabh Samarendra • Mary E John • Uma Chakravarti • Prem Chowdhry • V Geetha • Sharmila Rege • S Anandhi • J Jeyaranjan • Rajan Krishnan • Rekha Raj • Kancha Ilaiah • Aditya Nigam • M S S Pandian

Orient Blackswan Pvt Ltd

www.orientblackswan.com

Mumbai • Chennai • New Delhi • Kolkata • Bengaluru • Bhubaneswar • Ernakulam • Guwahati • Jaipur • Lucknow • Patna • Chandigarh • Hyderabad

Contact: info@orientblackswan.com

Outbreak of dengue in Tamil Nadu, India

R. Chandran* and P. A. Azeez

Division of Environmental Impact Assessment,
Sálim Ali Centre for Ornithology and Natural History,
Anaikatty, Coimbatore 641 108, India

Dengue is known in India since 1940s, but the disease is very limited in its spread. Dengue is becoming rampant in many states of southern India. As of now, no specific treatments (therapies) or vaccines are available against the disease. The people of Tamil Nadu and Puducherry, where the dengue incidences are increasing, perceive this spurt as due to poor rainfall and power supply. We attempted to verify this perception. We also sought to find out whether these factors are in concert with the monthly surveillance reports, used to predict yearly dengue cases by formulating a prediction model. The results showed that a combination of rainfall and power supply had major effect on the spread of dengue. The prediction model, incorporating rainfall and power supply data for four seasons, could not predict the dengue outbreaks accurately. Due to poor rainfall and power supply, people resort to storing water when power is available, and this prolonged open storage of water provides habitat for the vector to breed. The present study emphasizes the need to strengthen the surveillance system for timely and effective execution of vector-control programme. It also highlights the need to improve awareness among the public about the vector's ecology. The strategy against such vector-borne diseases has to focus more on environmental health rather than only on disease management that is patient-centred, largely curative and chemical/medicine intensive.

Keywords: *Aedes aegypti*, dengue, power cut, rainfall deficit.

GLOBALY climate change is getting reflected in unusual rainfall pattern leading to surplus rains in some locations, deficient rains elsewhere and untimely burst in rainfall. Studies indicate that the South Indian states are facing perceptible fluctuations in climatic conditions, and possibly the health of people is directly or indirectly affected because of these fluctuations^{1,2}. Rise in average temperature, an element of climate change, favours higher breeding and spread of the vectors such as *Aedes aegypti*, and consequently spread of dengue virus³. In general, incidences of dengue fever, a mosquito-borne tropical disease (Flavivirus, an RNA virus of the family Flaviviridae), are increasing fast resulting in higher morbidity and mortality in humans worldwide, particularly in tropical and subtropical countries⁴. More than 2.5 billion people of the global population are at risk and 50–100 million dengue

infections per year are likely⁵. Earlier in India, although dengue fever was recognized as a classical disease with high morbidity, but no mortality, the disease was mainly restricted to urban and semi-urban areas because of the favourable breeding sites for the vector *A. aegypti*^{6–8}. During the past few years, the frequency of dengue hemorrhagic fever (DHF) has increased remarkably in South India^{9–11}. The density and distribution of the vector depend on a few vital environmental factors such as season, temperature, rainfall and humidity that vary with latitude and altitude^{12–14}. The life span of the vector is strongly influenced by temperature and humidity and it survives best between 16°C and 30°C and relative humidity of 60–80%. The abundance of *A. aegypti* fluctuates with unusual rainfall pattern and water storage, as it breeds well in the open containers in and around houses¹⁵. Manmade factors such as environmentally negligent developmental activities also cause outbreaks at new locations^{16,17}.

Tamil Nadu gets rains in four spells: winter (January–February), pre-monsoon (March–May), monsoon (June–September) and post-monsoon (October–December). The northeast monsoon, starting in October and lasting up to December, is marked with heavy rainfall, whereas the southwest monsoon, from June to September, accounts for moderate rainfall. Rainfall is scanty in the pre-monsoon period. Of the total annual rainfall (945 mm) in the state, 48% is received during the northeast monsoon, 32% during the southwest monsoon and the rest during other seasons.

Rainfall critically influences several crucial issues of people¹⁸. Many towns and cities in Tamil Nadu and Puducherry are dependent on rivers for drinking water and deficit in rainfall reduces drinking water supply. Three consecutive rain-deficit years (2011, 2012 and 2013) and delayed monsoons have created drought-like situations; overall shortfall was 20–23% of the annual average rainfall¹⁹. The reduced rainfall also causes shortfall in power output from hydroelectric projects, and the changes in wind pattern, intensity and speed lead to decline in wind-generated electricity²⁰. Taking into account the economics of power purchase, there is no choice but drastic compulsory power cuts to counter the power shortage. Because of extended 16-hour daily power cuts in some parts of the state, people are forced to store water in open containers^{21,22}. An important, but indirect effect of this seems to be proliferation of *A. aegypti*, the vector spreading dengue. In 2010–2012, outbreaks of dengue/chikungunya-like illnesses with severe clinical manifestations were reported from several districts of Tamil Nadu, such as Tirunelveli, Virudunagar, Theni, Madurai, Thiruvallur, Vellore and Dharmapuri. Although the exact number of fever cases or number of fatalities is not available, approximately few hundred thousand people were affected^{23,24}.

In this context, the present study was designed to explore the relationships of rainfall and power supply

*For correspondence. (e-mail: chandran.r.123@gmail.com)

with the dengue incidences to develop a model that can predict future possible seasonal dengue cases in Tamil Nadu and Puducherry that could be used for prevention and control of dengue outbreaks.

In this study, we have used three (2010–2012) years' monthly data on rainfall, power supply and reported cases of dengue in Tamil Nadu and Puducherry. The number of dengue cases was collected from the weekly disease alert reports of the Integrated Disease Surveillance Project (IDSP) launched by the Government of India through Central Surveillance Unit (CSU), State Surveillance Units (SSU) and District Surveillance Units (DSU). The annual dengue count from the National Vector Borne Disease Control Programme (NVBDCP) is prepared based on reports received. The state-wise monthly power supply data was sourced from the Central Electricity Authority (CEA) and the climatic data from the India Meteorological Department (IMD), Pune.

The data on monthly rainfall and power supply were correlated with the monthly dengue case. Data on seasonal rainfall and power supply were taken as independent variables and the reported dengue cases as dependent variable while attempting Pearson correlation. A regression model was also attempted to predict dengue incidences from the independent variables. One-way analysis of variance (ANOVA) was done to see if each of the variables differs significantly among seasons and Student's *t*-test was used to check the null hypothesis on validity of the prediction model. For prediction of seasonal dengue incidences, the two independent variables' (rainfall and power supply) deficit measurement units (mm and MW respectively) were converted into percentage units and weekly IDSP dengue numbers were grouped into seasonal numbers.

Over the last 5 years (2008–2012), 22,584 dengue cases were reported from Tamil Nadu region by NVBDCP and the number of reported cases varied from year to year. The highest dengue incidences were reported in 2012 ($n = 15,770$) and lowest in 2008 ($n = 565$, Figure 1). Interestingly, every year, until 2011, there was a 175% increase. But the increase in 2012 was 532%, three times more than the earlier years.

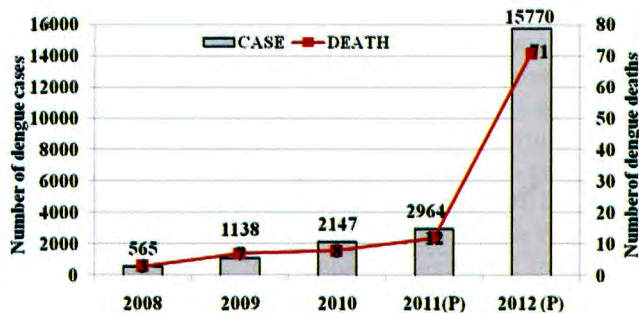


Figure 1. Dengue incidences and deaths during 2008–2012 in Tamil Nadu and Puducherry ($n = 22,584$) according to NVBDCP. P = Provisional.

Dengue cases showed a specific pattern of occurrence. In each year, except in 2010, while hardly there was any dengue case in winter, most cases were reported during northeast monsoon. The monthly data showed a distinct pattern in dengue incidences in 2012, a pattern hardly seen in 2011 or 2010. Substantial incidences were reported in June, a peak in October followed by gradual decline towards the beginning of the next year, reaching lowest in February (Figure 2). Across the seasons and years, the number of dengue cases varied; in 2012, the numbers increased from winter to northeast monsoon; in 2011, the numbers remained almost the same for the first three seasons and increasing in post-monsoon. In 2010, it wavered in all the four seasons (Table 1). The rainfall during these three years also varied considerably; in 2012, severe deficit in all the four seasons was seen, while in 2011 and 2010 the rainfall was in excess in two seasons and deficit in the rest (Figure 3). In general, the dengue outbreaks coincided mainly with the northeast monsoon, followed by the southwest monsoon with moderate rainfall.

With respect to the districts, according to IDSP records maximum cases were reported from Viluppuram district (226) in 2010, Puducherry (152) in 2011 and Puducherry (1600) followed by Tirunelveli (1365) in 2012. However, the deaths were negligible in contrast with the number of cases reported in 2010 and 2011; but deaths were high (40) in 2012, especially from the Tirunelveli district (32 deaths, Table 2).

During the study period, the average seasonal rainfall in winter was 18.7 mm, in summer 117.9 mm, in southwest monsoon 304 mm and in northeast monsoon sharply

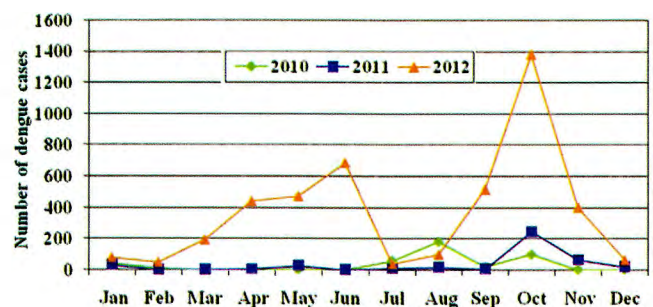


Figure 2. Monthly dengue cases in Tamil Nadu and Puducherry during 2010–2012 ($n = 5265$) according to the IDSP surveillance report.

Table 1. Seasonal variation in number of dengue cases according to IDSP surveillance monthly alerts during 2010–2012

Season	2010	2011	2012
Winter	48	31	131
Summer	0	31	1112
Southwest monsoon	255	31	1347
Northeast monsoon	98	328	1853

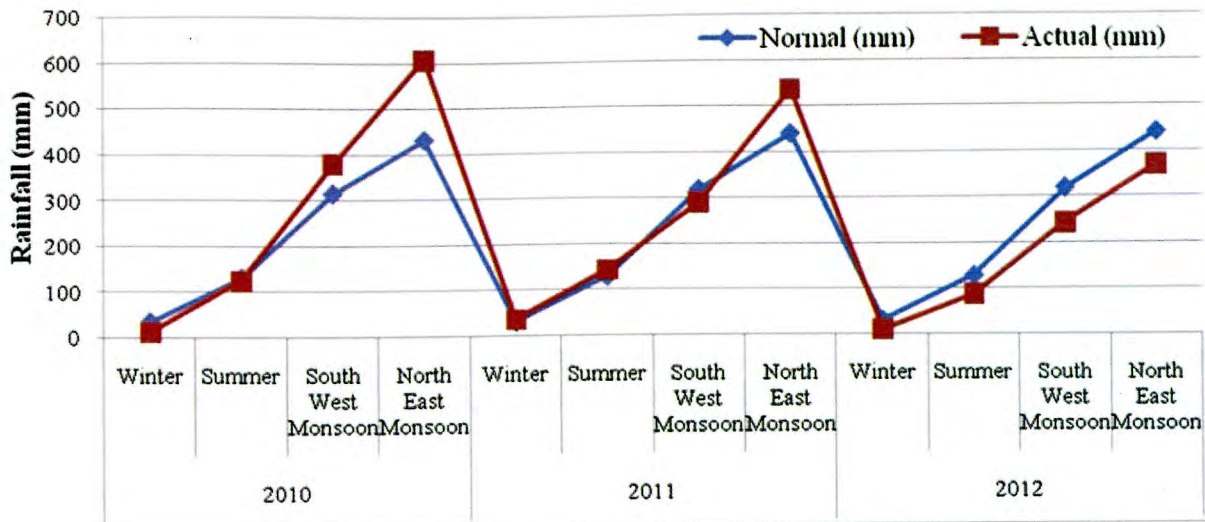


Figure 3. Seasonal rainfall pattern – normal versus actual rainfall (in mm) during 2010–2012 in Tamil Nadu and Puducherry.

Table 2. District-wise dengue cases and deaths each year in the study area according to IDSP surveillance monthly alerts during 2010–2012

District	2010		2011		2012	
	Case	Death	Case	Death	Case	Death
Ariyalur	–	–	7	–	–	–
Chennai	–	–	–	–	–	–
Coimbatore	–	–	13	–	–	–
Cuddalore	–	–	–	–	47	–
Dharmapuri	–	–	–	–	103	–
Dindigul	9	–	7	1	58	–
Erode	–	–	29	1	20	–
Kancheepuram	–	–	56	–	–	–
Kanniyakumari	–	–	–	–	–	–
Karur	–	–	4	–	17	–
Krishnagiri	–	–	–	–	11	–
Madurai	–	–	–	–	79	5
Nagapattinam	–	–	–	–	–	–
Namakkal	21	–	–	–	–	–
Perambalur	–	–	24	–	22	–
Pudukkottai	–	–	–	–	166	1
Ramanathapuram	–	–	37	–	224	2
Salem	18	–	8	–	106	–
Sivaganga	30	–	6	–	–	–
Thanjavur	–	–	20	–	132	–
The Nilgiris	–	–	–	–	–	–
Theni	–	–	11	–	35	–
Thiruvallur	–	–	–	–	–	–
Thiruvavur	22	–	–	–	55	–
Thoothukudi	–	–	–	–	80	–
Tiruchirappalli	–	–	16	–	156	–
Tirunelveli	–	–	16	–	1365	32
Tiruppur	–	–	–	–	–	–
Tiruvannamalai	27	–	–	–	67	–
Vellore	–	–	–	–	–	–
Viluppuram	226	–	16	–	67	–
Virudhunagar	38	1	–	–	33	–
Puducherry	10	–	152	1	1600	–
Total	401	1	422	3	4443	40

high 503 mm. The rainfall varied significantly (ANOVA $P < 0.05$) across the seasons. At the same time, seasonal rainfall deficit was not statistically significant (ANOVA $P < 0.05$). Regarding seasonal power supply, the average supply in winter was 9,889 MW, in summer 10,388 MW, during southwest monsoon 10,507 MW and during northeast monsoon 9,766 MW. However, the actual power supply and its deficit were not significantly different across seasons (ANOVA $P < 0.05$; Table 3). But the power deficit during winter was significantly lesser ($P < 0.05$) than in other three seasons.

The IDSP dengue cases were plotted against the seasonal rainfall and power supply to assess their associations. During the study period, while the rainfall deficit increased, the number of reported cases of dengue decreased. This was different from the pattern of declining rainfall deficit and concurrent inclining dengue cases during southwest monsoon to northeast monsoon (Figure 4). The same pattern of decreasing dengue case against power deficit was observed in these seasons except during the southwest monsoon. When the number of dengue incidences was plotted against annual rainfall and power supply, a distinct pattern (i.e. deficit increase concurrent with increasing dengue cases) was seen only during 2012 (Figure 5).

The incidences of dengue increased during northeast monsoon. The overall rainfall and power supply showed significant positive correlation with the weekly IDSP reported dengue cases ($r = 0.967, p = 0.033$ for rainfall, and $r = 0.972, p = 0.028$ for power supply). These positive correlations provided us a basis for a potential dengue prediction model. In this model, average monthly rainfall, power supply and the reported dengue cases were considered. We used tolerance measure to see collinearity between the two independent factors included in the

Table 3. Seasonal variation in rainfall, power supply and reported dengue cases during 2010–2012

Season	Average rainfall (mm)	Average rainfall (deficit/surplus) (mm)	Overall rainfall status (%)	Average power supply (MW)	Average power supply (deficit/surplus) (MW)	Overall power status (%)	Surveillance alert dengue cases
Winter	18.7	-14	-41	9,889	-2784	-12	210
Summer	118	-11	-9	10,388	-5149	-14	1,143
Southwest monsoon	304	-12	-3	10,507	-5045	-11	1,633
Northeast monsoon	504	69	16	9,766	-5328	-15	2,279

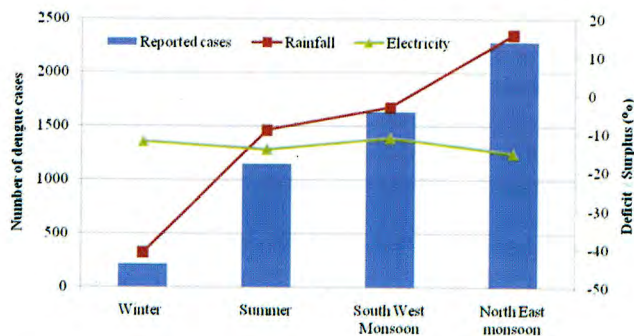


Figure 4. Seasonal variation in rainfall, power deficit and dengue cases reported by the IDSP surveillance alerts, during 2010–2012.

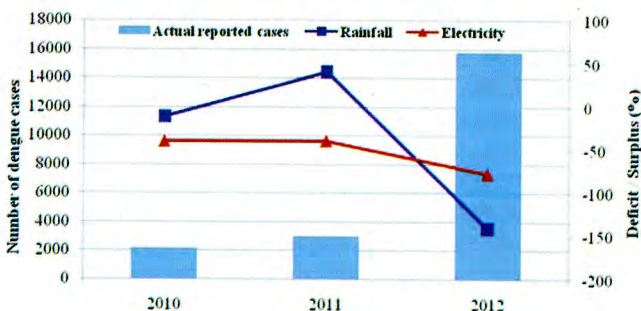


Figure 5. Annual rainfall, power deficit and number of dengue cases during 2010–2012.

model. The tolerance value of collinearity diagnostics (0.709) and Variance Inflation Factor (VIF = 1.141) fell clearly within the acceptable values >0.2 to <5 . We also checked the independence of the data points using Durbin Watson estimates. The value (2.151), noticeably away from zero, suggests significant independence of the data points.

The prediction model was developed using multiple regression of dengue cases with rainfall and power supply for all the seasons in three consecutive years. However, the model showed relatively higher accuracy in the prediction of actual dengue numbers reported by NVBDCP and but lower accuracy with that by IDSP. From this, it is clear that poor accuracy of the model could be due to influences of other variables (externalities) on the rainfall, power supply and dengue relationships (Table 4).

Table 4. Number of predicted and actual number of dengue cases during 2010–2012 according to prediction model

Cases	2010	2011	2012
Predicted	400	421	4442
Actual (NVBDCP)	2,147	2,964	15,770
Accuracy (%)	18.6	14.2	28.1

Table 5. Overall difference between predicted and actual number of cases during 2010–2012

Variables	N	Mean	SD	t-value	Significance
Predicted cases	3	1754.3	2327.6	-1.129	0.322*
Actual cases (NVBDCP)	3	6960.3	7640.3		

*Statistically not significant (t -test; $p < 0.05$).

We also attempted to evaluate the prediction capability of our model retrospectively to predict the number of dengue incidences that occurred in 2010, 2011 and 2012 in Tamil Nadu and Puducherry. When the predicted dengue cases were plotted against the actually reported cases for the respective years, the model exhibited significant correlation between the predicted and the actual number of cases ($r = 0.999$, $p = 0.031$). The overall difference between predicted and actual number of dengue cases was also insignificant ($t = -1.129$, $p = 0.322$, Table 5).

Dengue is becoming ubiquitous throughout the tropics, with local spatial variations in risk being influenced strongly by rainfall, temperature and degree of urbanization²⁵. The authors estimate that there were 96 million dengue infections globally in 2010. Asia, holding 70% (67 million infections, ranging between 47 and 94 millions) of this burden, is characterized by large densely populated human habitation highly conducive for disease transmission. India alone accounted for 34% of the global total; 33 million infections, ranging between 24 and 44 million. This number would certainly be higher if we take into account the very likely unreported dengue infections in the country²⁶. The country had dengue-like illnesses for long, although the virus was isolated in Japan only in 1943 and in Calcutta in 1944. The first clinically recorded epidemic of dengue-like illness occurred in Madras in 1780, but the full-blown confirmed dengue epidemic in

its severe form was reported from north India only in 1996 (ref. 27). In 2001, a major outbreak was recorded in Chennai, 90% of the 861 cases recorded from the whole of Tamil Nadu²⁸. The incidence brought out the community knowledge on dengue, vector transmission, breeding sites, biting behaviour and dismal preventive measures. Since then, the number of dengue incidences in Tamil Nadu has been increasing considerably²⁹ and the spread of the disease in rural³⁰ and semi-urban areas of Tamil Nadu has become a matter of concern for public health.

These frequent outbreaks stress the pressing need for putting in place permanent dengue surveillance systems in India. The Ministry of Health and Family Welfare established NVBDCP and formulated strategies, which were intensified during the XI five-year plan (2007–2012) for prevention and control of different vector borne diseases. After the implementation of the surveillance system in the country, the season and the area that require more attention in terms of monitoring, prevention and forecasting the impending outbreaks was identified³¹. However, the data-acquisition strategy needs further improvements; the present study also indicates the failure of the surveillance system in 2012, while it was relatively satisfactory in 2010 and 2011. Earlier studies on the relative prevalence and distribution have shown high *A. aegypti* larval indices during the monsoon and the post-monsoon period^{32–34}. The present study shows the outbreak coinciding mainly with the post-monsoon period of heavy rainfall (northeast monsoon). In India, hydroelectric power is a major source of power and severe rainfall deficit results in disruption of power generation. In 2012, the power shortage in the state, led to 14–18 hours power cut every day and this severely affected the public water supply, forcing people to adopt inappropriate water storage methods when power was available. Generally, dengue vector breeds in clear water, collected in open storage tanks or in plastic or other water holders left unattended. Such accumulated water provides perfect opportunity for the vector to flourish. Dengue cases were reported more during the months of northeast monsoon when power shortage was also relatively high. Nevertheless, the difference between total rainfall and power supply during the four seasons in a year not being statistically significant ($p < 0.05$) reveals the risk of vector-borne disease outbreaks being determined by other unknown complex factors.

The present study also reveals a few other interesting observations. First, the outbreaks coincided with the northeast monsoon with 1–2 times more number of dengue cases than during the southwest monsoon. Deficit in rainfall and power supply paved the way for severe outbreak in 2012. Such an outbreak did not happen in 2011 and 2010, because the deficit in one of the determinant variables was counterbalanced by the surplus in the other determinant variable. Secondly, in each year, the number of dengue cases varied almost corresponding to the fluctua-

tions in rainfall and power deficit. It was observed that the seasonal dengue infection in a particular season in a year was related with rainfall and power supply. However, across the years, these did not correlate adequately. This signifies the role of other factors, the externalities, in conjunction with rainfall and power supply, influencing dengue infection in a given geographical area. The present study shows that rainfall, as a single factor, likely plays a small but significant role. While power-cut alone was ruled out of any significant role, it along with the rainfall was important in the spread of dengue. However, earlier studies have reported no specific role for climatic factors in dengue infection^{35,36}. Thirdly, the present prediction model showed significant correlation with NVBDCP dengue cases, but not with IDSP dengue cases. This suggests that reliability of a prediction model in the case of contagious diseases, such as dengue, depends on accuracy and timely updation of the data by the surveillance system. It is discernible that IDSP does not have actual figures of dengue cases. Incidentally, highly populated districts such as Chennai, Coimbatore, Tiruppur and Vellore (where dengue is prevalent) and some coastal districts did not report any dengue cases in these three years. This would be possibly due to underreporting of the infections for the high dependency of patients on private health care, lack of adequate testing facilities, mix-up of the symptoms of dengue and other seasonal viral fevers and perhaps intentional attempts to underreport the cases. The flaws in the surveillance and reporting system could be a possible, but crucial, reason for the failure of this prediction model. Thus, possibly this model emphasizes the need for accurate IDSP alert reporting through better collection, collation, compilation and validation of data. It is also to be kept in mind that oversimplified prediction model without proper identification of the significant quantitative relations among the factors and externalities may lead to wrong forecast of epidemic outbreaks and might hinder prevention and control programme for the disease³⁷. Yet, the factors identified in the present study have inevitable roles in the overall dengue outbreak. This study also highlights the need for a detailed study taking into account various other factors, such as human population and mobility, urbanization rate, waste management, water supply and distribution and densities of vector mosquitoes. It is felt that strategy to deal with such vector-borne diseases has to be an integrated one, developed from environmental and health management perspectives rather than only from the standpoint of health management and therapeutics.

Dengue continues to spread to newer areas, newer populations and in increasing magnitude. This study examined rainfall, power supply and alerts from surveillance system as the factors for predicting dengue occurrences. The study also highlighted the importance of reliable and precise data for preparing a prediction model for the epidemic diseases. Further detailed studies could reveal the

relations of climatic, environmental and human-induced factors with dengue outbreaks, which would help in evolving strategies to deal with likely outbreaks well in advance. Surveillance programmes and appropriate models capable of detecting rise in vector outbreaks, strains, or disease emergence well in time are crucial.

- WHO, Climate change and human health: risk and responses. World Health Organization, Geneva, 2003; <http://www.who.int/globalchange/publications/climchange.pdf>
- Singh, P. K. and Dhiman, R. C., Climate change and human health: Indian context. *J. Vector Borne Dis.*, 2012, **49**(2), 55–60.
- Mishra, R. and Kumar, P., A study on outbreak of dengue from Bihar, India establishing new foci, attributable to climatic changes. *J. Public Health Epidemiol.*, 2011, **3**(11), 489–502.
- Gubler, D. J. and Kuno, G., *Dengue and Dengue Haemorrhagic Fever*, CAB International, London, 1997, 1st edn, p. 17.
- Guzman, M. G. *et al.*, Dengue: a continuing global threat. *Nature Rev. Microbiol.*, 2010, **S7–S16**; doi: 10.1038/nrmicro2460.
- Pandya, G., Prevalence of dengue infection in India. *Def. Sci. J.*, 1982, **32**, 359–370.
- Mohan Rao, C. V. R., Dengue fever in India. *Indian J. Paediatr.*, 1987, **54**, 11–14.
- Yadava, R. L. and Narasimham, M. V. V. L., Dengue/dengue haemorrhagic fever and its control in India. *WHO/SEARO Dengue News.*, 1992, **17**, 3–8.
- Bandyopadhyay, S., Jain, D. C. and Datta, K. K., Reported incidence of dengue/dengue haemorrhagic fever in India 1991–1995. *WHO/SEARO Dengue Bull.*, 1996, **20**, 33–34.
- Ramachandran, P. K., Sukumaran, D. and Rao, S. S. (eds), Proceedings of a symposium on entomology for defense services, 12–14 September, DRDO, Gwalior, 1990, p. 51.
- Thangarajah, P. S., Jeevan, M. K., Rajendran, R., Samuel, P. P. and Tyagi, B. K., Dual infection by dengue virus and *Plasmodium vivax* in Alappuzha district, Kerala, India. *Jpn. J. Infect. Dis.*, 2006, **59**(3), 211–212.
- Johansson, M. A., Dominici, F. and Glass, G. E., Local and global effects of climate on dengue transmission in Puerto Rico. *PLoS Neglected Trop. Dis.*, 2009, **3**(2), e382; doi:10.1371/journal.pntd.0000382.
- Chinery, W. A., A survey of mosquito breeding in Accra, Ghana during a two-year period (Sept. 1964–Aug. 1996) of larval mosquito control iii. The breeding of *Aedes aegypti*, Linnaeus, in Accra. *Ghana Med. J.*, 1970, **9**, 197–200.
- Surtees, G., The distribution, density and seasonal prevalence of *Aedes aegypti* in West Africa. *Bull. WHO*, 1967, **36**(4), 539–540.
- NVBDCP, Guidelines for clinical management of dengue fever, dengue haemorrhagic fever and dengue shock syndrome, 2008; <http://nvbdcp.gov.in/doc/clinical%20guidelines.pdf>
- Ilkal, M. A. *et al.*, Entomological investigations during outbreaks of dengue fever in certain villages in Maharashtra state. *Indian J. Med. Res.*, 1991, **93**, 174–178.
- Mehendale, S. M., Risbud, A. R., Rao, J. A. and Banerjee, K., Outbreak of dengue fever in rural areas of Parbhani district of Maharashtra (India). *Indian J. Med. Res.*, 1991, **93**, 6–11.
- Dhar, O. N. and Rakhecha, P. R., Foreshadowing Northeast Monsoon Rainfall over Tamil Nadu, India. *Mon. Weather Rev.*, 1983, **111**, 109–112; doi:10.1175/1520-0493(1983)111<0.109:FNMROT>2.0.CO;2.
- Venkat, V., 3 deficit years and an impending drought. *The Hindu*, Chennai, 2014; <http://www.thehindu.com/news/national/tamil-nadu/3-deficit-years-and-an-impendingdrought/article6230312.ece>
- Jain, S. K. and Kumar, V., Trend analysis of rainfall and temperature data for India. *Curr. Sci.*, 2012, **102**(1), 37–49.
- Stalin, J. S. D., The 16-hour power cuts in Tamil Nadu. *NDTV*, 2012; <http://www.ndtv.com/article/south/the-16-hour-power-cuts-in-tamil-nadu-286017>
- Ramakrishnan, T., Power cuts go up in Tamil Nadu. *The Hindu*, Chennai, 2012; <http://www.thehindu.com/news/national/tamil-nadu/power-cuts-go-up-in-tamilnadu/article4078407.ece>
- Wilson, J. J. and Sevarkodiyone, S. P., Breeding preference ratio of dengue and chikungunya vectors in certain rural villages of Virudhunagar district, Tamil Nadu, South India. *World Appl. Sci. J.*, 2014, **30**(6), 787–791; doi: 10.5829/idosi.wasj.2014.30.06.82347.
- Sudeep, A. B., Hundekar, S. L., Jacob, P. G., Balasubramanian, R., Arankalle, V. A. and Mishra, A. C., Investigation of a Chikungunya-like illness in Tirunelveli district, Tamil Nadu, India 2009–2010. *Trop. Med. Int. Health*, 2011, **16**(5), 585–588.
- Bhatt, S. *et al.*, The global distribution and burden of dengue. *Nature*, 2013, **496**, 504–507.
- Halasa, Y. A., Dogra, V., Arora, N., Tyagi, B. K., Nandand, D. and Sheperda, D. S., Overcoming data limitations: design of a multicomponent study for estimating the economic burden of dengue in India. *Dengue Bull.*, 2011, **35**, 1–14.
- Chaturvedi, U. C. and Nagar, R., Dengue and dengue haemorrhagic fever: Indian perspective. *J. Biosci.*, 2008, **33**, 429–441.
- Kumar, A. V. *et al.*, Studies on community knowledge and behavior following a dengue epidemic in Chennai city, Tamil Nadu, India. *Trop. Biomed.*, 2010, **27**(2), 330–336.
- Victor, J. T., Malathi, M., Asokan, R. and Padmanaban, P., Laboratory-based dengue fever surveillance in Tamil Nadu, India. *Indian J. Med. Res.*, 2007, **126**, 112–115.
- Paramasivan, R., Thenmozhi, V., Kabilan, L., Tewari, S. C., Arunachalam, N., Dhananjeyan, K. J. and Tyagi, B. K., Seroepidemiology of a focal outbreak of dengue in Tamil Nadu. *Indian J. Med. Res.*, 2006, **124**, 718–720.
- Sivagnaname, N., Yuvarajan, S. and Britto, D. R. L. J., Urgent need for a permanent dengue surveillance system in India. *Curr. Sci.*, 2012, **102**(5), 672.
- Kumar, R. R., Kamal, S., Patnaik, S. K. and Sharma, R. C., Breeding habitats and larval indices of *Aedes aegypti* (L) in residential areas of Rajahmundry town, Andhra Pradesh. *Indian J. Med. Res.*, 2002, **115**, 31–36.
- Sharma, R. S., Panigrahi, N., Kaul, S. M., Shivalal, Barua, K. and Bhardwaj, M., Status report of DF/DHF during 1998 in the National Capital Territory of Delhi, India. *Dengue Bull.*, 1999, **23**, 109–112.
- Katyal, R., Singh, K. and Kumar, K., Seasonal variations in *A. aegypti* population in Delhi, India. *Dengue Bull.*, 1996, **20**, 78–81.
- Brunkard, J. M., Cifuentes, E. and Rothenberg, S. J., Assessing the roles of temperature, precipitation and ENSO in dengue re-emergence on the Texas–Mexico border region. *SaludpublicaMex.*, 2008, **50**, 227–234.
- Rigau-Pérez, J. G., Ayuso-Lamadrid, A., Wolff, D. R., Reiter, P. and Kuno, G., Dengue severity throughout seasonal changes in incidence in Puerto Rico, 1989–1992. *Am. J. Trop. Med. Hyg.*, 1994, **51**, 408–415.
- Karim, M. N., Munshi, S. U., Anwar, N. and Alam, M. S., Climatic factors influencing dengue cases in Dhaka city: a model for dengue prediction. *Indian J. Med. Res.*, 2012, **136**, 32–39.

Received 7 July 2014; re-revised accepted 6 April 2015

INTERESTS, ATTITUDES, EXPECTATIONS AND PRACTICES OF BIRD-WATCHERS IN COIMBATORE

R.Chandran

Ph.D. Research Scholar, Salim Ali Centre for Ornithology and Natural History, Anaikatty,

Coimbatore – 641 108, Tamil Nadu, India

E-mail: chandran.r.123@gmail.com

P.A. Azeez

Director, Salim Ali Centre for Ornithology and Natural History, Anaikatty, Coimbatore – 641 108,

Tamil Nadu, India

Abstract

The interests, practices, attitudes and expectations of bird-watchers in Coimbatore of southern India were investigated, through questionnaires returned by 40 respondents, of whom 36 were males and four were females. Majority of the respondents tended to be middle-aged to elderly and were from diverse groups. The responses were evenly divided into 3 types, namely, 1) the most strongly shared views (>75%) were considered as most common characters, 2) the strongly-shared views (35% to 75%) were considered as common and 3) the less strongly-shared views (<35%) were consider as rare. The study showed that >70% of the Coimbatore birders were from different bird-watching organisations and surprisingly none of them from educational clubs. The study also revealed the preliminary/primary characteristics of the Coimbatore birders such as, like to see birds that are rare, threatened and never seen before; meantime birders choose their birding location based on the nearby natural history organizations guidance/advice; they were interested to identify birds and their ecology. They also enjoy socializing with other birders and all of them showed dislike for hunting birds; while they travelling often carry binoculars and keen on seeing wildlife other than birds; Birders receives enough supports from NGOs rather than government and private organisations for bird-watching and finally, they used to attend talks which have included bird-watching advice. This insists that the requirement of PPP (Public-Private Partnership) model to enhance bird watching in the region, and spread environmental awareness and conservation among wider segments of the society in and around the Coimbatore district.

Key Words: Interests, Attitudes, Expectations, Bird-watchers.

INTRODUCTION

Birding is probably one of the most cosmopolitan outdoor activities in existence. Birdwatchers have varying levels of knowledge, skill, interest, and satisfaction due to different degrees of involvement or desire in bird watching, apart from their own other personal professional qualifications. The term 'bird-watchers' embraces very diverse group of people and 'bird-watching' incorporates a very diverse group of activities (Jones and Buckley 2000), it is important to recognize meaningful groupings, within which the participation occurs. Based on the Birds of India and Google Analytics data, it would be reasonable to state that there are about 45,000 active bird-watchers in

India today (Sen 2010). The state of Tamil Nadu has probably the largest number of birders in the country. Coimbatore especially is one renowned district in Tamil Nadu for birdwatching and is land for more than 10 active birder groups. The fact that Coimbatore has in its easy access some of India's best birding areas is also a major reason for this.

The goal of this study was to explore the preliminary characteristics of birders according to their practices, needs and attitudes while birding, assuming that such information would help the local conservationists, administrators in the design and management of birding programmes, both within the city and in the regional area.

The chief aim of the study was to investigate the bird-watching population (birders) in terms of gender, age and organization. The study also aimed to document i) birdsthe birders would like to see, ii) howtheydecide where to go for bird-watching, iii) their attitude to birds and bird-watching, iv) their activity while travelling for bird-watching, v) from whom the birders receive support for bird-watchingand vi) birders’ participation in other programmes focused on birds.

Study Area

Coimbatore is located in the west of Tamil Nadu, bordering the state of Kerala. It is situated at an elevation of about 411 meters above MSL. It is surrounded by the WesternGhats on the west and north, with reserveforests and the (Nilgiri BiosphereReserve) on the northern side. The river Noyyalflows through Coimbatore and fills eight major tanks/wetlands during monsoon. Coimbatore is close to AnamalaiTiger Reserve andParambikulam National Park, home to a wide variety of flora and fauna typical of the South Western Ghats. The mean maximum and minimum temperatures here vary between 35°C and18°C.The highest temperature ever recorded is 41°C and lowest is 12°C. The average annual rainfall is around 700 mm with the North East and the South West monsoons contributing 47% and 28% respectively to the total rainfall.Coimbatore and its surroundings offer ideal climate for bird watching and associate activities.

METHOD

Customized questionnaireswere distributed to select birders based in Coimbatore and their practices and opinions were recorded.The questionnaire contained mainly three forms of enquiries. The first were statements to which respondents could ‘agree’, ‘neither agree nor disagree’, and ‘disagree’. The second were questions that extracted basic facts such as gender, age group etc. Some questions that were open-ended eliciting about the respondents’ bird-watching experiences in India and about what would

further enhance their experience formed the third type. The questions in general were not mutually exclusive.

RESULTS

Of the 65 questionnaires distributed 40 (66.6%) were returned relatively high return rate was expected given the active nature of the populationof the bird watchers.Respondents were spread across almost all age group and were from a wide range of occupations - permanent employees to school students. Therefore, their responses provide interesting indications of possible trends across a variety of societal segments. The majority of the respondents tended to be middle-aged to elderly. This would reflect either the nature of the bird-watching population or the relative willingness of the age group to fill out questionnaires.

The salient features of the responses from the birders are as follows.

Birders responses were evenly divided into 3 types, such as 1) The most strongly-shared views (>75%) were considered as most common characters, 2) The strongly-shared views (75% to 35%) were considered as common and 3) The less strongly-shared views(<30%)were consider as rare.

Figure 1: Age groups and gender of respondents

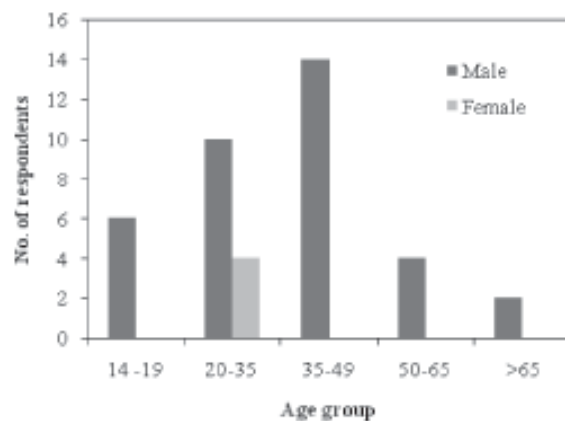


Figure 2 Birders belongs to

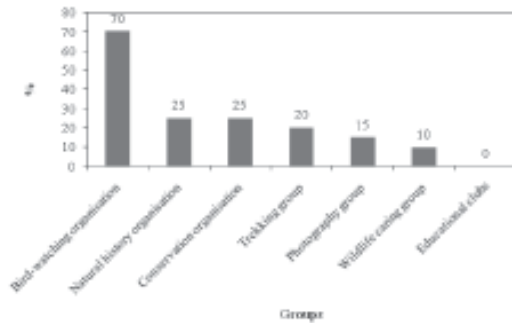


Table 1 Birders particularly like to see birds that are:

Feature	Very Important (%)	Important (%)	Not Important (%)
1 Rare species	85	15	0
2 Threatened species	75	25	0
3 Unique to India	75	10	15
4 Size, colour and bird call	70	15	15
5 Unique to the part of Tamil Nadu I'm visiting	65	10	25
6 Species my friends/colleagues/family have never seen	55	30	15
7 Species my friends/colleagues/family have never seen	40	25	35

Table 2 How bird-watchers decide where to go for bird-watching:

Feature	N	(%)
1 Natural history (including bird) organizations	22	55
2 Bird books or birdjournals	20	50
3 Literature	16	40
4 Magazines (News paper, Periodical, etc)	16	40
5 NGO's guidance	12	30
6 Internet browsing	10	25
7 Advice from friends/family	8	20
8 Television channel (Discovery, Animal planet, etc)	6	15

Table 3 Birders' attitudes towards birds and bird watching:

Statement	Generally A (%)	Neither A nor D (%)	Generally D (%)
1 Like to identify every bird I see	95	5	0
2 Bird-watching is one of my favorite activities	95	5	0
3 I am very interested in the ecology of birds	90	10	0
4 I am very interested in the behaviour of birds	90	10	0
5 I often re-visit bird-watching sites	80	15	5
6 Like to see children joining the group	80	10	10
7 Enjoy socializing with other bird watchers	75	10	15
8 I want to add as many species as possible to my life-list	75	10	15
9 I often read about birds of my destination before visiting	65	25	10
10 Spend a lot of time watching what the birds are doing	65	5	30
11 I would like to be able to identify every Indian bird	60	30	10
12 Birds are my favorite animals	60	20	20
13 I usually read a lot about my destination before the visit	60	20	20
14 Prefer no one to talk	55	30	15
15 Prefer to be alone	50	30	20
16 Guided visits spoil the wilderness feeling	45	25	30
17 I can identify females and juveniles of many Indian birds	40	35	25
18 I enjoy sketching or painting birds	25	45	30
19 Join in mainly because family or friends want me to	20	5	75
20 Would rather disturb a bird than fail to identify it	15	5	80
21 Soon get bored unless there is an entertaining colleagues	10	10	80
22 It's okay to flush birds from grass or heathlands for a sighting	10	5	85
23 Would rather disturb it from a nest than fail to identify it	5	5	90

Table 4 Birders' practice while travelling for bird watching:

Statement	Generally A (%)	Neither D nor A (%)	Generally D (%)
1 Often carry binoculars just in case I see an interesting bird	90	5	5
2 Am keen on seeing wildlife (other than birds)	85	10	5
3 Often record what birds I see (e.g. in a notebook)	65	25	10
4 Often take photos of wild birds	60	30	10
5 Often visit national parks or reserve sites for bird-watching	60	25	15
6 Willingly go camping to see a bird I've never seen	45	30	25
7 Find most information I need is readily available	40	30	30

A= Agree, D = Disagree

Table 5 Birders receives enough supports from:

Statement	Generally A (%)	Neither D nor A (%)	Generally D (%)
1 NGO's	65	15	20
2 Local community	40	20	40
3 Educational Institutions	20	25	55
4 Government organizations	20	20	60
5 Private companies	10	25	65

A= Agree, D = Disagree

Table 6 Birders have attended (during the past 5 years):

Programme	(%)
1 Travel talks which have included bird-watching advice	85
2 Meetings relevant to bird conservation	50
3 Meetings relevant to wildlife conservation generally	50
4 Public talks (e.g. at museums) on birds	40
5 Conferences focusing on birds	35
6 Adult education classes on birds	20
7 Photography classes including advice on bird or wildlife photography	20

*Some birders attended more than one programmes

CONCLUSION

This study revealed differences and similarities among the different groups of birders in terms of their interest, practices, attitudes and expectations. The pool of Coimbatore birders could be grouped into novice, active, experienced groups (Hvenegaard 2002) as is common elsewhere. It is found that Coimbatore birding remains more of male avocation. The birders here belong mostly to groups, which are into activities related to wilderness. It is yet to acquire a role in educational clubs or other socio-cultural groupings.

The birders in Coimbatore are found to comply with the bird watchers codes suggested by the British

Ornithologists' Union. They take birding as more than a recreation, are well aware of the technical aspects, and have contributed and continue to contribute much to the scientific knowledge of birds. They are also into other environment and habitat conservation activities. However, it is found that the distinct groupings involved in this avocation remain discrete and the groups are mostly formed of individuals who are close to each other, birding being only one of the link while other attributes form primary linkages.

It would be appropriate that bird watching groups are more integrated partnering in regional activities involving many public and private organizations. That would considerably enhance bird-watching, and spread environmental awareness and conservation among wider segments of the society in and around the district/state.

REFERENCES

- Hvenegaard, G.T. (2002). Birder specialization differences in conservation involvement, demographics, and motivations. *Human Dimensions of Wildlife*, 7, 21-36.
- Jones, D.N and Buckley, R. (2001). Bird-watching tourism in Australia, *Wildlife Tourism Research Report Series No. 7, Status Assessment of Wildlife Tourism in Australia Series, CRC for Sustainable Tourism*
- Reginald, J.L, Mahendran, C, Kumar, S.S and Pramod, P. (2007). "Birds of Singanallur lake, Coimbatore, Tamil Nadu". *Zoos' Print*, 22 (12): 2944-2948.
- Sen, S.K. (2010). Bird-watching in India – A Decade of Change. <http://www.kolkatabirds.com>