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Attitude towards Recycling: A Survey of High School Students in Coimbatore District, Tamilnadu, India

J. Jeyadevi*, M. Malarvizhi and S. Arulsamy*****

ABSTRACT

The principal objective of this study was to assess students' attitude towards recycling in an attempt to increase participation in recycling in schools.The study is based on quantitative research design and a descriptive survey of 9th standard students in Coimbatore District, Tamil Nadu, India. Samples were selected using simple random sampling method. The researcher surveyed 100 students from various schools in Coimbatore to assess the attitudes of students about recycling using a questionnaire. Participants were asked to provide demographic information and their attitudes about recycling. Data were analyzed using t-test and ANOVA. Respondents' attitude towards recycling is good and positive.

Keywords: recycling attitude, recycling value, personal belief, reduce and reuse, recycle.

Introduction

Understanding the attitude of students towards recycling is the key to improve the environmental performance. Positive attitude towards recycling may help students to participate in recycling and may lead to responsible behaviour of pupil in making the earth clean and green. School teachers have major role to develop positive attitude towards recycling among students, through the subjects they are teaching in school so that students could behave sensibly. This study will determine whether there are individual and societal factors that affect recycling attitudes. It is clear that recycling attitudes are affected by various factors and these factors need to be looked into in order to increase positive recycling attitudes amongst the students, . The attitudes of this age group will have a direct influence on the community. In the present study, researcher used a tool regarding students' attitude toward recycling and assessed their responses about recycling.

Need For the Study

Studies regarding recycling attitude are few in India and comparatively less on school students. Students come from home environment where recycling is a part of daily life. However, they must make a conscientious decision to continue that behaviour when away from home. The school years are an excellent time to increase environmental awareness and educate those students who are unfamiliar with recycling practices and to promote this behaviour. Environmental awareness and recycling behaviours learned early in the school may lead to a habit of recycling lifelong. Berger (1997) found that individuals who are better educated are

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more likely to recycle. The young student population is a good vehicle for disseminating recycling information to other consumer groups such as parents and peers (Koch & Domina, 1997).

Statement of the Problem

India's urban population generates tonnes of waste every day. Maximum percentage of waste comprises of domestic waste, and the rest being commercial waste. Various kinds of waste get generated and disposed of it in nearby area without caring for any kind of treatment. The Government of India, Local Government and Voluntary agencies have spent millions of rupees over the past few years in advertisements and campaigns related to recycling. These efforts were aimed at the public to increase their participation in recycling schemes. However, most Indians do not take part in a recycling scheme. Thus, much of the waste ends up in landfills and this is worsened by the fact that most landfills in India are open dumps. The rapid increase of solid wastes has detrimental effect on both humans and the environment. To reduce the amount of waste being disposed at landfill sites, the public needs to start reducing their waste followed by reuse and recycle (3R).

Uncertain attitudes on recycling of waste is an impediment to the implementation of effective recycling. For students this is not an issue of forefront in their mind. If they develop positive attitude towards recycling, they will take the message to the people from all walks of life. Being an educator, the investigator has strong contention that the destiny of the future world is in the hands of children. Most of the studies on solid waste management in India are technical in nature. To date there has been only few studies conducted to explore the recycling attitude of school students. Hence, the researcher has taken up the study that intends to explore the attitude of school students towards recycling and to make them actually participate in recycling.

Operational Defintions

Recycling Attitudes – A tendency to respond positively or negatively towards recycling based on prior knowledge, past judgments, and ideas. In the present study, recycling attitude has the following four dimensions:

Recycling value: - The worth of recycling and what it provides to a community or society.

Recycling Belief: - The belief that 'recycling is good' is founded on the benefits of avoiding landfill processes and the notion that material is reused and therefore does not need to be extracted from the environment.

Reduce and Reuse: - Attitude towards waste reduction and reducing consumption or buying less and reuse or find new uses for the items which has been already used.

Recycling: - Recycling is the practice of reusing items that would otherwise be discarded as waste or making a new product out of them.

High School Education:- Education offered to IX and X Standard from the age group of 14 to 15 at schools in Tamilnadu and Pondicherry states, India.

High School Students: - The students those who are studying IX and X standard.

Objective of the Study

To assess the high school students' attitude towards recycling

Hypotheses of the Study

H_0 -1: There is no significant difference in the mean score of male and female students with respect to (i) recycling attitude and its dimensions-(ii) recycling value, (iii) Personal Belief, (iv) Reduce and Reuse and (v) Recycle.

H_0 -2: There is no significant difference in the mean score of high school students with respect to (i) recycling attitude and its dimensions-(ii) recycling value, (iii) personal belief, (iv) reduce and reuse and (v) recycle based on type of school.

H_0 -3: There is no significant difference in the mean score of high school students with respect to (i) recycling attitude and its dimensions-(ii) recycling value, (iii) personal belief, (iv) reduce and reuse and (v) recycle based on locality of school.

Methodology

The investigators used normative survey method to study about the recycling attitude of high school students.

Sample: -A total sample of 100 students was taken up for the present study. Simple random sampling technique is used for the selection of sample. The stratification has been done on the basis of gender, type of school, and locality of school. Accordingly 100 questionnaires were distributed among students.

Tool: - The investigators developed a tool to measure the recycling attitude of high school students which contains twenty three statements. They opted to follow Likert's method of summated ratings to develop this scale. The tool has four dimensions namely, Recycling Value, Personal Belief, Reduce and Reuse, and Recycle.

Data collection : - For the data collection, the investigators approached the high school students in various schools in Coimbatore. The data was collected with the help of the developed tool. The investigators assured that their responses would be kept confidential and used for research purpose only. The gathered responses were scored.

Statistical Techniques: - The data collected were analyzed by using descriptive and inferential analysis. The investigators employed percentage, t-test and One-Way Analysis of variance (ANOVA) for the analysis and interpretation of the data.

Analysis of Data

Table: 1
Recycling Attitude of High School Students

Table: 1(a)

N	Mean	%
100	83.65	72.74

Table: 1(b)

Variables	Categories	N	Mean	%
Gender	Male	52	81.77	71.10
	Female	48	85.6	74.51
Type of School	Aided	13	82.31	71.57
	Private	38	83.61	72.70
	Government	49	84.04	73.07
Locality of School	Urban	36	80.75	70.21
	Rural	51	84.59	73.55
	Semi-urban	13	88.00	76.52

From the above table-1(a), it is clear that irrespective of gender, type of school, or locality of school all high school students showed high positive recycling attitude. The table-1(b) shows that the female respondents showed more positive recycling attitude (74.51%) than male respondents. The above table further reveals that students from Government schools have slightly more positive recycling attitude (73.03%) than the students from the aided and private schools. Semi-urban students showed more positive recycling attitude (76.52%) than rural and urban students.

H_0 – 1: There is no significant difference in the mean score of male and female students with respect to (i) recycling attitude and its dimensions-(ii) recycling value, (iii) Personal Belief, (iv) Reduce and Reuse and (v) Recycle.

Table: 2 (i)

Difference in the Mean Score of Male and Female Students with respect to Recycling Attitude and Its Dimensions

Dimension	Variable	N	Mean	S.D	t-Value	Result
Recycling Attitude	Male Female	52 48	81.77 85.69	9.164 9.885	2.057	p<0.05
Recycling Value	Male Female	52 48	27.54 29.02	3.455 4.633	1.482	p>0.05
Personal Belief	Male Female	52 48	23.77 25.21	4.350 4.366	1.650	p>0.05
Reduce and Reuse	Male Female	52 48	18.67 19.52	2.785 2.124	1.701	p>0.05
Recycle	Male Female	52 48	11.79 11.94	2.703 3.405	0.243	p>0.05

***Significance level at 0.05 level**

The Table – 2(i) shows that there is a significant difference between male and female high school students in their mean scores of recycling attitude. The calculated value of 't' (2.057) is greater than the table value. Hence the null hypothesis – 1(i) is rejected. However, there is no significant difference between male and female high school students in their mean scores of recycling attitude with respect to its dimensions. Hence, the null hypotheses – 1(ii, iii, iv and v) are rejected.

H_0 -2: There is no significant difference in the mean score of high school students with respect to (i) recycling attitude and its dimensions-(ii) recycling value, (iii) personal belief, (iv) reduce and reuse and (v) recycle based on type of school.

Table: 3 (i)
Difference in the Mean Score of High School Students With Respect to Recycling Attitude and Its Dimensions Based on Type of School

Dimension	Variable	N	Sum of Square		Mean Square Vale		F-Value	Result
			Between	Within	Between	Within		
Recycling Attitude	Type of School	100	30.983	9227.767	15.492	95.132	0.163	p>0.05
Recycling Value	Type of School	100	18.081	1654.669	9.041	17.058	0.530	p>0.05
Personal Belief	Type of School	100	14.064	1898.776	7.032	19.575	0.359	p>0.05
Reduce and Reuse	Type of School	100	26.612	598.748	13.306	6.173	2.156	p<0.05
Recycle	Type of School	100	2.070	915.970	1.035	9.443	0.110	p>0.05

Table: 3 (ii)
Post Anova

DIMENSIONS	**VARIABLES**	**N**	**Subset for alpha = 0.05**	
Reduce and Reuse	Type of School		1	2
	Aided	13	17.77	
	Private	38	19.16	19.16
	Govt	49		19.37

The Table – 3(i) shows that there is a significant difference among the students of private, aided and government schools in their mean scores with respect to reduce and reuse. The calculated value of 'F' (2.156) is greater than the table value. Hence the null hypothesis – 2(iv) is rejected.

The output of Duncan test in table 3(ii) indicates that students from aided schools are significantly different from students from Government schools. As the students from private schools fall in the two subsets (i.e. in subset 1&2) they do not significantly differ from students from aided schools and students from Government schools.

H_0 -3: There is no significant difference in the mean score of high school students with respect to (i) recycling attitude and its dimensions-(ii) recycling value, (iii) personal belief, (iv) reduce and reuse and (v) recycle based on locality of school.

Table: 4 (i)
Difference in the Mean Score of High School Students With Respect to Recycling Attitude and Its Dimensions Based on Locality of School

Dimension	Variable	N	Sum of Square		Mean Square Vale		F-Value	Result
			Between	Within	Between	Within		
Recycling Attitude	Location	100	593.47	8665.103	296.824	89.331	3.323	p<0.05
Recycling Value	Location	100	110.078	1562.672	55.039	16.110	3.416	p<0.05
Personal Belief	Location	100	95.352	1817.488	47.676	18.737	2.544	p<0.05
Reduce and Reuse	Location	100	43.967	581.393	21.984	5.994	3.668	p<0.05
Recycle	Location	100	14.545	903.495	7.272	9.314	0.781	p>0.05

*Significance level at 0.05 level

The Table – 4(i) shows that there is a significant difference among the students of urban, rural and semi-urban schools in their mean scores with respect to recycling attitude, recycling value, personal belief, and reduce & reuse. The calculated values of 'F' (3.323, 3.416, 2.544, and 3.668) are greater than the table value. Hence the null hypothesis – 2(i), 2(i1), 2(iii), and 2(iv) are rejected.

Table: 4 (ii)
Post Anova

Dimensions	Variable	Category	N	Subset for alpha = 0.05	
				1	2
Recycling attitude	Locality	urban	36	80.75	
		rural	51	84.59	84.59
		semi-urban	13		88.00
Recycling value		urban	36	26.89	
		rural	51	28.86	28.86
		semi-urban	13		29.62
Personal Belief		urban	36	23.69	
		rural	51	24.39	24.39
		semi-urban	13		26.85
Reduce and Reuse		urban	36	18.42	
		rural	51	19.18	19.18
		semi-urban	13		20.54

The output of Duncan test in table 4 (ii) indicates that students from urban school are significantly different from students from semi-urban school with respect to recycling attitude, recycling value, personal belief and reduce and reuse. As the students from rural schools fall in the two subsets (i.e. in subset 1&2) they do not significantly differ from students from urban schools and students from semi-urban schools.

Findings

1. High school students have positive recycling attitude.

2. There is a significant difference in the recycling attitude of men and women high school students. Women high school students have more positive recycling attitude than the men students.

3. Government high school students have more positive recycling attitude than the aided and private school students.

4. Students from Semi-urban schools have more positive recycling attitude than the urban and rural school students.

5. There is a significant difference between aided and government school students with respect to the dimension 'reduce and reuse'.

6. There is a significant difference between urban school students and semi-urban school students with respect to the dimensions 'recycling value', 'personal belief', 'reduce and reuse' and 'recycling attitude'.

Conclusion

The results of this research indicated that the high school students have high positive recycling attitude. It was determined that female high school students have more positive recycling attitude than the male students. Students from semi-urban schools have more positive recycling attitude than the urban and rural school students. Based upon the findings one can conclude that the high school students already had positive attitudes toward the recycling.

The recycling programs in schools will not be effective if we do not change the attitudes of the students towards recycling waste. This study will provide some insight into the improvement of current recycling programs in schools. It is clear that recycling attitudes is affected by various factors and in order to develop positive recycling, these factors need to be overcome. Generally, the students demonstrate concern for the environment and are aware about the importance of recycling; however, there is need to apply the knowledge of waste recycling into effective and affirmative action.

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Historical timeline of initiation of compulsory tertiary level 'Environmental Studies' in Indian universities

Soma Bhattacharjee (Biswas), Anindita Saha*, Debabrata Dasgupta**

ABSTRACT

From and childhood our Mother Earth has nurtured us with food, air, water, shelter everything we need for our life. But today our environment is on the brink of destruction because of various environmental issues like climate change, pollution, global warming, ozone layer depletion, etc. Mahatma Gandhi rightly said "In nature there is enough for everyone's need, but too little for everyone's greed." It is very sad that the reasons of these environmental issues are mostly anthropogenic. Many projects, awareness campaigns etc. have been arranged but those attempts hardly could touch the core of the issue. We know that only "Education leads us from darkness to light" (Plato), "Education is the manifestation of the perfection already in man" (Swami Vivekananda).Jawaharlal Nehru very significantly said "No subject is of greater importance than that of education. It is the men and women in a country that make and build a nation and it is education that is supposed to build those men and women". As environmental education brings about desirable changes in human behaviour, and a positive attitude towards nature and finally environment friendly citizens towards sustainable development, so incorporation of environmental education in our education system is of paramount very much important today. According to the directives of the Hon'ble Supreme Court, the UGC has introduced a basic six months' compulsory course on environment for all the students of the undergraduate courses of all branches of Higher Education. This paper documents how the compulsory environmental studies were introduced at the tertiary level of Indian universities.

India has a long tradition of using the environment as the source of learning. Rabindranath Tagore and Mahatma Gandhi both emphasized the study of the environment. Gandhi believed in simple living to save our Earth's resources and Tagore's philosophy of education focused upon the need for a harmonious association between human beings and their environment. To achieve this, he relied on exposing young people to nature which is still practiced in Visva-Bharati, Santiniketan. However, compulsory environmental education at the tertiary level in our country has not been introduced in one day; it took several years to come into the system. Not only the domestic incidents but also some international incidents or events have played a some direct or indirect role towards the introduction of the concept and implementation of the programme which is documented below-

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1964-1966 (Recommendations of the Kothari Commission)

The first step taken by the government to implement the introduction of environmental education in Indian schools and colleges was taken by the Kothari Commission.

The Kothari Commission (1964-66) suggested that basic education had to offer Environmental Education (EE) and relate it to the life needs and aspirations of the people and the nation. At the primary stage, the report recommended that "the aims of teaching science in the primary schools should be to develop a proper understanding of the main facts, concepts, principles and processes in the physical and biological environment". Environmental education at the primary, secondary, higher secondary levels were treated in different ways. Environmental education is an essential part of every pupil's learning. It helps to encourage awareness of the environment, leading to informed concern for active participation in resolving environmental problems. It should be introduced without any delay from class –1 as EVS, as a subject, so that right from their childhood, the right attitudes towards environment will be nurtured in the young minds.

1972 (The United Nations Conference on Environment, Stockholm, June 1972)

The UN conference was a major event for those who were concerned with the quality of the environment of the world. The output of this conference was the 'United Nations Environment Programme (UNEP)'; the UNEP was founded with the following objectives:

1. To provide leadership in caring for the environment.

2. To encourage partnership in caring for the environment.

3. To enable nations and peoples to improve their quality of life without compromising the interests of the future generations.

4. To promote implementation of the environmental dimension of sustainable development.

5. To serve as an authoritative advocate of the global environment.

1972 (Formation of National Committee on Environmental Planning and Coordination)

In the same year i.e., in 1972, a National Committee on Environmental Planning and Coordination was set up by our late Prime Minister, Mrs. Indira Gandhi. The objective of the Committee was in line with the recommendations of the Stockholm Conference i.e., to identify and investigate the problems of conserving and improving the human environment in India, especially in the context of excessive population growth and its effect on economic development and society.

1975 (International Workshop on Environmental Education, Belgrade)

The Stockholm Conference on the Environment was followed by an International Workshop on Environmental Educational Belgrade held at Yugoslovakia in 1975 and organized by UNESCO. This workshop listed several environmental educational goals.

The ultimate goals of environmental education are to develop a world population that is aware of and concerned about, total environment and its associated problems, and commitment to work individually and collectively towards the solution of current problems and the prevention of new ones (UNESCO, 1975).

1976 (The Constitution of India (42nd Amendment) Act 1976)

The Constitution of India (Forty second Amendment) Act 1976, led to the insertion of *Article 48A—"Protection and improvement of environment and safeguarding of forest and wildlife"*- The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country". Apart from this, a new provision in the form of *"fundamental duties"* as *Article 51A* was also incorporated by the 42nd Constitutional Amendment, sub clause (g) which states, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures."

1977 (Intergovernmental Conference on Environmental Education at Tbilisi, USSR)

The first Intergovernmental conference on Environmental Education organized by UNESCO in cooperation with the United Nation Environmental Programme (UNEP) was held at Tbilisi, USSR from 14 to 26 October 1977 and is considered to be a landmark in the field of Environmental Education. The conference made important recommendations on the following:

1. Role of Environmental Education.

2. Objectives of Environmental Education.

3. Guiding principles of Environmental Education.

1979 (National Seminar, New Delhi)

A National Seminar at New Delhi was organized by the Indian Environmental Society and the International Programme on Environmental Management at National Science Academy, New Delhi in 1979. Emphasis was placed on incorporating Gandhian thought and values as a part of environmental education.

1980 (1st international Conference on EE held, New Delhi)

On the occasion of the First International Conference on Environmental Education held in New Delhi, in 1980, the late Mrs. Indira Gandhi observed that environmental education (EE) is to help arouse social consciousness and make the community aware of the fact that the good of the individual and that of the community are both harmed by ecological disruptions.

1980 (Formation of Tiwari Committee and Department of Environment)

In February 1980, the Tiwari Committee was set up to review and recommend legislative and administrative measures for ensuring environmental protection. On the recommendations of this Committee, the Department of Environment was set up in November 1980 which in January 1985 became the Ministry of Environment and Forests. Its objectives include the following:

1. Environmental laws and policy.

2. Pollution monitoring and control.

3. Survey and conservation of natural resources.

4. Management and conservation of forests and wildlife.

5. Promotion of environmental research.

6. Environmental Education, awareness and information.

7. International cooperation

1980-1985 (The sixth five-year plan)

For the first time, there was a specific environmental objective in the Five-Year Plan, which was expressed in the following words-"Bringing about harmony between the short and long term goals of development by promoting the protection and improvement of ecological and environmental assets".

1985(Second International Conference about EE, New Delhi)

The Second International Conference on Environmental Education was held in New Delhi and attracted some 200 participants from 25 nations. It was sponsored by the Indian Environmental Society, Indian Department of Environment, the New Delhi School of Planning and Architecture and the Committee on Science and Technology for Developing Countries. One of the central assumptions of the conference was the belief that requirements of culture, economics and environment, can be satisfied compatibly to promote ecologically sustainable development. The conference concluded by agreeing on a comprehensive series of recommendations entitled the "New Delhi Declaration on Environmental Education-1985" for local and global action.

This report describes briefly the major goals and highlights of the conference, at which discussions were intended to further four primary aims for biosphere preservation:

(1) promoting sustainable development
(2) strengthening environmental education
(3) increasing local to global action and
(4) Targeting special emphasis on environmental education for youths.

1986 (National Policy on Education)

The National Policy on Education in part VIII entitled 'Reorienting the content and process of education', in para 8.15 states, "There is a paramount need to create a consciousness of the environment. It must permeate all ages and all sections of society, beginning with the child. Environmental consciousness should inform teaching in schools and colleges. This aspect will be integrated in the entire educational process."

1987 (Brundtland Report by World Commission on Environment and Development)

The World Commission on Environment and Development publishes the Brundtland Report. Also known as *Our Common Future*, this report introduced the idea of sustainable development in which environmental protection and economic growth are viewed as interdependent concepts.

1985-1990 (The Seventh Five-Year Plan)

The approach of the Seventh Plan 1985-1990, also recognizes ecological and environmental conservation as one of its principal objectives. In terms of integrating environmental considerations with national economic planning, the Plan emphasizes that "The environment must not be considered as just another section of national development. It should form a crucial guiding dimension for plans and programmes in each sector. This becomes clear only if the concern for environmental protection is understood in the proper context. Environmental problems in India can be classified into two broad categories: (a) those arising from conditions of poverty and under-development. (b) those arising as negative effects of the very process of development.

The first category has to do with the impact on the health and integrity of natural resources (land, soil, water, wildlife, etc.) as a result of poverty and the inadequate availability, for a large section of the population to fulfill their basic human needs. The second category has to do with the unintended side effects of efforts to achieve rapid economic growth and development. Thus, it is clear that the concern for the environment is essentially a desire to see that national development proceeds along rational sustainable lines. Environmental conservation is, in fact, the very basis for all development."

1991 (Supreme Court order to enforce compulsory Environmental Education)

In 1991, Shri. M.C. Mehta filed an application in the public interest, asking the Supreme Court to: (1) issue direction to cinema halls that they show slides with information on the environment; (2) issue direction for the spread of information relating to the environment on All India Radio; and (3) issue direction that the study of the environment become a compulsory subject in schools and colleges.On this public litigation petition, the Supreme Court of India asked the NCERT and other concerned authorities to take steps to enforce compulsory environmental education from the academic session 1992-1993.

1992 (United Nations Conference on Environment and Development, Rio De Jenerio)

The United Nations Conference on Environment and Development (UNCED) held at Rio De Janeiro in 1992 agreed to a global environment and development agenda for the 21st century called Agenda 21. The agenda recognizes education as an important instrument of solving environmental problems. Chapter 36 of Agenda 21 emphasizes the role of education in protecting environment and promoting the sustainable development. The following programmes were included in agenda 21.

1. Reorienting education towards sustainable development.
2. Increasing public awareness.
3. Promoting training.

2003 (M.C. Mehta again filed a PIL)

In July 2003, Magsaysay Award winner and environmental lawyer Mr. M. C. Mehta again filed a Public Interest Litigation (PIL) which highlighted the issue of non-compliance of the 1991 court order by the states in which a series of directions were given about maintaining the ecological balance and launching a sustainable campaign on protection of the environment. The Apex court took a serious view over the non- compliance of a 12 year-old directive by various educational bodies. The Supreme Court issued notice to the country's key educational bodies like NCERT, AICTE, UGC and State Governments to seek information on whether the state had included environment studies in the school and college curriculum as directed by it, and if not, ask them for an explanation. Finally, in September 2003, the Supreme Court then imposed a fine of Rs.15,000 each to 10 states including West Bengal (Times of India, 24.09.2003).

2004 (The Supreme Court passed the order for implementation of compulsory environmental education)

Since the order about the compulsory environmental education was not implemented even after twelve years, the Supreme Court passed the order on 22nd April, 2004 for compliance.

The Supreme Court issued a notice on 13th July, 2004 to the concerned authorities to inform whether they had implemented the order for inclusion of environmental education in the institutions under their court. Keeping in view the 1991 judgment, for the college level, UGC and AICTE were asked to coordinate and bring out a uniform syllabus on "Environmental Studies" for the undergraduate course for all branches of higher education.

2005 (Expert Committee on Environmental Studies appointed by UGC)

The UGC had appointed a Committee of Experts to advise on the curriculum for Environmental Studies at the undergraduate level, and the Committee was also requested to produce a textbook on Environmental Studies for such an undergraduate course. The Committee was headed by Dr. Erach Bharucha, a well-known environmental scientist of Bharati Vidyapeeth, Pune. The Committee had come out with a common core module syllabus for Environmental Studies at the undergraduate level and a very comprehensive textbook on this multidisciplinary subject, to be used by every University in the country.

Conclusion

However, it is now up to the Universities to ensure the implementation of this common compulsory course by getting it passed through their Academic Councils and other bodies. Unless and until "Environmental Studies" to supplemented with ethical values, get its rightful place in various cultures and societies through different educational systems, neither mass media nor other informal educational activities can become the instruments of environmental sensitivity. Hence, incorporation of compulsory environmental studies at the tertiary level of education will certainly add momentum towards environmental sustenance.

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Assessment of Environmental Awareness among Higher Secondary School Teachers in Tamil Nadu

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ABSTRACT

The present study is an attempt to elicit the level of environmental awareness of higher secondary school teachers of Tamil Nadu State in India. A total of 3200 teachers teaching 6th to 12th standards were randomly selected for the present study. The environmental awareness test was employed to assess the level of environmental awareness through National Green Corps (NGC) among teachers. Mean Standard deviation (SD) and "t" values of the table analysis were employed to find out the significance of difference between the teachers with respect to gender, subject, and school type. Results revealed that on the whole, a majority of the teachers had moderate levels of environmental awareness. Female teachers had significantly higher levels of environmental awareness as compared to their male counterparts. Science teachers had significantly higher levels of environmental awareness when compared to arts teachers. School-wise analysis also revealed that teachers working in private schools revealed significantly higher environmental awareness than teachers working in government schools. Implications of environmental education were also stressed.

Keywords: Mean Standard deviation, National Green Corps, environmental awareness.

Introduction:

Environment is part and parcel of every one of our lives. It is concerned with the surroundings in which we live and cherish our life. Due to population explosion as well as industrialization, environmental problem like pollution, global warming, solid waste, plastic menace, acid rain etc. have become daunting problems. To combat all these environmental awareness is needed first. In order to protect and conserve the environment, enabling people to lead quality life, emphasis has been given to environmental education in both formal and non-formal system of education. In formal system of education, teachers can play an important role in educating their students about environment related issues, which is possible only when the teachers themselves have mastery over environmental awareness. Gupta (1986) studied the attitude of teachers towards environmental education and he found that the majority of teachers evinced keen interest towards environmental education. Shahnawaj (1990) studied environmental awareness and environmental attitude of secondary and higher secondary school teachers. Patel and Patel (1994) examined the environmental awareness of 120 primary school teachers of standards I to IV and found that male teachers with years of school experience in urban areas are found to be more aware of the environmental education. Nagra (2010) studied the environmental education awareness among school teachers in relation to level of school, residential background, gender and subject specialization. Environmental Education has become a part of the curriculum in majority of schools. Therefore the awareness level of teacher in their schools

intern is being transferred to the student's awareness. The present study is an attempt to study the environmental awareness of higher secondary school teachers of Tamil Nadu State in India.

Objectives of the Study

This particular study is undertaken keeping in view the following objectives:

1. To study the difference, if any, between Environmental awareness of Govt and private Secondary school teachers

2. To study the difference, if any, between Environmental awareness of male and female of Secondary school teachers.

3. To study the difference, if any, between Environmental awareness of science teachers and art teachers of Secondary school.

2. Materials and Methods:

The tool used in the present investigation the Environmental Awareness Test (EAT) developed by Shabina Jinarajan (1999), Bangalore University. This tool measures environmental awareness of teachers as consisting of ten components, viz Tree planting activity, Energy conservation awareness, Plastic awareness, Nature camp, Water pollution, Vermi- composting, Rainwater harvesting, Herbal garden, Environmental Awareness rally, Segregation of solid waste. A total of 3200 (1500 male and 1700 female) teachers teaching from 6th to 12th standards were randomly selected for the present study. The teachers were selected both from government and private schools. The environmental awareness test was employed to assess the level of environmental awareness through National Green Corps (NGC) among teachers. In 32 districts in Tamil Nadu state, we personally/ officially visited all the selected schools and met the teachers for explaining the purpose of study and instructed them as to how to respond to the questionnaire. Also, whenever, they had doubt in understanding questions, we made those questions understandable and clear. All the questions of the Environmental Awareness Test are of Yes / No types. Using Mean, SD and "t" test analysis it was possible to find out the significance of difference between the teachers with respect to their Subject, gender and school type.

Hypotheses of the Study

Hypothesis 1 There will be no significant difference in the level of environment awareness among secondary school teachers in Government school and. Private school

Hypothesis 2 There will be no significant difference between male and female teachers in their level of environmental awareness in Tamil Nadu state.

Hypothesis 3 There will be no significant difference between Science teachers and Arts teachers in their level of environmental awareness in Government School and Private school.

3. Result and Discussion:

Table 1.

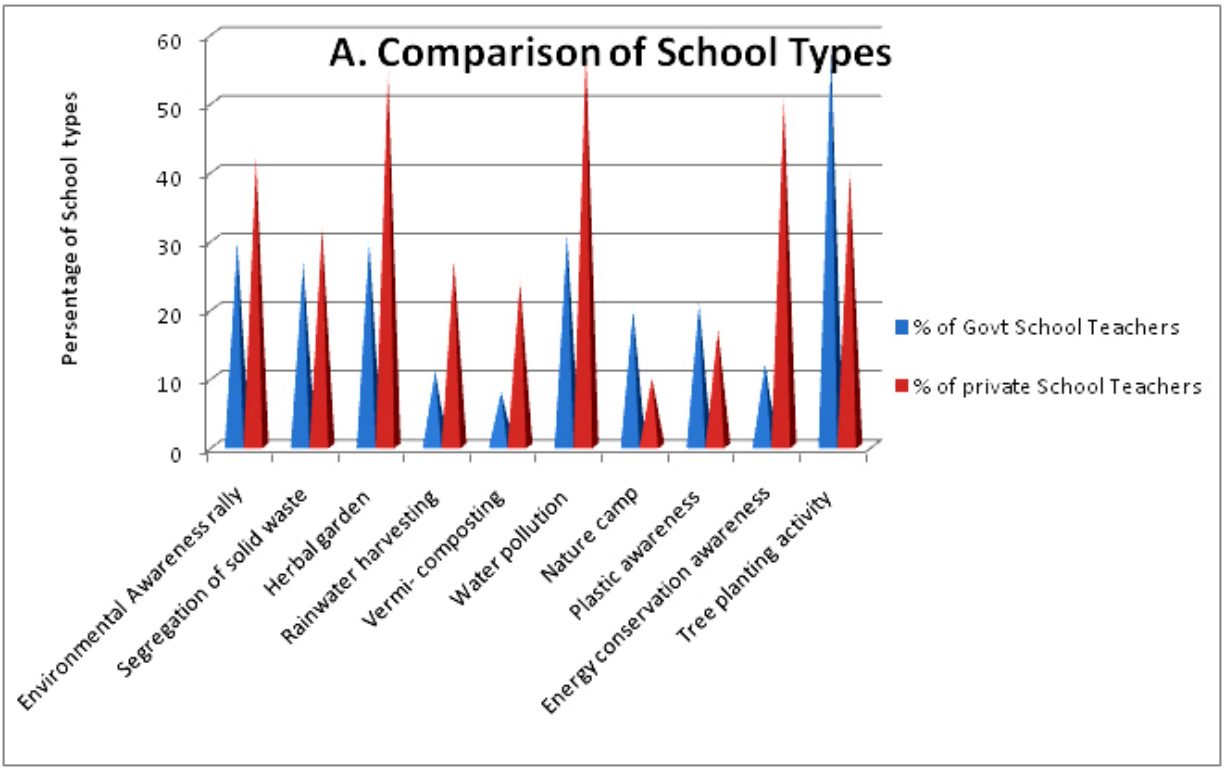
Percentage of Environmental awareness in School, Gender, Subject types for Higher secondary Teachers

Environmental Activities	% of Govt School Teachers	% of private School Teachers	% of Male Teachers	% of Female Teachers	% of Science Teachers	% Arts Teachers
Environmental Awareness rally	30	42	38	34	39	33
Segregation of solid waste	27	32	23	35	31	28
Herbal garden	30	55	27	58	46	39
Rainwater harvesting	11	27	22	16	24	14
Vermi- composting	8	24	21	10	25	6
Water pollution	31	58	46	42	53	36
Nature camp	20	10	20	11	24	7
Plastic awareness	21	17	20	18	26	13
Energy conservation awareness	12	51	27	36	32	31
Tree planting activity	58	40	53	46	58	40

Table 2.

Comparisons of Environmental awareness in School, Gender, Subject types for Higher secondary Teachers

Environmental Activities	School types		Gender Types		Subject Types	
	Govt School Teachers	Private School Teaches	Male teachers	Female teachers	Science Teachers	Arts Teachers
Environmental Awareness rally	964	1352	1216	1100	1259	1057
Segregation of solid waste	852	1025	751	1126	981	896
Herbal garden	950	1765	859	1856	1456	1259
Rainwater harvesting	358	850	698	510	752	456
Vermi- composting	251	762	678	335	813	200
Water pollution	985	1853	1480	1358	1691	1147
Nature camp	652	325	632	345	754	223
Plastic awareness	685	544	653	576	824	405
Energy conservation awareness	389	1637	867	1159	1029	997
Tree planting activity	18 61	1286	1684	1463	1859	1288
Mean	**794.7**	**1139.9**	**951.8**	**982.8**	**1141.8**	**792.8**
SD	**460.98**	**524.07**	**375.93**	**517.96**	**405.30**	**428.18**
"T" value	**0.13**		**0.87**		**0.07**	
"P" Value	**0.98**		**0.39**		**0.94**	


A. Comparison of School Types
Persentage of School types
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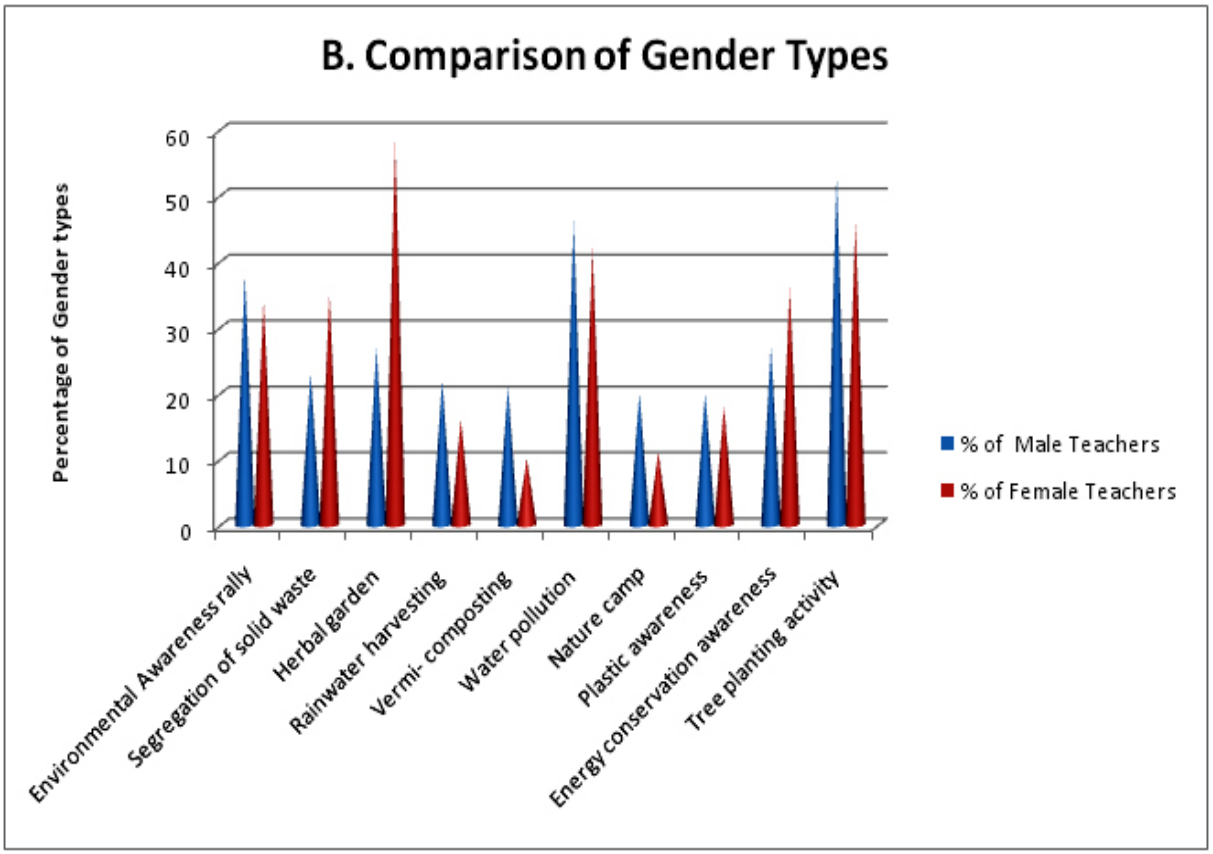
Environmental Awareness rally
Segregation of solid waste
Herbal garden
Rainwater harvesting
Vermi- composting
Water pollution
Nature camp
Plastic awareness
Energy conservation awareness
Tree planting activity
% of Govt School Teachers
% of private School Teachers


B. Comparison of Gender Types
Percentage of Gender types
60
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Environmental Awareness rally
Segregation of solid waste
Herbal garden
Rainwater harvesting
Vermi- composting
Water pollution
Nature camp
Plastic awareness
Energy conservation awareness
Tree planting activity
% of Male Teachers
% of Female Teachers

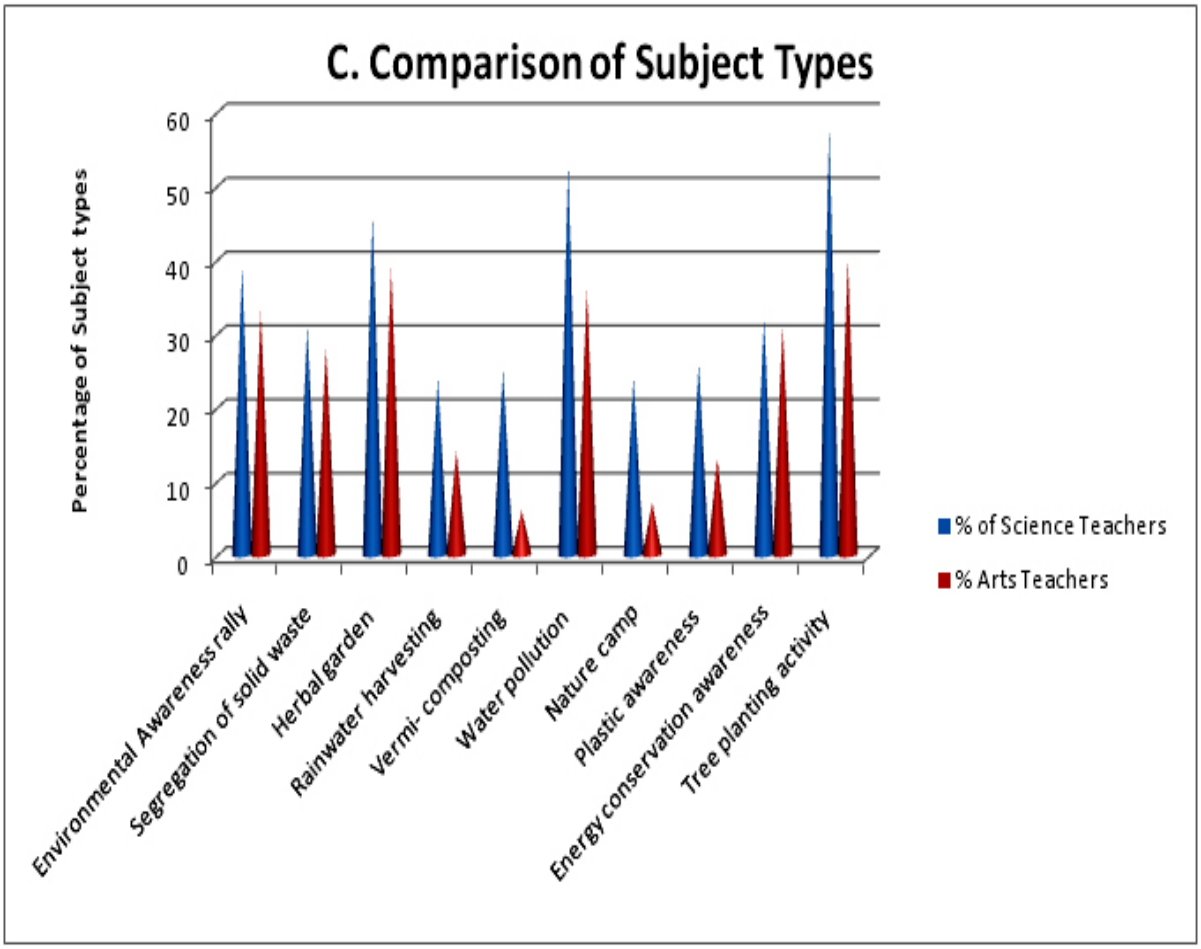

Fig. A, B, C. The environmental awareness of comparison in schools, gender, subject wise

Results: Of the 3200 teachers who took up the test, the low awareness activities was noticed in vermicomposting (6%) and nature camp (8%) (Table1.) In Table.2, 58% of the teachers had high awareness level of environmental awareness relating to Herbal garden, water pollution and tree planting activities. Table.1. Further, T test value revealed no significant difference among teachers of different levels of environmental awareness (T test value =0.13for school types, 0.87 for Gender types, 0.07 for subject types; P<.01), confirming that majority of them had moderate awareness

The Hypothesis 1 formulated in this context is therefore, accepted. Results from Table.2 highlighted the comparison between government and private school teachers with respect to their environmental awareness. It is evident from the table that there exist significant difference between government and private teachers (t= 0.13; P<.01) in their environmental awareness. This significant result shows that both government and private senior secondary school teachers are moderately aware about environment. Hence, The Hypothesis 2 formulated in this context is therefore, accepted. Table 1 also represents the comparisons between male and female teachers with respect to their environmental awareness. It is evident from table that there exist significant difference between male and female teachers (t= 0.87; P<.01) in their environmental awareness. The existence

of significant difference (Table I) shows that both male and female teachers have almost equal level of environmental awareness. Hence, the Hypothesis 3 formulated in this context is therefore, accepted. Similarly, Table 1 also represents the comparison between science and art teachers with respect to their environmental awareness. The results depict that there exist significant difference between science and art teachers (t= 0.07 P<.01) in their environmental awareness. The result concludes that art teachers have moderate environmental awareness.

Discussion: The salient findings of the present study are delineated below**:**

Results revealed that on the whole, majority of the teachers had moderate level of environmental awareness. Male teachers had significantly higher level of environmental awareness as compared to their female counterparts. Science teachers had significantly higher level of environmental awareness as compared to their arts counterparts. School-wise analysis also revealed that teachers working in private schools were found to have significantly higher level of environmental awareness than teachers working in government schools. Implications of environmental education were also stressed.

The overall analysis revealed that though majority of the teachers had moderate awareness, only a few of them had higher level of Awareness. Our globe being highly prone to environmental destruction due to human interference, there is an urgent need to educate the public on global warming, environmental degradation, etc. This can be very well initiated at school level by giving advanced training to teachers on environment related aspects. If children at their early age learn about these negative effects, as they grow, at least they can make some effort for sustainable development. The results obtained in the present study are more or less not in accordance with some of the studies mentioned here. Badkobi and Hadipour (2001) reported significant difference among male and female teachers in their awareness about environmental education where male teachers had higher awareness. Shabina Jinarajan (1999) in his study on student teachers from Bangalore did not find any gender difference in environmental awareness. Again, Vipinder and Jaswinder (2005) reported that male and female teachers had equal level of scores on environmental education awareness.

As far as the school type is considered, teachers working in private schools had better awareness as compared to government schools. One reason could be that in private schools, the emphasis would be given to recent developments, encouragement in participation on various programmes on environment related issues which is not so pronounced in government schools. Dinakara (2000) also reported significant difference in environmental awareness between government and private school teachers. However, Sabhlok (1995) reported government teachers had better awareness than private school teachers.

Way forward: Environmental education as a compulsory subject should be included in curriculum at school level so that students opting for humanities would be benefited. Region specific instructional material regarding environmental education should be developed. The environmental education should be interdisciplinary and should examine major environmental issues from local, national and international points of view. It should utilize various educational approaches to teach and learn about and from the environment with more emphasis on practical activities which would provide firsthand experience.

NGC and Eco-clubs need to be actively involved by planning creative activities like

folk dances, street theatre, distribution of environmental education resource materials, management of household wastes, cleaning of water bodies. Students should be encouraged to participate actively in Eco-clubs. A multi-media campaign may be planned which employs conventional and non-conventional methods of communication for disseminating environmental messages.

Conclusion:

To protect and conserve the Environment, emphasis should be given to Environmental Education in both formal and non-formal system of education. In formal system of education, teachers play a pivotal role in developing greater awareness about environment among Teachers and students. This calls for a radical change in the way we think, live and work. It therefore goes without saying that sustainable development calls for a paradigm shift in our educational system right from school level to university level. In fact, it cannot be thought of achieving a sustainable way of life without an appropriate educational system designed to internalize the principles of sustainability in the life and work of our youth. Because of the government initiative to make Environmental Education an integral part of formal education through its national curriculum framework, considerable work is being done in the direction of integrating environmental concepts into the existing curriculum, developing new strategies, preparing instructional material for effective implementation of Environmental Education in the formal system. In conclusion, it is through this process of education that people can be sensitized about the environmental issues. The comprehension of environmental objective is very essential for the formulation, implementation and evaluation of environmental education programme.

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Protection of Environment: Indian Contribution to the Debate.

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ABSTRACT

Progress and pollution go together. The economic growth is essential to combat poverty and deprivation but has exerted considerable pressure on the environmental sustainability. With industrialization, energy consumption has increased, prosperity resulted in building more settlement and using more vehicles, all this deteriorated the environmental quality. The crisis before the world and more particularly before developing nation like India is how to achieve target of economic growth without damaging environment.

Key Words: Environment, Protection, Economic growth, Pollution, Contribution, Debate

Introduction

The last two centuries triggered great many changes in the geographical aspects of the world. Empires grew and collapsed, population surged, agriculture gave place to industry as the main source of livelihood, technological changes took man to the moon and beyond ,fossil fuels became the main source of power, people drifted away from the principle of "simple living and high thinking" to consumerism and unconcern for others. All these had serious implications for the Earth's natural resources. Today, we are are facing a threat due to climate change that may result in a great damage to the biodiversity on earth, if humanity does not respond equivocally to the occasions of environmental damage and change its ways.

Protection of Environment

It is universally accepted that protection of environment is a global problem and should be solved globally. Since, Stockholm declaration of June 1972, the world is grappling with the issue of correcting damage caused to environment. Earth summit at Rio de Janerio in 1992 and Johnesburg in 2002, Kyoto protocol of 1997 or Gleneagle meet of July 2005 discussed the ways and means of protecting environment. Similarly national governments enacted laws on implementing these international declarations.

But due to national priorities, moral convictions and compulsions both developed and developing nations have divergent perceptions on environment related issues and found themselves at dragger drawn. For example, the first Earth summit was called to work out a World Schedule for saving the environment, combating the depletion of the ozone layer and reducing "Greenhouse gas emission". The participants were to adopt an "Earth Charter" to protect the environment in the 21st century, called Agenda 21.The Southern nations hold the rich nation responsible for environmental mess and questioned about their efforts for controlling greenhouse gas emission and curbing the export of hazardous waste (Roy, 1992).

They also look with suspicion on Global Environmental Facility (GEF) set up for cleaning the globe. Third world countries

cautioned against the attempts of OECD countries to use environmental standards as a means of non-trade barriers.

In a position paper called "WTO: Trade and Environment" presented to GATT Director General, the Third World Network (TWN) states that inclusion in the WTO Agenda of new areas as environment, labor standards and human rights is being sought by the North not for advancing the noble cause of protecting the environment or people's rights but to use them to reduce the competitiveness of the South in its home markets and enlarge the market space of MNCs in the world.

The developed countries are imposing their values on less developed nations in the name of biodiversity. The Tuna- Dolphin case (Koul, 2001) and Shrimp-Turtle case are examples of 'eco-imperialism'. It relates to Mexico and India respectively. It is a sort of 'moral militancy' of environmentalists who are imposing trade sanctions unilaterally on other nations, who don't share their values and preferences (Mathur, 2003).

Similarly, the developed countries are exporting their industrial waste into poor Southern countries. Instead of reprocessing it at home, they prefer to dump it into less developed countries. India has become a major dumping ground for such toxic waste. The Bassel ban of March 1994 prohibits the trans-border movement of hazardous waste from OECD to non- OECD even for recycling after 1997. India has become a 'Willing Recipient of this toxic waste under the influence of domestic industry who recycles the OECD waste.

Climate change is taking place due to global warming caused by the Greenhouse effect. Kyoto protocol on climate change required the participating countries to cut back emission to 6.2 per cent of carbon-dioxide of 1990 levels. The USA and Australia refused to ratify Kyoto protocol in 2005 under the influence of 'Short – sighted bizmanship'.

Poor countries held the rich nations responsible for environmental mess. The rich nations argued that poverty and underdevelopment were greatest source of pollution. G-8 countries account for 47 per cent of world carbon emission but the USA supported studies has held developing countries responsible for environmental devastation. The example of 'Asian Brown Haze' has been given in this regard (Mathur, 2006).

The Asian Brown Haze study is controversial. The Chairman of the IPPC Dr.R.K.Pachauri said that it would very well be that these are being generated in North America or even in Europe and traveling all the way. Recently, similar to Asian Brown Haze, pollution cloud has been spotted in other parts of the world also. It has been renamed as 'Atmospheric Brown Cloud' {Menon, 2007}.However, the presence of haze has to be researched for the sake of protection of (health and wealth of the people of the world) environment.

Collaboration for Environmental Sustainability

According to World Watch Institute (WWI), Washington D.C, environmental powers such as U.S.A, Russia, Japan, Germany (developed) and China, India, Brazil, Indonesia (developing) must play a pivotal role in determining the quality of the global environment. They must evolve such strategy that harmonize economic, environmental and equity considerations into a synergistic whole essential for the sustainable development of the world.

Sustainable Development

The concept of sustainable development strives for a perpetually stable resource base and a perpetually stable economic growth. Development should not only be growth oriented, but should be environment friendly, and then only the objective of sustainability will be achieved. The new global focus of power is sustained economic growth. The reckless exploitation of national resources for economic growth is detrimental to environmental sustainability. With economic growth and environmental sustainability, the social dimension of sustainable development is equally important. Mere economic progress

is not an end in itself. Beyond the formal growth statistics, what is needed is not only increase in gross national products but also gross national happiness. We need to do justice to subjective and soulful aspect of development.

Traditional Wisdom and Practices

The wisdom of our fore fathers has much to offer in pursuing an environment friendly and sustainable development path. In an Indian folklore, a wise farmer said he placed one-third of his income in God's feet, other one-third for personal use and last one-third he used to throw in a well. Offering a portion of income to God means paying tribute to ancestors who left this planet Earth ecologically viable for us, other portion of income is for growth and enjoyment for present generation, throwing in well means to pay for conservation of the environment so that the posterity could enjoy the bliss of pollution-free environment.

The country of South Asia has capability as well traditional knowledge for preservation of environment. One of the provisions of Kyoto Protocol known as the Clean Development Mechanism (CDM) establishes a frame work within which the industrialized countries can meet a part of their carbon-dioxide emission requirements by purchasing certified emission reductions (CER) from India and other developing countries. In fact, South Asian countries can also offer to the rest of the world valuable lessons on green practices that are part of their traditions.

Indian Contribution to the Debate

Indian scholars have also profusely contributed to the protection of environment debate. These contributions have emanated from various disciplines. N.S. Jodha's, an economist, Seminal work on the deterioration of rural Common Property Resources (CPR) in arid and semi-arid Rajasthan has informed the international debate on CPR that the privatization of village, commons and incorporation in the market economy, has eroded of traditional community institutions; which through social sanctions regulated sustainable use of village commons like pastures (Jodha, 2002).

The study of desiccation of the Luni River has added on to Jodha's hypothesis by exploring the erosion of ecological niches occupied by different caste groups. The acute water crisis in Gujarat caused by over extraction of ground water is the result of the decline of the village community and a corresponding growth of economic Individualism (Aggarwal and Narain, 1997).

Similarly, the Chipko movement of Garhwal Himilayas, which emerged in 1970s in response to national economic policies and strict forestry regulations, has been articulated by a number of Indian environmental scholars and activists as an emblem of grass root movement with a new ecological consciousness that challenged the traditionalist GEM approaches to development whose pursuit destroyed local ecology and traditional ways of life and have contributed to the populist discourses (Bahuguna, 1987; Dwivedi, 1998; Gadgil and Guha,1992; Shiva, 1989).

The aforesaid scholars have contributed immensely to demystification of the colonial myth that 'Traditional' is 'Irrational', but the arguments are problematic as well in various ways. The vision of 'organic\ green village community' advanced by Aggarwal and Narain ignores the fact that these communities were not egalitarian entities but differentiated along caste lines (Bavisker, 2007; Hardiman, 2007).Undoubtedly, the circumstances of environmental degradation in any one instance are complex and unique. Therefore, analysis should be able to explain the local conjuncture of physical and social processes as well as provide a clearly understood basis for generalizations about process world wide.

Certain environmental movements and discourses, consciously or unconsciously, have expressed themselves in ways articulating revivalist and nationalist Hinduism. Indian environmental politics

is extremely heterogeneous. This heterogeneity offers hope. However, authoritarian environmentalism and its politics are found in various movements in different forms. At least five principal inference points can be identified: ultra-nationalism, a yearning of brahmanical Hindu religion culture; emphasis on authority, social order discipline; implicit hostility towards Muslims, Dalits and Christians; and a pragmatic politics entailing communalism.

In different regional and organizational locations, from Anna Hazare' s Ralegan Siddhi to conservation in Virndavan, it is found that environmentalism is allying with feudal attitudes to instill moral codes, rules and discipline justified as central to the nation. This kind of environmentalism has made huge inroads into popular consciousness and gained a far wider acceptance in India.

India's environmental paradigms often render caste and Dalits questions invisible. It needs to be recognized that caste is one of these central categories framing environmental politics. In the past and present, Dalit thinkers had wider critique of environmental articulations. New ecological studies should also bring fourth not just fresh dimensions about environment and people but also help in redefining their inter-relationships with polity, democracy, justice and modernity (TOI, Feb. 2012).

Conclusion

Ecological and societal problems that confront humanity are complex and difficult to surmount. To quote Ciscero, nature has granted the use of life like a loan without fixing any date for repayment. It means that gift of life is not an absolute right, it is coined with duty: duty to take care of fellow beings and duty to preserve all resource for future generations. Finally, the discourse on protection to environment is endless.

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Reorienting Education Towards Sustainable Development: Exploring Issues Of Integration Of Science And Environmental Education

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ABSTRACT

As highlighted in the discourses on Environmental Education(EE), the goal of environmental sustainability and its inclusion in school education calls for reorientation of the existing curriculum involving a critical analysis of the goals, pedagogy and tools for assessment in order to promote teaching and learning for sustainability. The paper aims at analyzing the place of EE in school curriculum in Indian context as envisaged in the policy documents with regard to its goals as well as pedagogical practices. It attempts to pursue critical reflection of the linkages between EE and science education and examines the challenges and possibilities of integrating and broadening science education using perspectives from environmental education. Although the pedagogical and epistemological conflicts between the two disciplines are often debated, it is argued that both the subjects have much to contribute to each other in terms of offering different perspectives and in creating a somewhat broader goal for science in the curriculum that encompasses interdisciplinary approach central to EE. Finally, the paper attempts to elaborate upon two contentious socio-scientific issues presented in the current science curriculum through epistemic and educational lens to highlight the lacunae in the existing science textbooks.

Key words: Environmental Education, Science Education, integrating, socio-scientific issues, science textbooks.

Introduction

Education has an important role to play in the process of changing society. Realization of education as the basis for developing competencies for a sustainable human society, lead to the declaration of 2005-2014 as the Decade of Education for Sustainable Development by UN General Assembly and a call for reorientation of education for sustainability. This was reiterated in the Position Paper on 'Habitat and Learning' (2005) which emphasized the need for a new paradigm for education as humanity endeavours to move onto a path of sustainable development. However, in light of multiple, often contradictory, conceptions of 'sustainability' and 'development', a critical examination of the constructs is required for a clear conceptualization of the goals and pedagogy. Furthermore, in accordance with the recommendations of Education and National Development, Report of the Education Commission (1964-66), National Policy of Education (1986) and the Supreme Court of India (2004), National Curriculum Framework (NCF) 2005 stressed on the inclusion of environmental education in school curriculum and

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recommended that EE should be infused in all the subjects. This integration poses possibilities as well as challenges for the curriculum developers and educators at the level of selection of content as well pedagogical practices.

With regard to integration of science education with perspectives of EE, the ontological, pedagogical and epistemological conflicts between the two disciplines are often debated. This inclusion calls for a broadening of the science curriculum towards a postmodernist view that recognizes uncertainty and a plurality of competing but legitimate perspectives. For environmental education to be fully integrated into schools, particular care must be taken to properly incorporate it into the curriculum (Conde, M.C., & Sánchez, J.S.,2010) and not just a mere addition of environmental issues to existing content. There is a need of consistently aligning it with the ethical, conceptual, and methodological principles underlying environmental education such that it provides opportunities to learners to identify and think about the complexities of issues from various perspectives, acquire ability to analyze issues and understand the values underlying opposing positions on issues. This calls for examination of the teaching-learning resources including the science textbooks for its alignment with the vision of infusion of issue driven, multidisciplinary EE.

Thus, this paper attempts at analyzing the material on controversial socio-scientific issues' incorporated in the science textbooks at two levels. First, *Epistemic level,* which involves examining the text as a set of conclusions: identifying the main conclusions, examine the evidence and arguments in support of and against the conclusions and identifying the underlying assumptions. Second, *Educational Level,* which involves examining the material from the perspective of the value of content in achieving the learning objectives.

Place of Environment Education in School Curriculum and its Goals: Policy Perspectives

The roots of the present status of EE in school curriculum can be traced back to the Report of the Education Commission (1964–66). Highlighting the importance of EE, the Report recommended, "The aim of teaching science in the primary school should be to develop proper understanding of the main facts, concepts, principles and processes in the physical and biological environment". Thus, environmental education has been viewed as part of science curriculum.

National Policy of Education, NPE(1986) emphasized the integration of aspects of environment with all the subjects. "There is a paramount need to create a consciousness of the environment. It must permeate all ages and all sections of society, beginning with the child. Environmental consciousness should inform teaching in schools and colleges." Para 8.15

Thus, environmental education has been visualized as an integral part of the curriculum at all levels and was expected to be integrated with the teaching of other subjects, particularly science. As envisioned in NPE (1986), National Curriculum Framework (2000) emphasized the importance of EE in school education. In 1991, the Supreme Court directed that: *"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. 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. 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."

Taking this forward, National Focus Group, Position Paper on 'Habitat and Learning' (2005) stated,

"As humanity endeavours to move onto a path of sustainable development, even as it enters the Information Age, it is evident that we need a new paradigm for education. Environmental education (EE) is ideally placed to serve as the lever for this paradigm shift…"

Highlighting the need for reorienting education to promote and facilitate sustainable development, National Focus Group, Position Paper on 'Habitat and Learning'(2005) views EE as a tool to promote the pursuit of sustainable development. It emphasizes that EE should aim at developing the ability to critically analyse the environmental problems and issues and build the capacity to take positive environment actions in order to facilitate the move towards sustainable development. However, it nowhere attempts to provide a working definition of 'sustainable development'. This is crucial in light of the fact that the term "sustainable development" itself is socially and culturally contested. The multiple interpretations and different meanings depending on the cultures and the different interest groups within societies reflect both a variety of contesting ideologies and underlying assumptions as well as ongoing political debate about the nature of sustainable futures (Tilbury, 1995).

In other words, the concept of 'sustainable development' is a dynamic and evolving concept and conflicts and contestations are very much a part of it. The discourses on EE and Education for Sustainable Development have for years been an on-going site for struggle (Stevenson, 2007). Questions such as, - What constitutes development and for whom? What kind of development do we want to sustain: social, cultural, and/or economic? Are these aspects separable or interlinked? What changes are required to achieve sustainability? How can they be achieved? What are the implications for economic growth? What are the political debates about sustainability? - do not offer easy answers and require understanding of issues from multiple perspectives demonstrating the complexity and interconnectedness between issues that are significant to humanity. The discourses on EE and Education for Sustainable Development represent multiple conceptions of these constructs. Four conceptions regarding the relationship between EE and Education for Sustainable Development emerge from the discourses. A review and analysis of these constructs and relationship between sustainable development and EE is central to the determination of the foundations of education as these constructs are dynamic and evolving.

First, sustainable development as the ultimate goal of environmental education: the term environmental education "for" sustainable development (EEFSD) is proposed (Tilbury 1995). Sustainable development is viewed as the ultimate goal of "Man's" relation with the environment and suggests that environmental education should be reoriented to meet this end (Suave, 1996). According to this, EE can be seen as a means to achieve sustainable development.

Second, sustainable development refers to specific objectives, which should be added to those of environmental education. Therefore, the expression 'education for environment and sustainable development' is used (Suave, 1996). EE and Education for Sustainable Development are perceived to be distinct fields, where EE comprises the foundation for Education for Sustainable Development but the latter has evolved into an educational practice on its own (Eilam and Trop, 2011).

Third, EE and Education for Sustainable Development are perceived as separate fields of education with areas of overlap (Fien &Tilbury, 2002).

Fourth, the term environmental education implicitly includes education for sustainable development and it is therefore pointless to change the terminology; quite the contrary, this could lead to confusion (Suave 1996).

Examining the relationship between EE and Education for Sustainable Development as highlighted in National Focus Group, Position Paper on 'Habitat and Learning'(2005) with reference to the conceptions above, it can be seen that sustainable development is viewed as the ultimate goal of environmental education and is regarded as a vehicle in the pursuit of sustainable development. The position paper emphasizes the reorientation of the education system towards sustainable development. Moreover, it presents sustainable development as a 'process' that encourages individuals to engage in the process of critical inquiry as opposed to 'product' centered view which represents a one-dimensional vision of sustainable development as some sort of endstate (Tilbury, 2002), thus, seeing educational programmes as indoctrination with the vision of an ideal, sustainable future (Jickling, 1992). However, lack of a comprehensive definition of sustainable development in the document leads to ambiguity regarding the following: What constitutes sustainable development? What might be the contribution of the field of "sustainable development" to environmental education? Reformist v/s Radical view of sustainable development? (Tilbury, 2002) These questions, although complex, are of value while making decisions about the goals of EE.

Further the National Focus Group, Position Paper on 'Habitat and Learning' (2005) states that the components of EE should be infused within each subject. It is worthwhile to pursue the implications of the 'infusion' of EE with the other subjects in terms of the goals, teaching-learning resources as well as pedagogical practices. In what follows, possibilities and challenges posed by the integration of Environmental and Science Education are explored.

Environmental and Science Education: Conflicting Paradigms?

The teaching of environmental education has traditionally occurred in science classrooms. Yet, the interrelationships between science and EE are discussed and debated for their incongruity and incompatibility in terms of goals as well as pedagogical practices. Pedagogical approaches in EE are aimed at embracing a complex view containing multiple, undetermined and interdependent causalities as opposed to the nature of scientific activities focused on the simpler physical and chemical systems (National Focus Group, Position Paper on 'Habitat and Learning', 2005).

The discipline of science as it is taught in most schools is constructed largely as a value-free, objective domain aiming at understanding the cause-effect

relationships governing the natural environment through experiments. Traditional science classes are based on a positivist paradigm and are replete with bodies of discrete content knowledge that are considered beyond dispute, politically and socially neutral and laboratory activities that are not investigations into the unknown, but recipes to be followed (Gough, 2002; Hodson, 2001; Hodson & Bencze, 1998). Conventional science teaching includes dealing with established and secure knowledge, while contested knowledge, multiple solutions, controversy and ethics have been excluded (Hodson, 2003). This is in sharp contrast with EE, which is considered to be issue-driven, value-laden and includes social dimensions. Referring to the problem of integration of EE and science education, Hart (2001) points out that science education represents a worldview that is ontologically distinct from that of EE. He asserts that "The science teacher's typical preoccupation with objective observation and quantification represents a scientifically determined philosophy of teaching and learning characterized by knowledge transmission which often excludes active independent learning."

Science teaching and learning is dominated by the transmission of indisputable scientific facts that have been accumulated through rigorous experimentation, observations and theory building. This is in sharp contrast with EE which involves a critical understanding of the complex, often contradictory issues, reflection on one's assumptions, beliefs, biases and ideological boundaries (Hart, 2001). Following the experimental method of science to study the complex systems poses serious difficulties as it depends on the experimenters' ability to control all relevant parameters and to replicate conditions at will (National Focus Group, Position Paper on 'Habitat and Learning', 2005). Hence, the reductionist approach science teaching is in contrast with the systems approach of EE that focuses on holistic thinking and inter-disciplinarity, ethical, political, social and cultural components to curriculum thereby challenging teachers' views that science should be value-free (Dillon, 2002).

Integrating Science Education and Environmental Education: Towards a holistic view

Although the pedagogical and epistemological conflicts between the two disciplines are often debated, it is argued that both the subjects have much to contribute to each other in terms of offering different perspectives on the "pedagogy of understanding" and in creating a somewhat broader role for science in the curriculum(Zandvliet, 2001). Integrating perspectives from environmental education with science education requires reconceptualization of goals of science education, role of teacher and pedagogy (Gough, 2002). To accomplish this goal, science educators must better understand the multiple perspectives inherent in the conceptual framework which informs the pedagogy of environmental education and

need to discard the old scientific reductionist models.

This view was echoed by Dillon (2001) who suitably pointed out:

"Environmental education can offer science education a range of perspectives on knowledge and situated learning that assist those in the science education movement who wish to challenge existing orthodoxies. Through its multi-disciplinary origins and traditions, environmental education offers a conceptual richness that challenges some current thinking in science education."

The integration between EE and science education is stressed upon in National Focus Group, Position Paper on 'Habitat and Learning' (2005) both at the level of content as well as pedagogy. It recommends that EE should permeate every discipline being taught in the schools. Further, describing the method of science as objective, grounded in observations and empirical facts, it argues that elements of the scientific method are equally pertinent to the exploration of other branches of knowledge as well including EE and helps in building capacity for critical thinking and problem solving. Thus, it calls for strengthening of the scientific perspective in EE. With regard to ways of knowing, Hart (2001) argues that a mere accumulation of scientific knowledge that presumes progressive technological development (which has been the focus in traditional science classrooms) will not resolve the tensions between the individual and the collective. Clarity and balance between the cognitive and the interpretive perspectives is required to ensure better personal-social environmental decisions at the level of practice. Environmental education provides an opportunity to bring in these interpretive perspectives to the science classroom through inclusion of contemporary and challenging social and scientific issues and deepens the idea that science curricula should provide for experiences that are flexible, experiential and which students perceive to have personal as well as social meaning. Such an approach negates issues of right and wrong and allows individuals or groups to consider multiple perspectives on an issue. On the other hand, scientific viewpoint, without consideration of socio-cultural perspectives, does not present the holistic picture on environmental issues.

Thus, it is argued that distinct, yet interrelated epistemologies of science education and EE have much to offer to each other. Integrating dimensions of EE in science education could facilitate the understanding of the nature of science, and scientific inquiry, using the natural environment as a context for investigating real world problems, and the development of socio-developmental skills and cognitive attributes through learning experiences in natural settings (Zandvliet, 2001).

Translating Vision into Practice: Examining Science Textbooks

Through examples of two contentious socio-scientific issues, namely, Genetically Modified (GM) crops and Global Warming, the content in science textbooks has been examined critically with reference to the objectives of EE.

Educational Level

The focus of EE (National Focus Group, Position Paper on 'Habitat and Learning', 2005) is to

*expose students to the natural and social world

* to enable them to analyse, evaluate, and draw inferences about problems and concerns related to the environment; to add to understanding of environmental issues

* to promote positive environmental actions in order to facilitate the move towards sustainable development.

The issues of global warming, GM crops, incorporated in textbooks can provide a context to promote active student learning, present a realistic and dynamic view of science, and provide a mechanism for integrating the scientific, political, economic and social dimensions of global environmental change (Schweitzer, 2005) offering opportunities to analyse, evaluate, and draw inferences about problems and concerns related to the environment. Research has shown that inclusion of contentious environmental issues in the science curriculum is a useful way of organising the curriculum to develop concepts in a way that supports an integration of the cognitive and affective domains in science (Littledyke, 2006) and promote critical thinking, moral reasoning and understanding of nature of science. It provides students with opportunities to learn about the functioning of natural systems, to identify their beliefs and issues, to consider a range of perspectives to make informed and responsible choices.

Moreover, these controversial issues provide opportunities to educators to address a number of important goals pertaining to environmental issues in the broader curriculum with the goal of sustainable development. Inclusion of such issues marks a departure from the previous approaches to EE that focused primarily on apolitical and aesthetic work without addressing the need of developing closer links among environmental quality, human equality, human rights and peace and their underlying political threads. Incorporating and addressing these links between social justice and ecological sustainability are central to education for sustainability (Tilbury, 2002). The selection of contentious issues like Global warming provides a mechanism for integrating the scientific, political and social dimensions of global environmental change and provide opportunities to learners to obtain valuable socio-developmental and cognitive skills through exposure to real-world problems.

As pointed out by Gayford (2002):

"Inclusion of controversial issues, such as global climate change within the school science curriculum presents several different challenges to teachers. Firstly, the controversial nature of the topic, secondly it does not relate well to the normal sequencing and division of topics within most science courses and thirdly there are important non-scientific aspects to possible solutions to the problem. It helps to create a learning experience for students that allowed them to explore and develop their own value system in a rational way."

Thus, the inclusion of these environmental issues provide a context and opportunity for teachers and learners to consider multiple values-based views about environmental education (including the scientific view) and develop socio-developmental skills and cognitive attributes through exposure to real-world problems. Developing understanding of the interconnectedness in nature and in human society is integral to the concept of environmental education. It cannot be viewed mechanistically to indicate availability, scarcity and use of physical resources and encompasses relationships among people, land, water, forest etc. as well as the cultural and spiritual aspects of human existence.

Epistemic Level

Genetically Modified Crops

Chapter-XII in the Biology textbook of Grade-XII has a section on GM crops. The text mentions the advantages of Genetic modification, namely, (i) made crops more tolerant to abiotic stresses (cold, drought, salt, heat), (ii) reduced reliance on chemical pesticides (pest-resistant crops), (iii) helps to reduce post harvest losses, (iv) increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil) and (v) enhanced nutritional value of food, e.g., Vitamin 'A' enriched rice. In addition to these uses, GM has been used to create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals.

These uses/advantages are presented as indisputable conclusions. The text does not cite evidence in support of the conclusions and offer the opportunity to engage with the issues and concerns. However, literature on GM foods clearly shows the lack of consensus on these highly debatable issues and raises concern over social, economic, political, ecological impact of GM crops. This is in contradiction with the objectives of EE that aims at enabling students to analyze, evaluate, and draw inferences about problems and concerns related to the environment. The points listed above are contestable and raises the following socio-political, economic, ecological, and ethical concerns that have been sidelined in the text:

** Issue of Hunger vs. Antibiotic Resistance*

With the increase in the population and a major section facing issues of shortage of food leading to hunger and poverty, biotechnology is considered to be a powerful enabling tool that can revolutionalise agriculture.

On the contrary, concern has been expressed on the possibility of transfer of GM DNA from the plant to gut micro flora of humans and animals. The antibiotic resistant genes, used in the genetic modification process, have the potential to adversely affect the efficacy of antibiotics. Reports of toxicity tests submitted to the Indian regulatory authorities, calls Bt Brinjal: "potentially unsafe for human consumption." The risks involve generation of antibiotic resistant protein in consumption. The risks involve generation of antibiotic resistant protein in Bt-Brinjal, presence of 16-17mg/kg of Bt-insecticide toxin in the plant leading to alteration in blood clotting time (prothrombin) and affects liver.

** Advancement in technology vs. food quality and nutrition*

Bt-crops offer a solution to the enormous losses in crop yield by creating drought-resistant and pest-resistant crops. Moreover, GM crops require less energy and chemicals leading to healthier, cheaper foods. On the contrary, it is argued that genetic modification in plants may lead to changes in nutritional composition resulting in a negative impact on the nutritional heath of the consumers.

** Increased crop yield vs.farmer's autonomy*

It offers an incentive to the poor farmers, by increasing the crop yield as well as profit making, thus reducing their dependence on the unpredictable climatic changes. However, is it ethical to snatch away farmers' autonomy and make them dependent on foreign companies to supply the seeds. Are we not putting our self-reliance again at stake by depending on western companies for seeds?

** Genetic modification vs. Local agricultural knowledge*

Hybridization, grafting etc as ways of cultivation of crops increases the crop yield and allows mixing of genes but in this, all the traits of one crop are transferred to the other without any privilege of selection. This has been made possible in modern biotechnological method leading, however, towards rejection of indigenous methods of production, and adopting advanced agri-based technology. But, farmers lack appropriate expertise in these technologies and such absorption and adaptation of fads, while displacing their own local knowledge systems, has also lead to increasing 'agricultural deskilling' leading to stress among farmers.

Pest resistance vs. Religious faith

Extensive use of herbicides and pesticides affect the digestive, circulatory or reproductive systems of the consumers.

Bt-crops help in reducing the dosage of these pesticides, and hence provide us with healthy food. However, many religions have explicit dietary prohibitions against consumption of certain foods. Concerns have been laid about mixing human and animal DNA with plants. Concerns have also been raised on the labeling of GM foods.

Super weeds vs. Herbicide resistance

Bt-crops help in reducing the use of herbicides, and hence provide healthier food. However, the herbicide resistant gene that is being genetically transferred to the GM crop can sometimes become resistant to the effect of pesticides or herbicides.

Global warming:

Chapter-seven in the Chemistry textbook of grade XI has a section on global warming.

The text, broadly, talks about following aspects:

* Concepts of global warming and green house effect;

* Its causes, namely, Chlorofluorocarbons (CFCs)-man-made industrial chemicals, use of chemical fertilizers and the burning of fossil fuels;

* Impact of increase global temperature- melting of polar ice caps and flooding of low lying areas all over the earth, increase in the incidence of infectious diseases like dengue, malaria;

* Ways to reduce global warming

The text claims that global warming is occurring (although no evidence is presented in favour/against it). No data has been presented in the text in support or against the claims and learners are expected to accept these conclusions. It is important to present data as research has shown that students make use of observation-based climatic data sets in crafting their arguments in four ways: to support their central argument; to negate the central argument of the opposing side; to present challenges to the opposing side; and to raise new scientific questions and while discussing the social and political dimensions of global warming. (Schweitzer, 2005)

In addition, causes of global warming highlight an underlying assumption that this phenomenon is due to human activities and sidelines the following issues/debates concerning global warming.

* Is the global temperature and sea-level rising?
* Are Glaciers retreating?
* Acidification of oceans?

Further, the physical, social, ecological and economic ramifications are ignored in the text. It is crucial to establish these linkages

between the social, political, economic and ecological issues as it highlights the interconnectedness and multidisciplinary nature of EE and transcend the boundaries and compartmentalization imposed by the 'subjects' taught as part of the pre-decided syllabus.

Socio-political-economic issues

* Understanding the political debate on climate crisis between developed and developing countries
* Impact on agriculture
* Health issues

Ecological issues

* Impact on ocean: rise in sea levels and ocean acidification
* Increase in the frequency of natural disasters
* Change in weather patterns
* Impact on biological systems-loss of biodiversity

The overemphasis on scientific perspective in the text cannot be overlooked. However, it is argued that the lack of a social or emotional component in the teaching and learning of environmental issues is the greatest deficit in the scientific perspective (Deloria, in his book *Red Earth, White Lies:Native Americans and the Myth of Scientific Fact,* as cited by Zandvliet, 2001). Analysis of these socio-cultural, political, environmental and economic issues based on evidence helps learners to understand that there isn't always a "right" answer, and reinforces the importance of making informed decisions that are well-supported by evidence. These provide opportunities to teachers to help learners understand nature of science and that contradictions and conflicts are very much a part of science, which negates the popular but faulty notion of science being thought of as a black and white, all-or-nothing proposition, and scientists are portrayed as purely logical with no personal feelings. It is, therefore, crucial for teacher to bring these debates to the fore in the classroom. This requires a shift from a simplistic, reductionist view where issues and concepts are presented as indisputable, value-free ideas. This requires curriculum to be restructured so as to incorporate elements that require learners to critically analyse these issues from multiple perspectives on the basis of statistical data and arrive at informed conclusions. The advances in science and technology have always been regarded as progressive steps towards the development of the nation. However, this notion needs to be revisited and examined owing to recent science and technology disasters. These incidents have compelled us to think about fundamental questions like - what constitutes development and development for whom? Is the trajectory of development heading in the right direction?

Conclusion

As envisioned in the policy documents, the integration of environmental and science education calls for a paradigmatic shift from a traditional, discipline-oriented, objective, value-neutral approach (as observed in traditional science classrooms) to a comprehensive, interdisciplinary, holistic approach which is characteristic of environmental education. As argued in the paper, the distinct, yet interrelated epistemologies of science education and EE have much to offer to each other. The teaching-learning resources should reflect this vision and incorporate the elements that provide opportunities to teachers and learners to engage in critical evaluation of the socio-political, economic, ecological and ethical perspectives. Just a mere addition of the issues in the curriculum and over-emphasis on scientific perspective will not help achieve the goals of EE, as envisaged in National Curriculum Framework, 2005.

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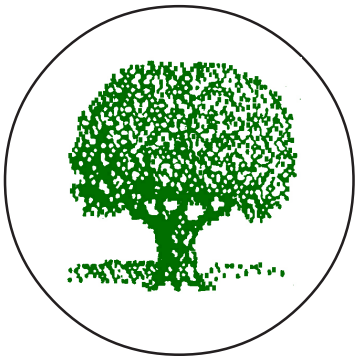

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