Teaching of Environmental Education through Infusion
An Analysis with Reference to Science Teaching

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Abstract

In the present era, environmental consciousness is a major concern which needs to be addressed by all future citizens. In India, this concern is addressed through formal school education. Environmental education is a compulsory subject in Indian schools. Some topics pertaining to environmental education are included in every discipline at school level such as in science subject. Science is a way to understand the surrounding in an effective manner. Local and global environmental concerns also can be taken care of properly by understanding scientific principles. The paper tries to analyse the transactional strategies being used by science teachers at secondary stage for infusion of environmental education components with the science subject. Analysis reflects that infusion of environmental components with science teaching needs more attention in science classrooms as teachers are not well equipped with strategies for infusion. Status of various other aspects related to infusion approach is found different in the study. Result suggests an urgent need to evolve well designed strategies for orientation of science teachers to use infusion approach in the classrooms. This paper also suggests some guidelines for infusion of environmental components with science teaching which can be helpful for teachers.

INTRODUCTION

Environmental consciousness is a major theme of almost all global and local deliberations and discussions in today's time (Our common future, 1987 and Rickinson, 2001).

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Environmental education is also an integral part of education at all levels of schooling. As per the guidelines of Hon'ble Supreme Court of India, the environmental education is a compulsory subject in schools (Writ petition (civil) No 860 of 1991). Apart from this, some topics pertaining to environmental education are the part and parcel of every discipline at school level (Habitat and Learning, 2006). However, there are still some gaps reflected in the attitude of our student in regard to environmental awareness and sensitivity (Tesfai, Nagothu, Simek, Fucik 2016; Himmani et al, 2017). Preparation of the students to meet real life challenges is one of the important aims of formal school education programme (NCF, 2005). In the present context, the biggest challenge is to inculcate the environmental friendly practices and attitude amongst the school students. This is essential because students need to cope up with rapidly changing environmental conditions and to act in an environmental friendly manner (Environmental Education in Schools, NCERT, 2004). Therefore, it is essential to focus on environmental education components with the teaching of all subjects at school level.

Need and significance of the study

NCF, 2005 recommends that environmental education should be taught through infusion approach with other school subjects. (NCF 2005). For this purpose, text books of all subjects reflect the concern for environmental education wherever is possible. Science text books also incorporate the chapters which generate the awareness and attitude towards the environment and environmental conservation. There are many other chapters in science books where the environmental concerns are reflected along with the scientific concepts (Science, Class IX and X, NCERT). In spite of this all, still there is a lot which needs to be reflected in the practices of our students for the healthy and happy life. School teachers are expected to take lead for this purpose. There are ample opportunities for a science teacher to talk about components related to environmental education during routine class-room science teaching at secondary stage of schooling. It is observed that some of science teachers try to infuse environmental education components with science teaching through different teaching-learning strategies. There is no study conducted so far in Madhya Pradesh with the objective to find out the details about transactional strategies used for infusion of environmental education components with science concepts. It is expected that the outcomes of this study would help the science teachers and other stake holders to put their focused efforts for inclusion of infusion of environmental education components with science concepts. The concerns related to environmental education needs to be addressed on priority basis through education as education is an unique investment for present and future (NPE, 1986).

Methodology

The paper focuses on the identification of different transactional strategies being adopted by science teachers in routine class room transactions at secondary stage in the state of Madhya Pradesh. Data for the study was collected from randomly selected 50 science teachers of government schools of Madhya Pradesh using survey method through self made questionnaire.

Objectives

The main objective of this study was to find out the ways through which science teachers try to infuse environmental education components with science teaching. Another objective includes the analysis of transactional strategies (practiced routinely) in regard to infusion of environmental education with science.

Sample

Data was collected from randomly selected 50 science teachers(teaching at secondary level i.e. Class IX and X) of government schools of Madhya Pradesh.

Tools

A self made questionnaire (having 10 descriptive type questions)was used as tool to collect the responses of science teachers. (Annexure – 01)

Result and analysis

Item wise analysis of questionnaire reflects that infusion of environmental components with science teaching is in practice by some of the teachers. The different aspects related to infusion have different status. A summary of the teacher's response in regard to each of question is presented herewith in the form of graphs.

Item 1: Teaching strategies used for infusion of environment related issues and concerns

Responses of teachers in regard to Item no. 1 are presented in the Table 1.

Table 1

Teaching strategies used for infusion

S. No.	Name of Strategy	Frequency of responses
1.	Discussion and group discussion	50
2.	Project work	25
3.	Field trip	20
4.	Demonstrations	2
5.	Quiz and games	5
6.	Brain storming	00
7.	Role play	00
8.	Reflective diaries	00
9.	Portfolios	00
10.	Use of ICT	5
11.	Discussion with resource persons	00

Table 1 reflects majority of teachers (100%) use discussion and group discussion method for teaching science at secondary level. Project work is also used by 50 per cent of teachers. Field trip as a way to incorporate environmental issues with science teaching is also used by 40 per cent teachers. Demonstrations made by the teacher hardly incorporate the issues of

environment. Very less percentage of teachers (2%) mention that the brain-storming and role play is being used to incorporate the environmental issues. Quiz and games are also used by about 10 percent of teachers as pedagogy of infusion. None of the teachers mention that they use reflective diaries and portfolios as pedagogy for secondary stage science teaching. ICT is also used by some of the teachers (10%) for incorporating environmental issues with the science teaching at secondary stage. Discussion with the resources person and use of any other material as teaching aid is also not mentioned by any of the respondent teacher.

In a nut shell, it is reflected from the responses of the teachers that in general, the traditional chalk and talk method is being used by the majority of the teachers for transaction of science concepts and to incorporate the environmental issues with science teaching.

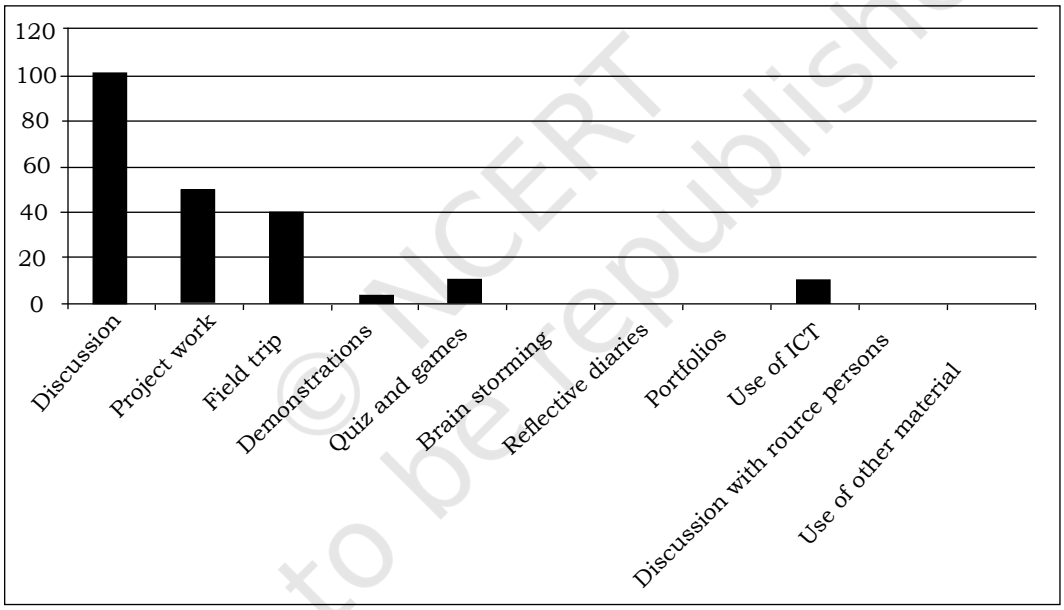

Fig. 1: Teaching strategies used for infusion of environment related issues and concerns

Table 2

Examples of environmental related topics taught through infusion approach

S. No.	Examples of environment related topics	Frequency (Total 100) Each respondent to mention two activities
1.	Air pollution	10
2.	Water pollution	30
3.	Energy	20
4.	Biodiversity	10
5.	Not provided any examples	30

Item 2: Each of the respondent teachers were expected to provide at least name of two topics or concepts as examples of environmental related topics taught through infusion approach. The responses reflect that only 40 per cent of teachers give examples. Majority of the examples includes the concepts from the topics directly related to environment; air pollution (20%), water pollution (15%), energy (10%), biodiversity (5%).

In second part of question, teachers were asked to provide reasons for not including infusion approach. 60 per cent of the teachers do not mention any of the examples. Majority of them also, does not give any reason and 40 per cent of them mention that they have not been given any training in this regard.

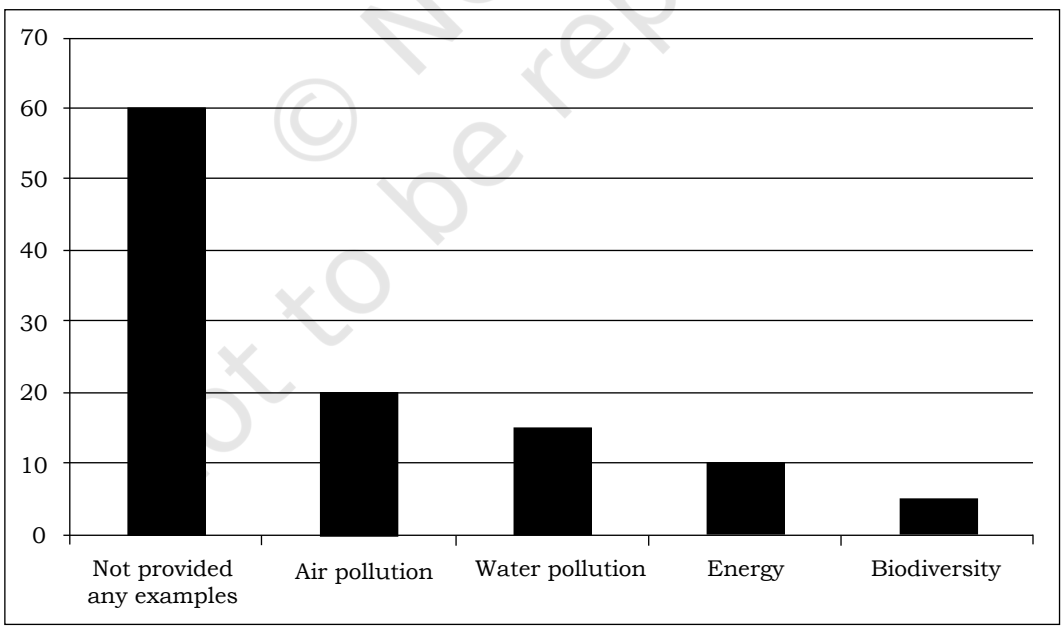

Fig. 2: Examples of environmental related topics taught through infusion approach

Table 3

Activities for students regarding environmental awareness and attitude development

S.No.	Activities for awareness and attitude development	Frequency of responses (Total 50 respondent) Each teacher to mention two activities
1.	Plantation in school premise	40
2.	Competitions on environment related topics	30
3.	Nature club activities	10
4.	Infusion with content	20

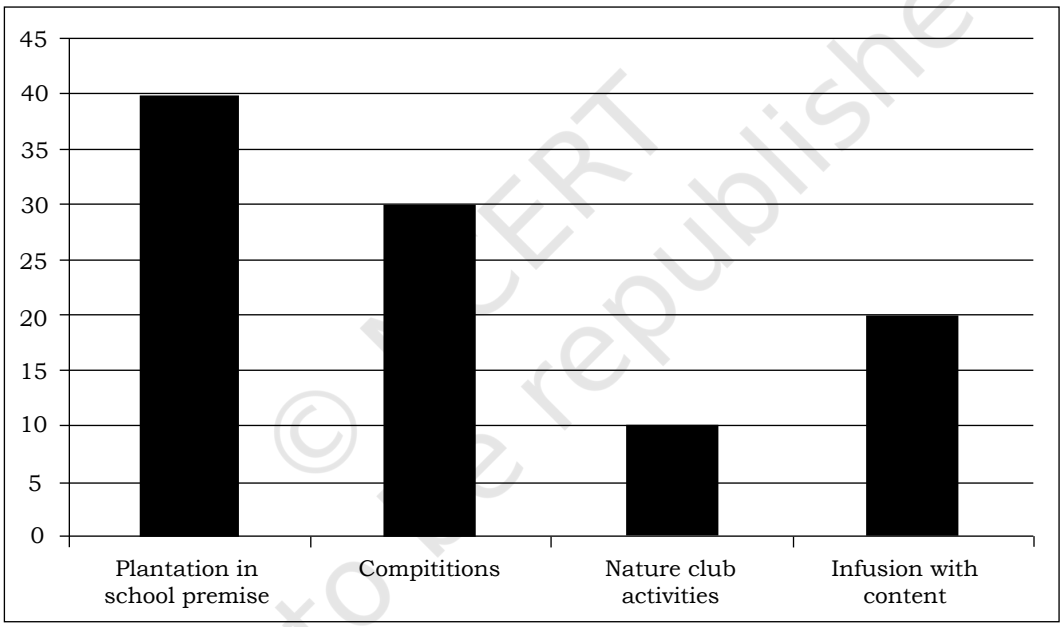

Fig. 3: Activities for students regarding environmental awareness and attitude development

Item 3: Activities for students regarding environmental awareness and attitude development revels that 40% teachers mention about tree plantation in the school premise.30% teachers mention about some competitions on the topics related to environment. About 10% teachers mention about nature club activities also. Some 20% of them mention that they make them aware about some of the issues along with the content wherever is possible. In this question also each of the respondents were suppose to mention to activities at least.

Table 4

Infusion of local environmental issues

S.No.	Infusion of local issues; examples	Frequency of responses (Total 50 respondent) Each teacher to mention two activities
1.	Water pollution at city lack	40
2.	Growth of Jalkumbhi	30
3.	Soil pollution	35
4.	Air pollution	30
5.	Decreased water level	15

Item 4: All the respondent (100%) teachers mention that they discuss about local environmental issues during science teaching. Majority (80%) of the teachers mention water pollution at city lack as an example. Over growth of water plant species (jalkumbhi) also have been mentioned by most of the teachers (60%). Other examples include about soil pollution (70%), air pollution (60 %) and decreased level of ground water in the city area (30%).

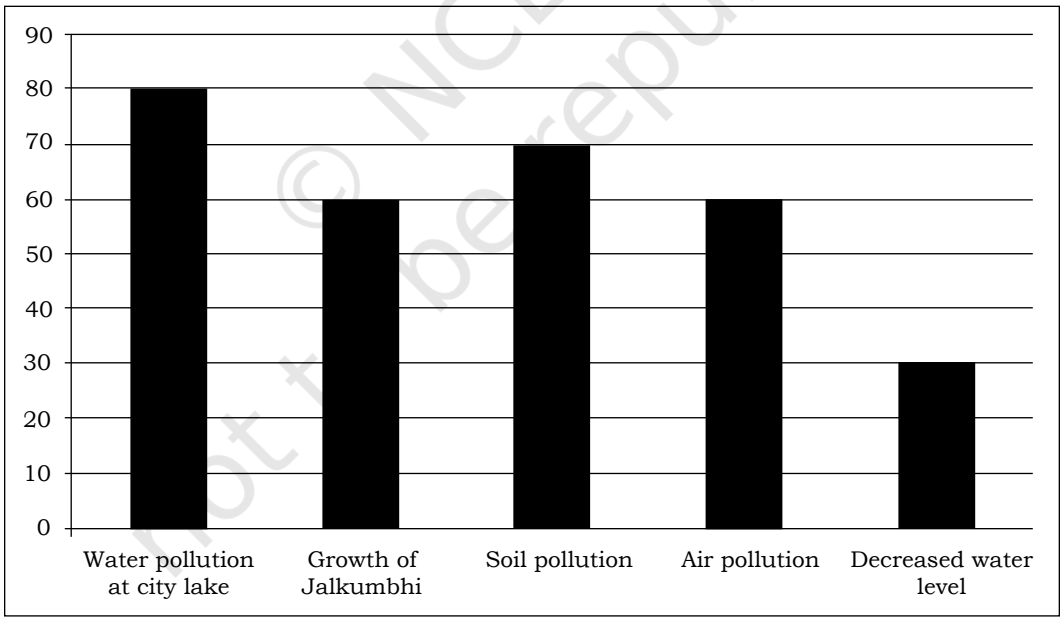

Fig. 4: Examples of infusion of local environmental issues

Table 5

Examples of activities to enhance students' participation for conservation of environment

S. No.	Activities for students	Frequency of responses (Total 50 respondent) Each teacher to mention two activities
1.	Tree plantation	50
2.	*Van Mahotsav* celebration	40
3.	Development of vermin compost pit	20
4.	School campus cleaning programme	90

Item 5: This question was asked to the teachers with the intention to know about classroom activities related to science concepts those can be helpful for conservation of environment as well. For example; teachers could mention the use of micro-scale apparatus, for example, 2 mL test tube, 10 mL beaker etc. for performing some activities during science teaching. Activities can be performed with the help of these apparatus to demonstrate the scientific concepts and are environmental friendly also. Teachers have not responded about the

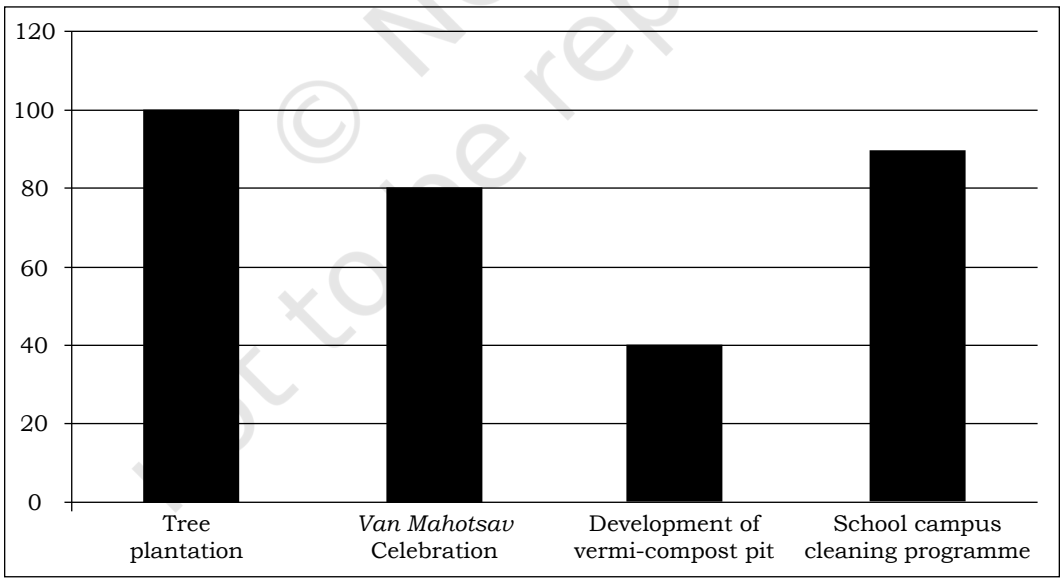

Fig. 5: Examples of activities to enhance students' participation for conservation of environment;

activities during science teaching but they have mentioned about other activities those are performed in the school for conservation of environment. The same is presented here in the graphical form.

All the respondent teachers (100%) mention about tree plantation as one of the major activity to increase student's participation for environmental conservation. Celebration of *Van Mahotsav* in the month of July is another activity which involves students at large. Around 80 per cent teachers mention about it. 40 per cent teachers mention that the development of vermi compost plantin school campus is also one activity ensures the students' participation. Apart from this, school campus cleaning programme involves students as mentioned by 90 per cent of the teachers.

In this question, teachers were expected to mention about content area which has scope to infuse legal provision for conservation of natural wealth. They were asked to mention at least one legal provision. Majority of the teachers (80%) mention that the content of science does not provide scope for infusion related to legal provisions for conservation of natural wealth and wild life. Only 20

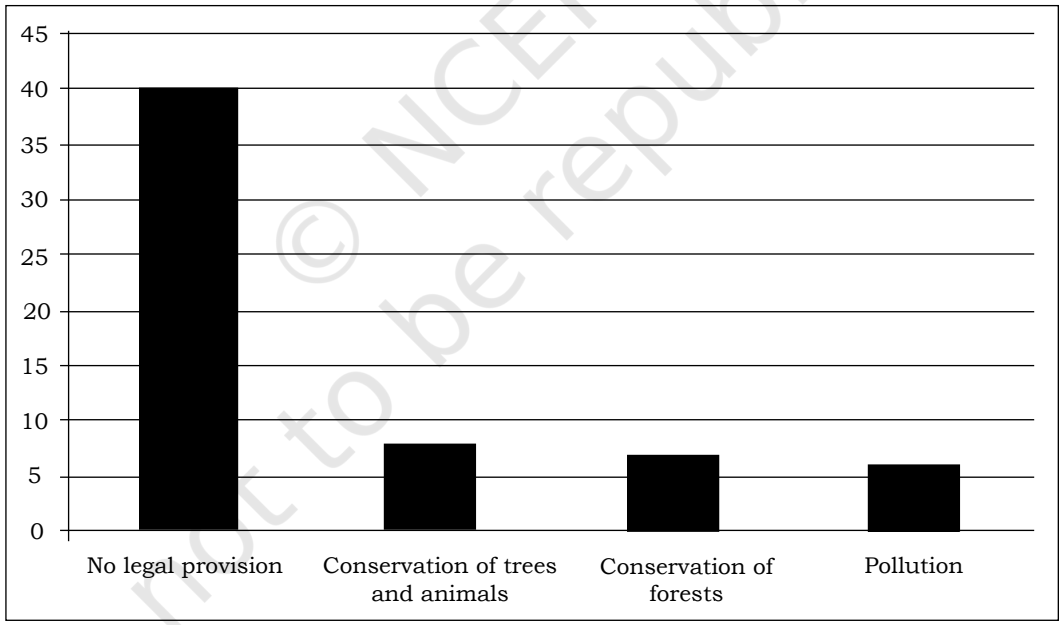

Fig. 6: Examples of legal provisions for conservation of natural wealth

per cent of the teachers mention that they discuss about legal provisions during classroom teaching of science. These 10 teachers (20 % of total respondent) mention more than two or three legal provisions. Frequencies of responses of 20 per cent teachers are mentioned in the following table;

Table 6

Legal provisions for conservation of natural wealth

S. No.	Areas of legal provisions	Frequencies
1.	No scope for legal provision	40
2.	Conservation of forests andtrees	8 (out of remaining 10)
3.	Conservation of wild animals	7 (out of remaining 10)
4.	Pollution	6 (out of remaining 10)

Table 7

Difficulties faced by teachers for infusion of environmental issues with science teaching

S. No.	Areas of difficulties	Frequencies (total 50)
1.	Curriculum load	34
2.	Unaware of infusion strategies	16

This question was responded by all teachers indicating need for training in this area. Maximum teachers (68%) mention that the curriculum load of science hardly provides any opportunities for infusion of environmental issues. Some teachers (32%) mention that they are not capable of doing so and they have no idea that what way the

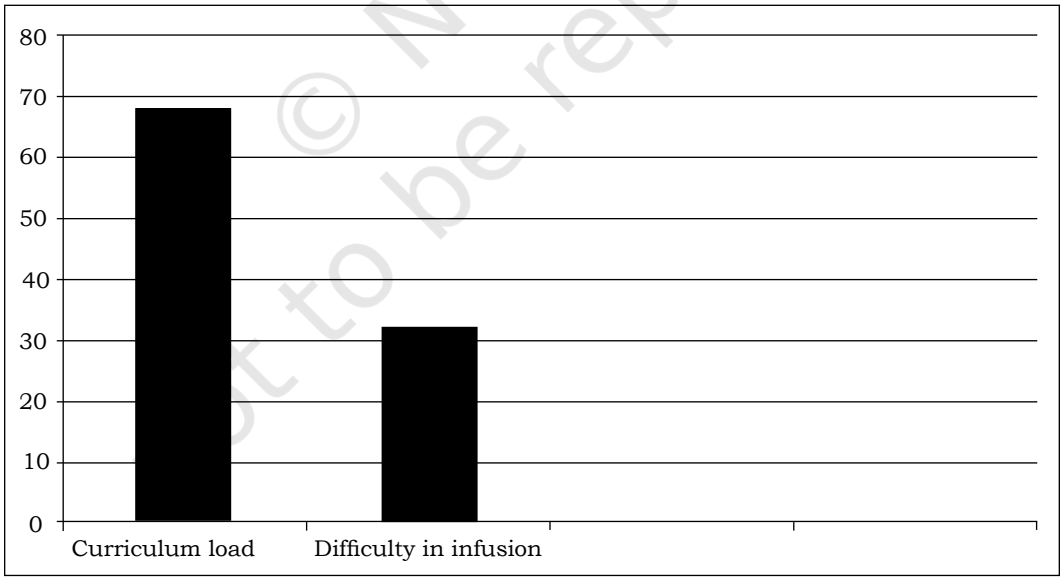

Fig. 7: Difficulties faced by teachers for infusion of environmental issues with science teaching

infusion should be carried out in the class room while teaching of science.

Table 8

Suggestions to overcome difficulties regarding infusion— teachers' view

S. No.	Suggestions to overcome difficulties	Frequencies (total 50)
1.	Need training	45
2.	Separate classes for environment education	05

Out of total respondents, 90 per cent teachers mention that they need proper training for infusion of environmental concerns with science teaching. Some of the teachers (10%) mention that the idea of infusing environmental education with science is not good. They advocate for the separate classes for the environmental education as in their opinion infusion leads to the dilution of the science subject.

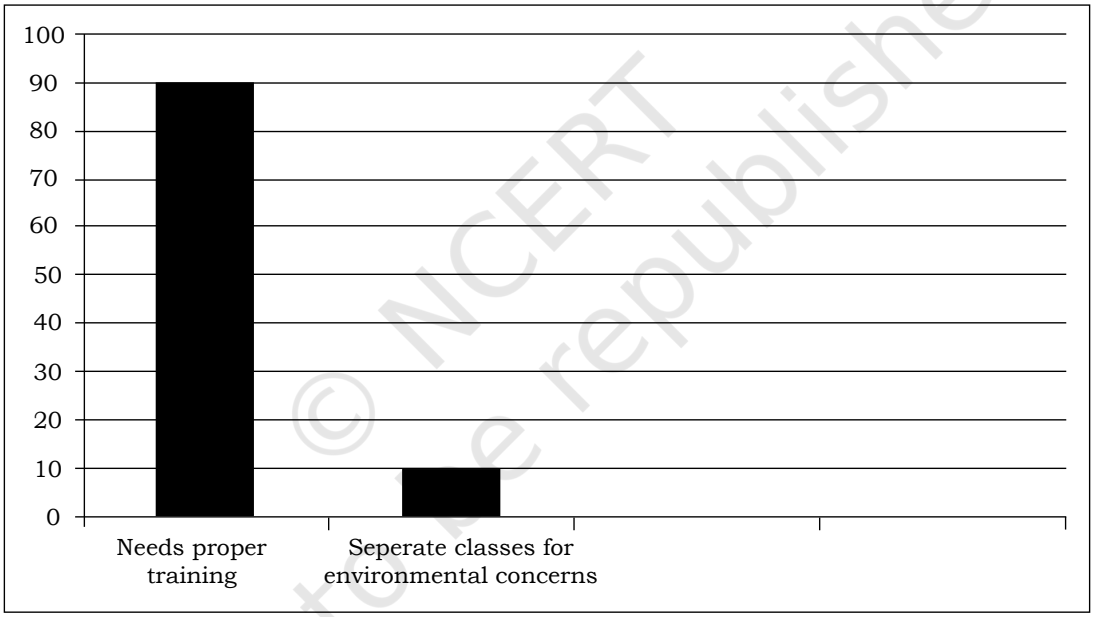

Fig. 8: Suggestions to overcome difficulties regarding infusion— teachers' view

Table 9

Daily life examples used for infusion

S. No.	Examples used for infusion from daily life	Frequencies (Total 100) Each respondent to mention two example
1.	Global warming	70
2.	Pollution	70
3.	Climate change	30
4.	Organic food and GM seeds	20
5.	Vegetarian vs non-vegetarian food	10

Teachers were asked to provide at least two examples from daily life those can be infused with the teaching of science at secondary level. Global warming (70%) and pollution (70%) are the two topics those are mentioned by most of the teachers. 30 per cent teachers mentioned about climate change and 20 per cent about organic food and GM seeds. 10 per cent of teachers also mentioned about vegetarian and non-vegetarian diet related environmental issues.

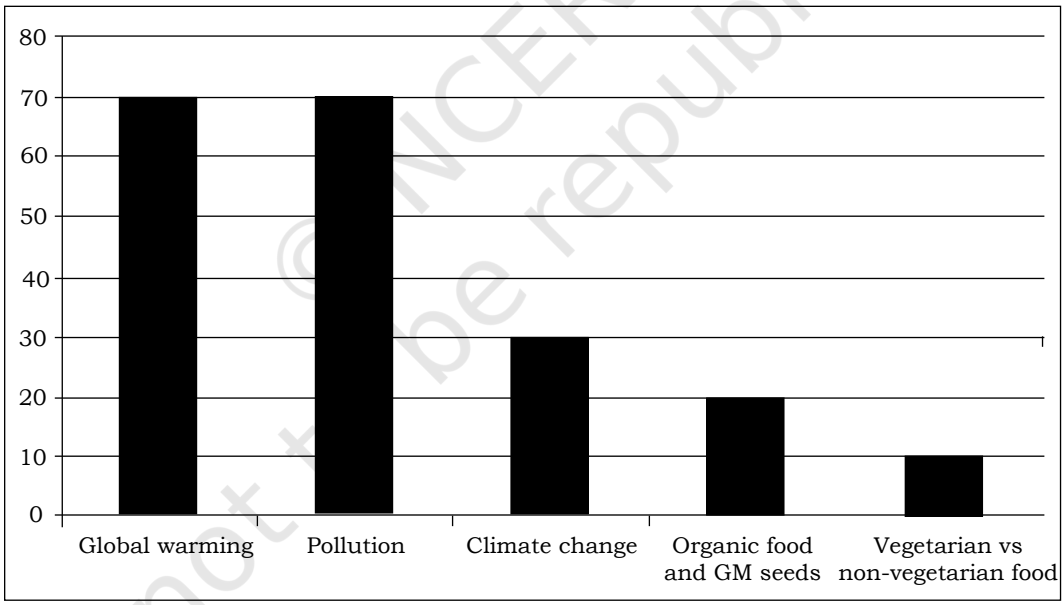

Fig. 9: Daily life examples used for infusion

Apart from the existing chapters related to environmental issues or problems, the majority of the teachers are in the opinion that incorporating the environmental related issues with the existing content may dilute the science in it. Still some of the teachers suggested that some of the places may have the possibility to incorporate the environmental issues related content with science teaching.

Table 10

Teachers' view examples of science content and concepts best suitable for infusion

S. No.	Science content / concepts	Frequencies (total 150) Each respondent to mention three concepts
1.	Metals and non-metals	08
2.	Sound	16
3.	Life processes	12
4.	Why do we fall ill	17
5.	Natural resources	34
6.	Our environment	27
7.	Sources of energy	33
8.	Human eye and colorful world	3

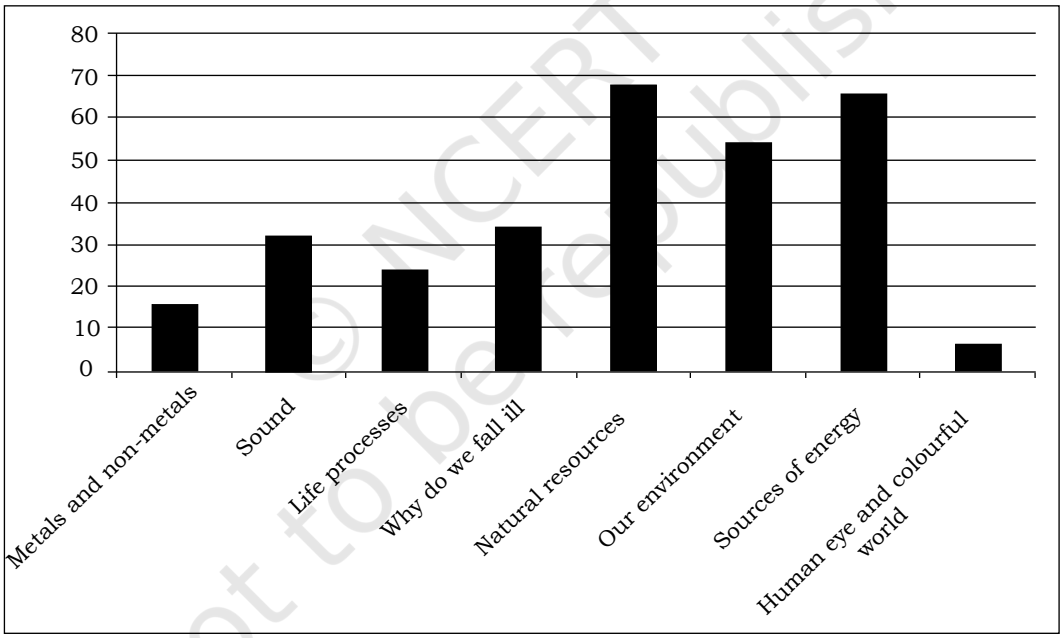

Fig. 10: Examples of science content and concepts best suitable for infusion— teachers' view

Conclusion

An analysis of responses of the teachers reflect that about 50 per cent teachers try to incorporate local and global environmental issues with the teaching of science. Further strengthening of this spirit can be done by opting well designed

strategies for infusion. Orientation and training programmes also can be organised to sensitise science teachers about infusion.

Another important exercise can be carried out while writing text book for secondary stage. Care should be taken to avoid repetition of same environmental components in various subjects. In this way, different environmental education related concepts can be incorporated at secondary stage without increasing the curriculum load.

For infusing the environmental education with science, some of the important concerns may be addressed by the science teachers during routine classroom transactions. Whenever possible during routine classroom transactions the teachers should focus on current environmental concerns and should try to relate them with their immediate environment. The possible interaction between science, technology and environment should be focused. For example, while teaching energy, the different sources of energy, non-conventional energy sources, technology used for renewable energy, their cost effectiveness and their positive impacts on environment needs to be discussed. While discussing local specific environmental concern, learners should be given opportunities to clarify their personal stand on the issue. Not only should one try to relate all environmental problems with science but for their solutions also science should be trusted. Learners should be trained to assess community needs, community resources and community problems. Also, they need to be exposed to problems solving situations. They should be made aware about environment through simulations, role playing and educational games.

Ecological principles are universal and having bearing on social, cultural, economical and political aspects of life. Every teacher must be aware of ecological principles and should be able to use them during routine science classes.

There is ample of possibility to incorporate the text related to environmental education in the science textbooks at secondary stage. But, at the same time there is a danger of dilution of some of the scientific concepts. The infusion has to be carried out in such a skilled manner that the spirit of the science teaching is not affected.

This is an important task, the present generation teachers are entrusted with. For this purpose the teachers need proper training. The task of imparting training has to carry out effectively by the teacher training institutions for better future of human kind.

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