Environmental philosophies underlying the teaching of environmental education: A case study in India

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This study consists of two interdependent parts. First we categorise the environmental philosophies prevalent amongst environmentalists in India by comparing the way the environmental crisis is understood and what its causes and solutions are thought to be. In the second part, we use this categorisation for a case study of three high school science teachers in Indore, Madhya Pradesh. Our aim is to find out what environmental philosophies underlay their teaching. In order to do this, we collected data by interviewing the teachers, observing their classrooms, and studying their textbooks. We then looked through our data for indications of the environmental philosophies found in part 1. Although the interviews showed some signs of Gandhian, Appropriate Technology, Eco-marxist, and other philosophies, in the classrooms the teachers adhered mainly to Ecological Modernisation and Eco-capitalist philosophies, and rarely expressed their own opinions. Despite progressive policy statements, the teaching was mainly textbook based, neglecting to consider systemic causes or solutions. One of the most significant findings was the prevalence of an idealist faith in a 'Balance of Nature' which was trusted to rectify upsets caused by human immorality.

Keywords: environmental philosophy, environmental education, high school science textbooks, balance of nature

Introduction: the goals and philosophies behind environmental education

Is acquiring 'skills, attitudes, motivations and commitment to work individually and collectively toward solutions' a goal of environmental education (as suggested by the UNESCO-UNEP International Environmental Workshop, 1975)? Or should schools merely teach students to become aware of social and/or scientific aspects, 'objectively'

presenting the points of view of all environmental philosophies so that students can decide for themselves what to believe and how to act (Blatt 2015; Heimlich and Ardoin, 2008; Stevenson 2007; Edelson 2007)? But since societal inequalities do exist, multiple perspectives cannot compete on a level playing field (Kelly and Brandes 2001) - so is 'objectivity' even possible (Haydock 2015)? Perhaps encouraging students to consider a range of perspectives need not mean that teachers should attempt to present every position as being equally valid (Dunlop and Brown 2015). These are the larger questions which motivated our case study.

Clearly, teaching does depend on the socio-political context (Sharma and Buxton 2015) and the underlying environmental philosophies. Any 'journey of transformation begins with the willingness and ability to question the philosophy upon which current [environmental education] practices are founded' (Edwards, 2016). By 'philosophies' we mean general world outlooks which may be conscious or unconscious, and can be revealed through an analysis of people's life-processes: their actions, statements, material conditions, and the social and political structure (Cornforth 1975). This is similar to what some call 'ideology' (Althusser 1971; Cross 1997; Säther 2003). We do not think that philosophy can be separated from physical reality. Life-processes are not just products of philosophies - philosophies are also products of life-processes. People may imagine false or apparent motives, and their actual environmental philosophies may be different from what they profess. Whether they realise it or not, everyone has an environmental philosophy, which can be revealed through an analysis of their statements and actions which have an impact on the environment. Therefore, it is important to understand how educators' philosophies affect classroom teaching (Pajares, 1992), bearing in mind that the philosophies are necessarily complex, nuanced, dynamic, and changeable.

Reviews and analyses of approaches which have been taken to teach environmental science throughout the world have revealed a diversity which depends upon the underlying environmental philosophies (Barraza, Duque-Aristiza´Bal, and Rebolledo 2003; Carter 2012; Cole 2007; Gough 2003; Hart and Nolan 1999; Laessoe 2010; Palmer 1998; Sauve 2005). Some claim that the prevalent rhetoric on sustainable development (Tilbury 1995) masks the actual aims (Winter 2007), with school practices favouring the maintenance of a system 'marked by high environmental impact and deeply stratified class relations' (Stahelin, Accioly, and Sánchez 2015) - i.e. capitalist economic control by the elite and powerful at the expense of human justice and environmental concerns (McLaren and Farahmandpur 2005). There is a controversy as to whether environmental philosophies which are not inline with globalisation, neoliberal forces, and a 'corporate curriculum' are denied adequate representation (Hursh, Henderson, and Greenwood 2015; Jickling and Wals 2008). This may be happening despite explicit recognition for incorporating critical inquiry, with actual practice instead emphasizing 'passive assimilation and reproduction of simplistic factual knowledge and an unproblematic "truth"' (Stevenson 2007).

The situation in India is not clear, although Almeida and Cutter-Mackenzie (2011) have noted a mainstream trend towards a techno-centric perspective and education for sustainable development. The National Council of Educational Research and Training (NCERT), a government body responsible for giving advice and support to improve the quality of education in India, has produced position papers which seem to be in line with a Freirean perspective (Freire, 1968), stating, 'Education must be seen as a liberating process... The process of education must...free itself from the shackles of all kinds of exploitation and injustice...which prevent our children from being part of the

process' (NCERT 2006a). Another document states that education needs to expose and sensitise students to their environment as well as 'to promote positive environmental actions in order to facilitate the move towards sustainable development' (NCERT 2006b).

A related objective of science education which is mentioned in most Indian policy documents (NCERT 2005, 2006a, 2006b, 2006c), and is also listed as a Fundamental Duty in Article 51-A of the Constitution, is the development of 'scientific temper': the practice of using a scientific method throughout one's daily life to ask and search for answers to all sorts of questions (Nehru 1946). Nehru claimed that this goes beyond the domain in which science is normally done, including the consideration of ultimate purposes, beauty, goodness and truth. Thus, its relevance to environmental education and science and society issues is clear. At the same time, scientific temper is the opposite of religion, which 'relies on emotion and intuition' and is (mis)applied 'to everything in life, even to those things which are capable of intellectual inquiry and observation' (ibid, p. 513). This hints at the pervasive conflicts between idealist (e.g. religious) and materialist (e.g. scientific) philosophies, and leads us to ask how these philosophies differentiate the various environmental education approaches which we find.

There is a pressing need to find out which environmental philosophies actually underlie teaching, both in order to understand the present state of environmental education, and ultimately to figure out what should be our role, as educationists, in solving the environmental crisis. We therefore decided to conduct a case study in order to investigate the following questions in the specific context of high school science teaching in Indore, the area in which we had been working.

Research questions

What environmental philosophies underlie the views and practices of the teachers and their textbooks? What are their stances towards (1) the main concerns of the environmental crisis, (2) the causes of environmental problems, and (3) the solutions to environmental problems?

Study Design

We had been teaching and working with schools and a non-governmental educational organisation in Indore (and other parts of Madhya Pradesh) fairly regularly over the past 30 years, so this was the area in which we were interested. Our aim was to conduct an exploratory study in order to examine a few cases in some depth, rather than to generalise or identify the most prevalent approaches to environmental education in India. Therefore we did not use the questionnaire or survey approach which others have used to explore the perspectives of environmental education teachers on controversial issues (Cotton et al. 2007; Dunlop and Brown 2015). We were well-situated to conduct a case study since we were not completely outsiders, already being familiar with the language, social, political, and economic culture. We purposely chose a variety of types of schools: one government and two private schools (which do not receive any government funding). Our previous experience with these schools meant that we were familiar with their educational system, classroom culture, pedagogies, and problems. The schools varied with regard to their educational Board and syllabus (as indicated by the textbooks used), the socio-economic class they served and the languages that were used (**Table 1**).

We focussed on science teaching in Class X (with 14-16 year-old students), because this is where the pre-Board examination science syllabus includes the most advanced work on environmental education. We sought and obtained the friendly agreement of the teacher who taught this level of science in each school, (allowing them ample opportunity to refuse). All the teachers had a Masters in a science subject as well as a B. Ed, and Amrita also had an M. Ed. Different aspects of environmental education are present in the science and the social science syllabi in these schools (with considerable overlap), but we chose to work only with natural science teachers (who do not also teach social sciences) so that our case studies would be more focussed.

Our methods were qualitative, and included non-participant classroom observations, individual semi-structured interviews (shortly after the final classroom observations), and critical analysis of textbook chapters. This is similar to the methods used by other researchers to investigate philosophies, teacher educators' understandings, and other aspects of environmental education programmes (Almeida, 2015; Pajares 1992; Tal and Peled 2016). We weren't sure whether the teachers themselves would be fully aware of the actual environmental philosophies that underlie their classroom teaching, or would be willing or able to describe them to us. Therefore, we needed to analyse the interconnections between what the teachers stated and what we saw in their classrooms, textbooks, and policy statements.

Each teacher taught lessons based closely on their science textbook chapters related to the environment. During the times these chapters were being covered, one researcher was present, sitting in the back of each class, observing, recording detailed field notes, and making a complete audio-recording (video recording may have been too invasive). The students did not pay much attention to the intrusion. The teachers may have been affected to some extent, but they appeared to be relaxed and carrying on as usual. The field notes included details of the selection of content, its organisation and presentation, pedagogy, questions raised by the teacher, activities, examples brought into the discussion, and details relating to the infrastructure of the classroom.

The semi-structured interviews were conducted in January and February 2014, in Hindi and English. They consisted of a few very broad questions about the teachers' views on development, progress, environmental problems, the nature of science, the nature of science education, and teaching methods. These questions were used only to initiate the teachers' talk. Rather than asking them direct questions regarding their environmental philosophies, we analysed their comments in order to understand their underlying environmental philosophies. Following are some of the questions we used as rough guides, although not all questions were asked to all teachers.

- What first comes to your mind when you hear the words 'development' or 'progress'?
- Many times people say the world is quickly changing. What do you think?
- Keeping in mind the present times, what kind of development model do you recommend for India?
- Based on your teaching experience, what do you see as the role of science in school education?
- Should forest conservation or the use of alternative sources of energy be taught or learned? If so, how?
- What changes might you like to see in the syllabus and textbooks?
- Do you think social issues should be mentioned in science classes?

The teachers were allowed to lead the interview in various directions, with the interviewer mainly asking for clarification and examples. The opinions of the interviewer were not explicitly stated, although in some cases they were probably implicit in the questions.

The audio recordings of the interviews and classroom observations were transcribed, summarised, and analysed, using an interpretive, inductive approach (similar to Tal and Peled 2016). We found indications of environmental philosophies by coding as well as by qualitatively analysing the narratives in context. Overlapping and interconnected codes and categorisations emerged from our analysis of the data in conjunction with our analysis and categorisation of environmental philosophies. Codes included: markers of development, role of science and technology, overpopulation as a root cause, anthropocentric viewpoint, quick-fix solution, individualistic, systemic, Balance of Nature, idealism, and other categories, as discussed below. Similar codes were used for analysing the textbook chapters. We also analysed the textbooks and classroom observation data with regard to pedagogy, but we will report the details of that analysis in a separate paper.

Environmental Philosophies prevalent in India

Our data analysis required us to identify, analyse, and compare environmental philosophies. Over the years, in India and abroad, there have been various perspectives on the environmental crisis, as expressed by governmental and non-governmental bodies, scientists, industrialists, academicians, and people's movements (Guha 2014; Meyers 1975; Foster 2009). Most of the published reviews of different environmental approaches in India have categorized them according to the particular problems and places they are concerned with and the sections of society they involve (Gadgil and Guha 2007; Prasad 2004; D'Souza 2012). Others have formed categories based on conceptions and characteristics of 'environment' (Sauvé 1996). However, we have found it more useful to categorise environmental philosophies by analysing what their main environmental concerns (symptoms) are, what their root causes are, and what sorts of solutions are advocated (**Tables 2, 3, and 4**).

Our analysis and identification of categories is based on the above reviews, original sources (given in the references to Table 2), as well as on our personal experience and involvement in environmentalism over the years. Through this analysis, we aim to go beyond simply naming, to overcome ideological blinders and empty signifiers (González-Gaudiano and Buenfil-Burgos 2009), and to understand the true nature of environmental philosophies. We have tried to indicate some of the many shades and admixtures within each type. Although these tables risk being oversimplifications, we have nevertheless found them useful in order to analyse how teachers, and textbook writers view the environmental crisis. We stress that their utility is not in branding people as having one philosophy, but in analysing similarities, differences and interrelationships, and in recognising mixtures of underlying philosophies. **Appendix A** gives a short critique of these environmental philosophies. We can summarise the Tables as follows.

Most environmentalists in India probably do not object to including almost all the items in **Table 2** in their lists of environmental concerns (Gadgil and Guha 2007b). However, their main concerns depend on their underlying environmental philosophies. Thus, compared to the mainstream Eco-capitalist philosophy, Gandhian and Appropriate Technology philosophies are likely to be more concerned about

urbanisation, pollution, and degradation of the environment from factories, mining, and other forms of industrial development, and less concerned about depletion of natural resources or maintaining modern development (R. Guha 2007).

As shown in **Table 2**, we found that some environmental concerns can be broadly classified as being more biotic (related to non-human life) or more social, although of course the biotic and the social interact with each other. This is similar to a differentiation on the basis of anthropocentrism (Eckersley 1992). Thus, Deep Ecology is less concerned about humans and more concerned about loss of habitat, extinction of species, and cruelty to non-human animals (Diehm 2002). Both Eco-capitalism and Eco-marxism are more concerned about anthropocentric (social) environmental problems and using nature for human needs. Eco-marxism emphasizes the unequal distribution of resources more than their depletion. Eco-capitalism may not consider the agricultural crisis as an environmental problem.

However, differences between environmental philosophies are more apparent with regard to the causes and solutions (**Tables 3 and 4**). This is similar to what has been reported in the west: 'While there was consensus within the environmental movement concerning the symptoms of the environmental degradation, the underlying causes and the means of averting further catastrophe were – and remain – in dispute even among professional ecologists' (Stevenson, 2007,p. 141).

Many of the differences in beliefs regarding causes can be understood in terms of how materialist or idealist (Cornforth 1975) the underlying philosophies are, as we indicate in **Table 3**. By idealist, we mean a way of looking at the world in which it is assumed that 'ideas' are basic and matter is derived from ideas (e.g. abstractions such as thoughts, consciousness, souls, spirits, or gods may be thought to exist prior to and independently of physical reality). This contrasts with materialist, in which ideas are believed to be derivative from matter (physical processes). Gandhian and Eco-spiritual philosophies (and to some extent Deep Ecology and Appropriate Technology) are more idealist because, according to them, environmental problems may be caused by attitudes, immorality, and ways of thinking (Naidu 2006), and therefore the solutions are to change beliefs and attitudes (**Table 4**).

Whether or how modern science and technology is considered to be a cause of environmental problems differs widely, and distinguishes the philosophies from each other, as shown in the last column of **Table 3**. For many philosophies, there may be an assumption that science and technology and other material causes are in turn caused by attitudes and beliefs.

The belief that environmental problems are due to humans upsetting the 'Balance of Nature' is consistent with all except the most materialist philosophies (**Table 3**). An explanation and critique of the Balance of Nature argument is discussed in **Appendix B**. It is basically idealist: an abstract idea of balance that is maintained by some unknown mystical force. Although humans do disturb nature to cause environmental problems, the belief in a 'Balance of Nature' contradicts: (1) the evidence that nature itself is not stable or balanced, but undergoes continuous change and evolution; (2) the lack of evidence for any possible physical mechanism whereby such a balance might be maintained; and (3) the evidence that nature is not teleological. The randomness in nature, the extinction of species, and the large oscillations in population density are some observations which can not be explained by a Balance of Nature theory (Cuddington 2001; Levins and Lewontin, 1985).

Results: The underlying philosophies of the teachers, their teaching and their textbooks

Using the classification of environmental philosophies in **Tables 2-4**, we have analysed the environmentalism expressed in the teachers' interviews, classroom observations, and by the two textbooks (which we will refer to as the MP (MP SCERT 2012) and NCERT (2006d) textbooks). We will show that despite progressive policy statements and diverse opinions the teachers expressed in their interviews, teaching was based on environmental philosophies which actually upheld inequitable capitalist development at the expense of the environment.

All three of the teachers were very friendly, relaxed, and eager to talk. When the interviewer began by asking what comes to their mind when they think of 'development', Amrita and Renu themselves brought up environmental problems. Chhaya seemed to be less concerned about environmental problems, and saw a distinction between science and social science issues, doubting whether the chapter, 'Management of Natural Resources' should be included in the NCERT textbook as it was a social science topic. She spent considerable classroom time explaining the 'science' behind the greenhouse effect rather than any related social questions. This contrasts with Renu who said that topics like waste management and resource preservation are not mentioned in social science classes and science teachers are better prepared to bring them up.

The classroom pedagogy (obviously impeded by the large numbers of students) was mainly confined to lecturing and a sort of enquiry-based teaching in which the teacher asked questions and the students answered, in chorus or individually (usually spontaneously rather than being individually called upon). Although there was no group-work or hands-on activity, the classes were lively, and there was a lot of 'background chatter' in which students seemed to be having interesting discussions amongst themselves. In all cases the teaching was 'to the textbook', closely following the selection and order of topics in each chapter. There was no indication of any critical analysis in which statements in the textbooks were opposed. The numbers of questions and marks related to environmental problems on the external examinations were prescribed to be less than 10% and the questions were not considered to be difficult. This meant that the teachers were under pressure not to devote much time to environmental education. Given the systemic constraints, we think the teachers were succeeding quite well in providing stimulating classes which were not too regimented, and the overall the mood was positive in all classes.

We have organised our findings into the following three sections in order to focus on (1) the nature of the environmental crisis and the key areas of concern, (2) the root causes of the crisis, and (3) the solutions to the crisis.

(1) The Nature of the Problem: Main environmental concerns

In this section we will analyse how the teachers and their textbooks defined the environmental crisis and which environmental concerns they focussed upon. We found little difference between the concerns that were expressed in the interviews, classroom observations, and textbooks. We will claim that their wide-ranging concerns do not lead to very clear-cut indications of any particular underlying environmental philosophy, except perhaps Eco-capitalism. The need for development was not questioned. There

was a common belief in the disruption of a 'Balance of Nature'. Since this was seen as both as a concern and a cause of environmental problems, we will defer its discussion to section (2).

Wide-ranging concerns

The NCERT textbook focuses mainly on environmental problems related to water, forests, pollution, depletion of natural resources, and the energy crisis, using examples in India. The MP textbook mentions all these and also acid rain, the greenhouse effect, sound pollution, and land management. These lists of concerns do not indicate an alignment with any particular philosophy. However, the mention of environmental problems due to large dams and nuclear power generation may not have been included in the NCERT text if the underlying philosophy was more Eco-capitalist. This contrasts with the MP textbook, in which (although it is briefly mentioned as a source of pollution), there is also the statement, 'nuclear energy should be used'. Depletion of the ozone layer is brought up in both texts, but global warming and climate change are mentioned only in the MP textbook (without doubting their existence).

Interestingly, the MP textbook mentions that there are also natural types of air pollution, such as dusty winds, volcanoes, micro-organisms (which release gases), and pollen grains. This is based on the stated definition: 'Unwanted change in the physical, chemical or biological characteristics of air, water and soil is pollution' (MP SCERT 2012 p. 277). This is an unanthropocentric definition in that it includes types not caused by humans - but anthropocentric since it excludes changes which people want. There is also the interesting statement: 'mixing of filth and gases like carbon dioxide in the drinking water makes the water polluted' – an obvious dig at certain multinational companies! It is interesting to find these elements of what might be seen as a Deep Ecology philosophy, although we did not find indications of it in the teacher interviews or classroom observations.

There were no clear signs of Eco-feminism in the classrooms or textbooks. Instead, we found gender bias, such as: 'Man has to depend on natural resources for all his needs...' (MP SCERT 2012, p. 277). However, there was one strange episode in which Renu (who was using the NCERT book), gave her class the definition of 'natural resources' as resources 'that are being continuously used by **women** for their betterment' (emphasis hers). When one boy objected, 'Not only women', she immediately relented, saying, 'not only women, all the living organisms' (a rather specious rebuke of anthropocentrism).

We observed two instances of an anthropocentric viewpoint in the classrooms. At one point, Amrita said, 'Does food web have any relevance in itself? Meaning, is there any use of a food web to us (humans)?' Similarly, Chhaya asked her class, 'What is the benefit of this ecosystem to us? What is the importance of it? Why is it necessary?' This could indicate Eco-capitalist or Eco-marxist philosophies (see **Table 2**).

The need for development is not questioned

The classroom observations, textbooks, and teacher interviews revealed an overall positive view of the need for industrial development which was more in line with Eco-capitalism than other philosophies (see **Table 2**). In their interviews, all three teachers mentioned the rapid technological advancements in information technology and

sophisticated electronics as being mainly positive. In their daily lives they also made use of development and technology - they all used electricity, phones, TV, vehicles, modern plumbing, etc. Renu said that development has made communication easier, inventions have become more environment-friendly, there are economical flights, and 'Life has become easy, especially for the - meaning, for everyone.' This is inline with the philosophy underlying the textbooks, as shown for example in the chapter, 'Sources of Energy':

> With technological progress, our demand for energy increases day by day. Our life-styles are also changing, we use machines to do more and more of our tasks. Our basic requirements are also increasing as industrialisation improves our living standards. (NCERT, 2006d, p. 248)
> Increasing industrialisation has led to a better quality of life all over the world. (ibid, p. 244)

There was no mention in the textbooks or classrooms that actually the majority of people in India are prevented from enjoying much of this better quality of life. No one raised the question of who benefits from development. Unequal wealth distribution and increasing rates of exploitation would have been mentioned if the text was based on an Eco-marxist philosophy.

Neither was there was any space in the textbooks or classrooms for questioning the need for increasing energy, which industries need energy, or which sorts of industrial production are needed. These questions might have indicated an environmental philosophy other than Eco-capitalism (see **Table 2**). Development itself was not seen to be an environmental problem, as it might have been if there was an underlying Gandhian or Deep Ecology philosophy. Although they were not specifically asked about biotic concerns in the interviews, none of the teachers spontaneously mentioned biodiversity or cruelty to animals, which might have indicated a philosophy such as Deep Ecology.

In line with their textbooks, in their interviews and classrooms all the teachers put much more emphasis on household rather than industrial waste, perhaps indicating an Eco-capitalist philosophy. However, the concerns that Amrita and especially Renu mentioned in their interviews do not indicate quite as much alignment with Eco-capitalism. For instance, they discussed industrial pollution, acid rain, effects on health, and problems related to agriculture more than their textbooks did. Chhaya also stressed the health effects of environmental problems in her classroom even though they were hardly mentioned in her textbook. But she discussed them in terms of 'basic science concepts' rather than social issues.

(2) The Root Causes of Environmental Problems

In this section we will show that the data concerning root causes indicated that there were some differences between the environmental philosophies of the teachers and what was expressed in their textbooks and classrooms. The textbooks tended to place the blame on individuals rather than industries or larger systemic causes, and to stress overpopulation rather than inequitable use of resources, indicating an underlying Eco-capitalist philosophy. This was despite some discordant statements blaming the economic system. However, in the interviews the teachers sounded surprisingly anti-capitalist - although this was not reflected in their classrooms. Significantly, we also found a pervasive idealist philosophy that blamed humans for upsetting a Balance of

Nature.

Disturbing the 'Balance of Nature'

Both textbooks took an overly reductionist approach when they failed to discuss the interrelationships between geochemical cycles, food chains, food webs, trophic levels and energy. They also failed to recognise the interdependence of biotic on abiotic components, something which Amrita did stress in her teaching. But echoing these confusions, Amrita told her class that 'nutrients go through the food chain and then come back to the soil again' in a natural ecosystem, but in an artificial ecosystem, the cycle may be disrupted, for example by non-biodegradable plastic bags. Thus, she said, an environmental problem is caused by making a naturally cyclic process unidirectional. She failed to mention that the associated flow of energy is in any case unidirectional.

In their classroom teaching, all three teachers discussed the existence of a 'Balance of Nature'. For example, when Amrita was talking about photosynthesis, she said, 'It is not only direction, it is actually: cycle. Oxygen cycle. Plants take carbon dioxide, produces oxygen. All living organisms take oxygen and produces carbon dioxide. So these living and non-living things also have to maintain Balance of Nature. Isn't it?' The belief that nature is teleological is also evident here.

In her classroom, Renu emphasized the disruption of balance as a cause:

> Our forests were destroyed by Britishers. They started growing those trees which were of their benefits. Biodiversity was destroyed. They grew plants in rows. Local people's benefits were overlooked. This had caused imbalance in environment. When India got independence, the pattern was followed by the Forest Department of India.

Similarly, Chhaya told her class:

> What will happen if animals don't eat other animals? What will happen if the plants are not eaten up? Will primary, secondary or tertiary consumers survive? The ecological balance will get disturbed...If you continue to cut trees like this, trees will disappear from the ecosystem and the balance will get drastically disturbed.

The NCERT textbook also refers to a Balance of Nature: 'All organisms, such as plants, animals, microorganisms and human beings as well as the physical surroundings interact with each other and maintain a balance in nature' (NCERT, 2006d, p. 257). Thus, the implication is that natural systems somehow (due to some unmentioned mystical force?) obey an idealist Balance of Nature, and people disrupt the balance to cause environmental problems. We saw signs of this teleological belief in both textbooks, in the teachers' interviews, and in the classrooms we observed. This is a common belief, characteristic of most environmental philosophies, as shown in **Table 3**. Neither in the textbooks, teachers' interviews, or classroom observations was there any mention of the evidence that contradicts the existence of a balance of nature (see the explanation for **Table 3**).

Is the cause the economic system or individual attitudes?

Although they were not mentioned in any of the classrooms, there were two discordant

statements regarding development in the textbooks. The NCERT textbook says: 'the kind of economic and social development we want will ultimately determine whether the environment will be conserved or further destroyed' (NCERT, 2006d, p. 272). However, there is no explanation or elaboration. The very first paragraph of Chapter 21 of the MP textbook goes much further: 'Industrialisation, urbanisation, technologicalisation and the market based economic system have increased the exploitation of natural resources resulting in an environmental crisis confronting humanity as a challenge' (MP SCERT 2012, p. 276). This sounds surprisingly damning (especially considering that it was written in a Bharatiya Janata Party (BJP) ruled state, and the BJP is well-known to be very pro-industry and anti-communist (Haydock, 2015). It seems to be very much inline with an Eco-marxist philosophy. However, the rest of the chapter quashes this stance, placing the blame on individual attitudes instead.

It goes on to mention a Gandhian love of nature and an idealist implication that environmental problems are caused by immoral thinking, such as greed. It includes the popular quote attributed to Gandhi: 'Nature has everything to give to man. But nature gives nothing to give to a greedy man. (MP SCERT 2012, p. 276)'. But there was no discussion or critique of this in any of the classrooms, except for admonishments by the teachers not to be greedy.

In the classrooms and textbooks there were a few implications of a causal relationship between economic development and environmental problems. For example, it was obvious that natural resources get depleted because they are used for industrial production. However, we did not see any critical discussion of the environment - economy conflict. On the other hand, in the interviews the teachers were not so hesitant to blame capitalism. They analysed the conflict in some depth, mentioning advantages and disadvantages, even though they were only having monologues with themselves. Chhaya shared her personal (moral?) dilemmas of whether to buy expensive things like computers and TVs and said that they have positive as well as negative effects on children. It was not very clear if she was realising the connection between rising consumerism and the environment. But Amrita clearly acknowledged that the growth-based development system is in direct tension with the environment. She explained that 'All things have two aspects, including development', sounding dialectical and indicating an underlying Eco-marxist philosophy. She argued against some forms of development, saying that it harms the environment and is not progressive, giving atom bombs and atomic energy as examples. This could indicate an Alternative Technology philosophy. But according to the way we have defined it in **Table 3**, she sounded Eco-marxist when she said that nuclear energy is being promoted because other countries will profit from it: 'Those people are not bothered about nature or people, they are just worried about their development, their profit.' When asked who profits, Amrita smiled and said,

> Countries like America... meaning elite people. There was a news some days back that all the money in this world is concentrated with a few hundred people. ...the wealth of all other millions and billions of people is in their hands. They are the ones who are regulating everything. First there used to be kings and there was a different kind of slavery, now we have another kind of slavery.

Renu also mentioned the corporate nexus behind nuclear power projects, and was bothered that they are proceeding, even though the local people are protesting. She also argued that one should not consume more than one needs. Was this a sign of Eco-marxism or a Gandhian or other idealist (Deep Ecology or Luddite?) philosophy?

Earlier, she had expressed pro-development concerns. However, she sounded Eco-marxist (against a capitalist concern for profit) when she said, 'Development means exploiting the natural resources just to make more and more profit' which may cause degradation of the environment and poor working conditions, and that is not progress, even if it does provide employment. She mentioned examples from her own life as well as distant events, such as the collapse of the Rana Plaza textile factory in Bangladesh.

However, despite what they said in their interviews regarding the causes of environmental problems, the teachers stuck fairly close to the main line of the textbooks in the classrooms that we observed. Individual attitudes were blamed and the economic system was not mentioned. For example, the general implication was that waste is caused by individual consumers' beliefs, desires, and uneducated choices, reflecting an idealism in which an idea or attitude gives rise to the physical reality of waste. This could be Gandhian. But the main focus was on waste disposal rather than its generation, indicating that waste production was taken for granted, sounding more Eco-capitalist than Gandhian. The blame for waste generation, disposal, and the 'use and throw' way of life was not placed on industries, governments, or the nature of development. There was no mention that in a capitalist system, industries have to keep their profit as the bottom line in order to survive (Marx, 1867), and this is what results in 'the disposable culture'. If there had been an underlying Eco-marxist philosophy, this would have been mentioned.

Mismanagement or inequitable use of resources?

The discussion on forests in the NCERT textbook (NCERT 2006d, Chapter 16) acknowledges 'local knowledge' and the needs of local people, in line with a Gandhian, Appropriate Technology, or similar philosophy. This is also shown by statements such as, 'before the British came and took over most of our forest areas, people had been living in these forests for centuries. They had developed practices to ensure that the resources were used in a sustainable manner.' This is romanticising the past, with no mention that deforestation, desertification, and over-grazing did sometimes occur even in ancient times (Barry 2007; Spence 2001). The chapter mentions the advantages of monoculture plantations which were promoted by the government and generate revenue for the forest department and industries, as well as the disadvantages of destroying biodiversity and not fulfilling the needs of local people. This discussion of conflicts of interest may imply a rather un-Eco-capitalist philosophy, in that it does not advocate profit as the only motive for forest plantation. Inequitable distribution of resources is also mentioned in this chapter, but it stops short of explicitly placing the blame for environmental problems on inequity (ibid, p. 269).

If was only in her interview that Renu, who used this book, clearly placed blame on inequitable use of resources, explaining how poor people are not allowed to cut forests but rich industrialists are, saying, 'So that is inequitable distribution...this is just one example...'

According to an Ecological Modernisation philosophy, many problems are blamed on the government's ineptitude, lack of will, or corruption. We saw some reflection of this when Renu said:

> The issue is with the implementation itself ... there is this general public opinion that there are laws. If someone complains, then the follow up is so slow that I think the laws are of no use.

However, she said this in reply to a leading question by the interviewer, and it contradicts other statements she made as well as her efforts to make complaints in order to solve local problems (see section (3)).

The alliance between scientific enterprise, industry and the state

In her interview, rather than blaming science for causing environmental problems, Chhaya expressed her awe of science: 'I am very impressed ...If science would not have existed, just think where would we have been...'

She first said that research is always for human welfare. She then added that the development of bombs is also one of the results of science, but she tried to justify this as being for self-defence, except in the case of a terrorist scientist. None of the teachers blamed science for the development of technologies which harmed the environment. This indicates that they were not having philosophies which are more critical of science itself, rather than just the misuse of science (see Table 3).

However, it is interesting that the NCERT textbook lists only disadvantages and not a single advantage of nuclear power. Neither did the teachers mention any advantages in the interviews or in their classes. Renu and Amrita both expressed anti-nuclear power sentiment in their interviews, which does not indicate an Eco-capitalist philosophy.

Overpopulation

The MP textbook states, 'The increasing population and the ever increasing demand of things for physical amenities have resulted in the fast exploitation of natural resources' (MP SCERT 2012 p. 277), and 'In the developing countries the growing population is the main reason of environmental imbalance' (ibid, p. 291). Placing the blame on the population explosion is typical of Eco-capitalist as well as Deep Ecology philosophies. There is no mention of the Eco-marxist view that coercive population control methods are aimed at the poor, who consume the least and require more children for their own welfare, or that the rich depend upon a large population of poor labourers to produce their wealth.

Chhaya, who was using this textbook, seems to have the same philosophy, since told her class:

> As the population increases, the CO_2 will also increase., won't it? Global warming will increase. Talking simply, if there are less people - This room has some capacity, if there are more people in this room than its capacity then what will happen?... suffocation. The same is true for the Earth.. If the load on earth increases, what will happen? The resources will be exploited. Isn't it? ... Consumption will increase for everything and things will deplete fast and several problems will emerge because of that.

In the NCERT textbooks, there is only one mention of the growing population: '...with the human population increasing at a tremendous rate due to improvement in health-care, the demand for all resources is increasing at an exponential rate' (NCERT, 2006d) p. 269). But there is no discussion on whether the problem could actually be due to the squandering of resources for the benefit of a few people. There is no effort to present multiple perspectives on the population problem in the textbooks. The teachers who

used the NCERT textbook did not mention the population problem either in their classrooms or in the interviews.

(3) Proposed Solutions to Environmental Problems

The range of environmental philosophies which were indicated by the data regarding causes was not so evident with regard to solutions. The underlying philosophy was mainly Eco-capitalist. As we shall discuss, this was indicated by individual or technocratic solutions which do not disrupt the capitalist economic system. The belief that disrupting the Balance of Nature was a cause led to the solution of just ceasing to disrupt.

The solutions reflected a limited variety of philosophies

The policy document produced by the National Focus Group on Habitat and Learning states:

> A great deal of the knowledge of the environment lies with India's barefoot ecologists, the people at the grass roots, and the new paradigm will be participatory, engaging members of local communities and will be sensitive to issues of diversity, gender and equity. (NCERT, 2006b, p. 111)

This could reflect multiple philosophies, including Gandhian, Appropriate Technology, Eco-feminist, and even Eco-marxist strands. However, this variety was hardly represented in the solutions mentioned in the classrooms, interviews, or textbooks.

There is some indication of an Eco-spiritual philosophy in the MP textbook when it suggests that 'Vedic' rituals are a solution to water pollution: 'The main method of purifying water is through mantras or by entering solar heat into the water through a natural process.' However, we did not find any indications of Eco-spirituality in any of the classrooms or interviews. The only reference to religion in the classrooms was when students in Chhaya's class mentioned throwing idols and wastage from rituals in water bodies as examples of pollution. The teachers, both in the interviews and in class, seemed to separate their religious beliefs from their science teaching.

The only instance in which animal preservation (one indication of a Deep Ecology philosophy) was mentioned in any of the classrooms was when Amrita mentioned the Save the Tiger campaign. She said they want to save tigers, rather than plants or other animals like birds, because tigers are at the top of the food chain, they are the most powerful, and therefore if they become extinct the whole food chain would be spoiled. This illogical argument was stated after she had asked which kind of food is better for you, vegetarian or non-vegetarian (she seemed to want the answer, 'both', on health grounds). One student said vegetarian was better because 'It balances food cycle.' But Amrita said that non-vegetarian is also necessary, and gave the tiger example. This shows how the Balance of Nature idea creates confusion when theorising causes and solutions. Also, the discussion did not include any counter-argument from the point of view of the villagers who get killed by tigers each year (as more anthropocentric Eco-marxists point out).

Technocratic solutions

The solutions to environmental problems which are suggested in the NCERT textbook include management of natural resources for sustainable development, creating international laws and regulations, forest management, and cleaning rivers. The focus on management and safe disposal rather than structural changes or reducing the production of wastes, indicates an underlying Ecological Modernisation, rather than Eco-marxist or Gandhian philosophy (see **Table 4**). Similarly, in a discussion of which energy sources should be used for which tasks, the question of which tasks are necessary or desirable is not mentioned. For example, it is assumed that 'we' need private automobiles. For other needs, using alternative and renewable sources of energy and improving efficiency are mentioned, which could suggest an Alternative Technology philosophy. However, it is taken for granted that energy requirements will keep increasing, which indicates an Eco-capitalist philosophy.

The MP chapter contains longer lists of technocratic solutions, but with less discussion. For example, it suggests treating and segregating industrial wastes from human habitation - but not reducing their production. Although the chapter began by blaming 'the market based economic system', it does not call for any systemic changes in order to solve the problems. It advocates minimising the use of fossil fuels 'as much as possible' and using nuclear power instead. It also calls for reducing the usage of pesticides and herbicides, which could be rather un-Eco-capitalist. However, most of the suggested solutions are aligned with an Ecological Modernisation philosophy, such as raising heights of chimneys, treating water from industrial units, and building irrigation canals.

In the classrooms, similar lists of technocratic solutions were mentioned, but without elaborating. The implicit assumption seemed to be that the solutions were factual and not worthy of critical analysis. Even in their interviews, the teachers set aside structural or systemic causes, and instead suggested corrective measures to a few symptoms as solutions. The possibility of curtailing development was unthinkable. As Renu told her class:

> Simply if we'll stop using the natural resources – if ... we will start conserving it, where will our development occur? We have to develop. India is a developing country. We can't just stop industrial development because we have to check the pollution.

Sustainable development or back to a balance?

A belief in a Balance of Nature may lead to an assumption that environmental problems can be solved by a hands-off approach, just letting nature go back to its 'balanced' state. We saw indications of this in the classrooms and textbooks. For example, the reduction or segregation of household waste was suggested, but the implicit assumption was that the mounds of waste already existing would just naturally disappear. An example of what happens when a hands-off approach is followed can be seen not far from Indore, where the Bhopal Gas Tragedy continues to cause health problems as chemical waste seeps into the ground and water supply (Broughton 2005). Neither this case nor any solution to industrial pollution was mentioned in any of the classrooms or in the NCERT textbook, although Amrita and Renu did mention it in their interviews.

Although Renu told her class that people's actions can upset the Balance of Nature, she also seemed to believe that people can do something to correct the imbalance if they are educated to act for the correct purpose. For example, she told her class, 'We need to educate the Forest Department about sustainable development.' But, on another occasion she told them, 'We don't need any human interference to maintain our forests. It maintains on its own.... All these geological cycles... they are being balanced,' and later, 'We need forests for ecological balance. That is the use of forests. It brings rains. It maintains temperature. Many cycles are maintained. It prevents soil erosion. Even it prevents global warming, drought, flood...'

In the interview, Amrita frequently mentioned 'sustainable development' as being 'natural':

> First of all, I think development should be sustainable... It should be according to nature. Whatever procedure we adopt for development, whatever work is started, first a complete survey should be done and [work out]... how sustainable it is ... how can it fit in the environment ....

She associated sustainable development with natural ecosystems (which do not include humans), that are described in the NCERT textbook as being 'self-sustaining', while artificial ecosystems may or may not be self-sustaining. This belief is related to the belief that natural ecosystems maintain a 'Balance of Nature'. In her interview Amrita related balance to cycles and she related the environmental crisis to humans making cycles uni-directional. This led her to believe that the solution is to go back to natural cycles and balance - to get some kind of sustainable development:

> They are saying that development should be sustainable. They go and block it. Whatever kind of development it is, it is uni-directional. If they somehow make it cyclic, then development will complete itself. Development can be for the long term if it can make a circle. Still, however many nuclear power plants or whatever they will make, their waste will be dumped anywhere, and then afterwards there will be a problem.

Perhaps she did not realise that a capitalist system of production could be better described as being a spiral rather than a circle, since it requires ever-increasing accumulation (Marx, 1867, Ch. 24-25) (Marx 1867). In discussing solutions, neither the teachers nor the textbooks mentioned the Eco-marxist view that there cannot be sustainable development while preserving the capitalist economic system.

Individualistic vs. systemic solutions

All the teachers conspicuously advocated The Three R's (Reduce, Recycle and Reuse) in their classrooms. This may appear to be anti-consumerist and perhaps anti-capitalist, in contrast to the main messages that we get through advertisements to keep buying more and more. But from the examples given in the textbook and in the classes, it was clear that The Three R's are all meant for individuals rather than industries, governments, or institutions. They seem to be based on the belief that the problem is caused by wrong individual behaviour which can be corrected if the individuals decide to follow the correct moral values. Although this is idealist, the text does not sound particularly Gandhian. Water consumption and wastage by industries is not mentioned. 'Reduce' mainly refers to switching off unnecessary lights and fans, and fixing leaky

water taps - a far cry from going back-to-the-village. However, displaying class bias, the NCERT textbook contains the question, 'Can you think of ways in which the use of [building materials in villages] can be reduced?' This could be a leading question made to support a Gandhian or Appropriate Technology philosophy.

Renu asked her students, 'Which one is better – reduce, recycle or reuse?' The class was divided between 'reuse' and 'recycle', with no mention of 'reduce' (the village building material question was not brought up.) This did not sound like a Gandhian call back-to-nature, which requires reducing unnecessary consumption and production (which Eco-marxism may also call for). In her classroom, Amrita discussed waste management and recycling, but not its social, political or economical aspects or connection to consumerism, which may have indicated Eco-marxism.

Although the MP textbook does not use the term, 3R's, it does suggest various steps individuals can take, including reducing and recycling: avoiding smoking, recycling biodegradable waste, wearing masks when spraying paints, not throwing waste in the open or into water, harvesting rainwater, planting trees, and not playing music loud. It also states, 'Man's attitude towards the expending of electricity, water, wood etc. is rather of carelessness. Man can change his habits and can save the precious natural resources by minimizing their use' (MP SCERT 2012, p. 291, emphasis added). While this might sound rather Eco-feminist (!) and anti-capitalist, the implication is that solutions lie in changing individual attitudes, which is a kind of idealism which is not in line with Eco-marxism.

The statement, 'But we need not feel powerless or overwhelmed by the scale of the problems because there are many things we can do to make a difference' (NCERT 2006d, p. 268), is in line with Ecological Modernisation, but does not sound convincing, given the scale of the problems as compared to the suggested solutions.

In her class, Amrita tried to focus on environmental problems which were relevant to the students' own lives, which makes good pedagogical sense. But since the larger political-economic connections were not mentioned by her or by the textbooks, it resulted in an implication that both the the causes and the solutions are individual rather than systemic, in line with an Eco-capitalist philosophy (see **Tables 3 and 4**).

Amrita tended to consider various points of view when she brought up topics in her interview, especially those related to concerns and causes. For example, in addition to raising issues in her own life, she also mentioned agricultural concerns such as the pro's and cons of stubble burning, including a farmer's perspective. However, in the classroom her statements related to solutions were relatively one-sided and authoritative. For example, she blamed students for having AC's and refrigerators at home, and thus causing the ozone hole. But there was no discussion on why they had these things in their homes, or why most people do not, or what the solution is. She blamed pollution on the students throwing out food wrappers, but there was no mention that the wrappers are caused by industries forced to make profits, and people not objecting to a system in which profit is the bottom line. Instead, more class time was spent explaining the 'science concepts', such as chemical reactions related to ozone and acid rain. Neither the teachers nor the textbook authors seemed to suffer from any serious deficit in understanding the basic 'science concepts' (except in relation to the Balance of Nature).

One of the ways we identified underlying environmental philosophies was by analysing what was left out of the textbooks and the classroom teaching. For example, the textbooks' only mention of transportation was, 'We cannot really imagine life without a number of electrical appliances and constant use of transportation' (NCERT 2006d). The authors neglected to mention the huge impact of private vehicles (roads,

fuel, pollution, safety, noise, marginalisation of lower classes, and an alienated way of life). This indicates an underlying Eco-capitalist philosophy in which we cannot even imagine a world with public rather than private transport. Vehicular air pollution was mentioned only in Chhaya's class, when she instructed her students (who were fairly lower class) to walk whenever possible, rather than using vehicles - again, an individualistic solution. But Chhaya herself did have an automobile.

The teachers' everyday lives and acts reflected somewhat different environmental philosophies. For example, Amrita mentioned that she may take part in ant-nuclear protests. Renu mentioned that she had joined with others in her locality to go to the local authorities to try to solve water drainage problems and set up rain water harvesting. These acts indicate underlying environmental philosophies which advocate community and governmental, rather than just individual action (see **Table 4**). But the only instance in which this was reflected in Renu's classroom was when she said: 'Equitable distribution is a government responsibility - not us. Though we can also ensure the thing.'

Conclusions

In order to analyse our case study data, we first categorised environmental philosophies that are prevalent in India (**Tables 2-4**). This revealed that the most crucial differences lie in the way the causes and solutions are viewed: whether they are idealist or materialist, how they view the role of science and technology in causing and/or solving environmental problems, and whether they call for individualistic or systemic solutions.

We then used this categorisation to analyse our data: recordings of teacher interviews and classroom observations, as well as the associated textbook chapters. We found that neither the classroom teaching nor the textbooks veered far from Eco-capitalist or Ecological Modernisation philosophies, despite some policy statements and opinions expressed by the teachers in their interviews which appeared to be based on other environmental philosophies. None of the teachers or textbooks denied the existence of the environmental crisis, but they all had a basically positive view of the need for development and new technologies.

One of our most important findings was that all three teachers and their textbooks showed a ubiquitous belief in a Balance of Nature. This was a clear indication of an idealist environmental philosophy that includes teleological assumptions and a disregard for material causes and interconnections (see Table 3). The widespread belief that environmental problems arise because this 'balance' is disturbed by humans leads to a belief in unrealistic solutions, such as just letting things go back to their 'natural balance'. The teachers also related the Balance of Nature to sustainable development. A critique of the belief in a Balance of Nature is often overlooked in analyses of environmental education, and we hope that our findings will stimulate other researchers to investigate this area. One study does indicate that even at the university level, a similar 'ambiguous, circular and polysemous' belief in a balance of nature was present (Zimmerman and Cuddington 2007).

In their interviews, teachers blamed some environmental problems on consumerism, the profit motive, and the inequitable distribution of resources, sounding Eco-marxist. They also mentioned some negative effects of technological development on the environment and on society. But in their classrooms they did not generally express their own opinions. They taught very closely to their textbooks, blaming environmental problems on the population explosion and individual attitudes and habits. The crucial question of 'Development for whom?' did not arise. There was some

discussion on conflicts of interest with regard to forest rights, but there was no mention of whether such conflicts and the disproportionate use of natural resources are inevitable in the existing economic system. This differs from Eckersley's (1992) report that teachers' personal opinions are reflected in their teaching (in Australia). It may be that teachers are being trained to follow prescribed agendas and are told not to express their own views in class (Firth and Winter 2007). More likely, based on our experience in schools and teacher education in India, they unconsciously follow this agenda due to implicit social compulsions of the mainstream ideology.

Although there is a popular complaint that the NCERT textbooks are 'leftist', our analysis revealed that their treatment of environmental problems, and especially solutions, is basically Eco-capitalist. Surprisingly, the MP chapter begins with a few anomalous statements that sound Eco-marxist and Gandhian (which were not discussed in class), but the over-all tone of the chapter suffers from a mechanical pseudo-factuality without critical discussion, making it appear to be an instrument of indoctrination rather than education. For example, each environmental problem is made to appear to be straight-forward and easily understandable, and each solution is stated as if it is unquestionably correct and cannot fail to solve the problem - without shaking capitalist development. This is particularly evident in its passages which celebrate presumed Vedic traditions, indicating an Eco-spiritual philosophy.

Interestingly, we did not find any signs of Eco-spirituality in the interviews, classrooms, or NCERT chapters. This is in contrast to Sylvia Almeida's (2015) claim that the religious beliefs of teacher educators in her case studies had a large influence on their knowledge and teaching of environmental education. More research is required to understand the relationships between religious practices, professed beliefs, underlying environmental philosophies, and practices that affect the environment. Other studies (Ratnam 2013) have provided evidence of differences between professed beliefs and underlying philosophies.

The teachers had a narrower range of underlying environmental philosophies with regard to solutions than causes. Their solutions, especially those voiced in their classrooms, were similar to those in the textbooks: individual and technocratic solutions and sustainable development, which are consistent with an Ecological Modernisation philosophy. This is similar to what has been reported elsewhere (Cotton et al. 2007; Stahelin, Accioly, and Sánchez 2015). Perhaps it is to be expected, given the traditional aims of education and the need to maintain the social order, as we mentioned in the introduction. As Angela Barton (2001) put it, 'school science reform has aligned itself to the imperatives of the capitalist marketplace rather than the goals of a democratic socialist struggle.'

What was more unexpected was that students were not only being told about environmental problems - they were also being urged, by both the teachers and the textbooks, to take certain action in order to solve the problems. (That the pedagogy was problematic is another question which we will address in another paper.) But there was an emphasis only on small measures that individuals can take, showing the same tendency to individualise environmental action that has been found in textbooks elsewhere (Sharma and Buxton 2015).

There were a few indications of an underlying Gandhian philosophy in the textbooks and classrooms: past village life was romanticised, forest destruction was blamed on the British, it was said that one should not consume more than what one needs, and environmental problems were blamed on greed. In the interviews, all three teachers seemed to have an Appropriate Technology philosophy when they voiced stands against nuclear technology, and one spoke out in favour of small dams over large

dams. However, in neither the textbooks, the classrooms, nor the interviews did we find much indication of Eco-feminism or Deep Ecology (even in its 'People for Animals' avatar), despite the prevalence of these amongst environmentalists in India.

We stress that this is an exploratory case study, and therefore we cannot use it to make generalisations. Also, we have not gone back to the teachers or textbook authors to find out what they think of our analysis, or how their stances may change over time. Although the particular teachers in our study were experienced, with a broader and more critical awareness (at least regarding the causes of environmental problems) than what was expressed in their textbooks, raising teacher awareness is certainly important (Summers and Kruger 2003). Almeida (2015) has reported on some of the difficulties of teacher education in India. However, the problems we have raised cannot be solved just by teacher education or textbook modification. Basic interdependent problems must also be tackled, such as the large number of students in classes, the shortage of government teacher and teacher educator jobs, the ongoing privatisation of education, poor infrastructure, overworked teachers with little time for planning or collaborating, pressure to cover large syllabi, and stress on examinations.

Identifying the environmental philosophies underlying environmental education is only a first step towards understanding and improving teaching. It shows us that, despite whatever the policy statements may be saying, the teaching in the cases we studied is aligned with a very limited range of philosophies. There is a rhetoric - reality gap (Stevenson 2007; Winter 2007), but no gap between the reality and what Cross (1997) calls the 'ideological imperatives' of education and the larger social system. However, we do not think that environmental education will be improved merely by presenting a wider range of perspectives. Our stance is in opposition to the popular tendency towards 'inclusivity' and the superficial acceptance of diverse points of view, which we think is often without adequate analysis. If we want students to raise questions at a systemic level and critically analyse structural issues and power relations, the opportunities need to be provided in classrooms as well as in textbooks.

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Teacher (pseudonym)	**Degrees & teaching experience**	**School**	**Number of students in the class**	**Textbook followed**	**Chapter being presented during our observation**	**Duration of classroom observation**
Amrita	MSc Zoology, B.Ed, M.Ed. 24 years	Middle-class Central Government School	50 [27 ♂, 23 ♀]	NCERT (2006d) in English	Ch 15: Our Environment	3 periods, 98 minutes total
Renu	MSc Zoology, B.Ed, 14 years	Elite unaided private school	35 [18 ♂, 17 ♀]	NCERT (2006d) in English	Ch 16: Management of Natural Resources	4 periods, 123 minutes total
Chhaya	MSc Chemistry, B.Ed, 8 years	Low-fee unaided private school	29 [All ♂]	MP SCERT (2012) in Hindi	Ch 21: Environment and Environmental Problems	3 periods, 118 minutes total

Table 1: The teachers, classes, and textbook chapters we used for our case studies.

Philosophy	General Concerns	Biotic Concerns	Social Concerns
Gandhian	environmental degradation pollution, waste uncleanliness, ugliness	ecological disharmony effects on non-human life	modern civilisation, development (urbanisation) mechanisation agricultural crisis
Appropriate Technology	environmental degradation pollution, waste resource depletion	ecological disharmony loss of biological diversity	some forms of development health and safety concerns agricultural crisis water crisis
Eco-spirituality	environmental degradation pollution, waste	ecological disharmony	
Deep Ecology	environmental degradation pollution, waste	ecological disharmony effects on non-human life loss of habitat, deforestation extinction of species cruelty to animals	modern civilisation, development
Eco-feminism	gender specific environmental degradation pollution, waste	loss of biological diversity violent exploitation of nature	health (less food from forest, pollution) and safety concerns - dangerous travel (women especially) more time spent on collecting water, fuel, & fodder (by women) less employment, less income from forest produce (women especially) agricultural crisis
Ecological Modernisation & Eco-capitalism	environmental degradation pollution, household waste resource depletion climate change		health and safety concerns loss of picnic spots, scenic beauty water crisis restrictions on individual freedom
Eco-marxism	global environmental crisis pollution, industrial waste resource depletion climate change (above effects on poorer countries, in particular)		poverty, unequal & wasteful resource distribution, anti-people industries & mining livelihood and survival threats alienation health and safety (especially of the poor) agricultural crisis water crisis (effect on the poor)

Table 2: Main concerns of different environmental philosophies, particular those which are prevalent in India. The founders and important figures (especially in India) for each type of philosophy are:

Gandhian: Mahatma Gandhi (1933, 1949), Pyarelal (1949), Kumarappa (1945), Guha (2007).

Appropriate Technology: Schumacher (1973), Reddy (1975), Pursell (1993), Dinesh Abrol (2005), Smith, Fressoli, and Thomas (2014).

Eco-spirituality: Nelson (1998), Berkes (2012), Cummings (1991), Dwivedi and Tiwari (1987), Jamieson (2001).

Deep Ecology: Edward Abbey (1968), Naess & Rothenberg (2003), Devall and Sessions (1999), Foreman and Haywood (1993), Derek Wall (1999), Ehrlich (1995), Diehm (2002), Chigateri (2011).

Eco-feminism: Maria Mies & Vandana Shiva (1993), Shiva (1988), Bina Agarwal (1992), Karen Warren (1990), Val Plumwood (1997), Jytte Nhanenge (2011), Greta Gaard (2011), Chaya Datar (2011).

Ecological Modernisation and Eco-capitalism: Al Gore (1992), Hajer (1995), Andersen & Massa (2000), Mol, Sonnenfeld, & Spaargaren (2009), Friedman (2008, Fisher and Freudenburg (2001).

Eco-marxism: Marx (1867), Engels (1878), Lenin (1908), John Bellamy Foster et al, (2010), Pepper (1998), Burkett (2005, 2006), Archana Prasad (2004), Parameswaran (2013), Stephan Engel (2014), Jensen and McBay (2009).

Philosophy	Idealist causes		Material causes	
	Attitudes	**Balance of Nature**	**Social/ political/economic**	**Role of Science and Technology**
Gandhian	immorality - individual people becoming irreligious greed, selfishness, laziness, competitiveness, envy consumerist attitude, material wealth, wastefulness, decadent desires	people disturbing the balance of nature	colonialism westernisation alienation - loss of social support networks	modern western science & technology, industrialisation, militarisation
Appropriate Technology	lack of love for nature consumerist attitude, material wealth, wastefulness greed, selfishness, laziness, competitiveness, envy	people disturbing the balance of nature		inappropriate technology (capital-intensive, large scale) unchecked industrialisation profit-oriented development military-industrial complex
Eco-spirituality	individual people becoming irreligious lack of love for nature consumerist attitude materialist beliefs	people disturbing the balance of nature		
Deep Ecology	anthropocentric thinking lack of love for nature consumerism disregard for the rights of all living beings western philosophy	people disturbing the balance of nature	human overpopulation civilisation itself unsustainable economic growth	
Eco-feminism	patriarchal attitudes causing domination over nature neglect of the 'feminine principle' in Hindu philosophies	men disturbing the balance of nature	gender inequality commodification, privatisation and land appropriation government control over previously common land colonialism, imperialism alienation - loss of social support networks	marginalisation and erosion of women's knowledge about nature and domination by male, western, reductionist science western, technocratic enlightenment erosion of community resource management
Ecological Modernisation & Eco-capitalism	individual carelessness individual mistakes corruption	people disturbing the balance of nature	human overpopulation mismanagement inappropriate government policies excessive governmental constraints on development	unsustainable development and primitive technologies
Eco-marxism			capitalism socio-economic inequalities, class division modes & relations of production, private ownership commodification loss of control over social relations - alienation internal capitalist contradictions colonialism / imperialism / neo-liberalism	science for profit, not for people private transport planned obsolescence dependence on exchange value rather than use value

Table 3: Causes of the environmental crisis, according to different environmental philosophies.

Philosophy	Idealist solutions		Materialist solutions			Individual or Systemic?
	Attitudes	Balance of Nature	Political/economic	Science and Technology	Nature	
Gandhian	spirituality, religion, value a work ethic, conservation ethics	back to nature (harmony with nature)	decentralisation - democracy - local self reliance, self-help return to past village life reject the western & socialism reduce consumption - live simply, hard work economy of permanence	return to traditional methods reject: 'modern western science', industrialisation	nature preserves	individual and collective action, non-violence
Appropriate Technology	change mindset to change technology	back to natural balance	decentralisation - democracy - local self reliance, self-help socialism? - mixed economy?	appropriate technological solutions (labour intensive), limited industrialisation (large and small scale) - jugaad reconciliation between modern western science and tradition reduce consumption, simple living, do hard work Reduce Reuse Recycle	resource conservation, ecological restoration, preserve biological diversity, environmental sustainability	individual and community based
Eco-spirituality	spirituality find 'inner truth' change mindset				do not kill non-human animals	religious community
Deep Ecology	love nature environmental ethics - take a holistic view of the universe change basic beliefs value & respect all life equally, regardless of its usefulness to humans	stop interfering in the balance of nature	local autonomy, decentralisation change economic policies? (anti-profit)	change economic policies? (anti-profit) - simple living, organic food reduce consumption, simple living,	ecocentrism / biocentrism kindness to animals, animal liberation wildlife preserves control human population	individual (and collective?) radical direct action (monkey-wrenching)
Eco-feminism	change values and beliefs to end gender inequality recover the feminine principle as respect for life in nature and society return to traditional Hindu view of nature as prakriti and purusha (?)	stop interfering in the balance of nature	decentralisation, local self-reliance, non-commercial cultures, establish egalitarian, democratic, non-hierarchal systems (socialism? - mixed economy?) mutually regenerative linkages between development, redistribution, & ecology	develop non-industrial cultures rejection of modern western science - or reconstruction with traditional feminist science to make holistic knowledge	cooperate with rather than dominate nature preserve biological diversity	individual and collective women
Ecological Modernisa-tion & Eco-capitalism	modify mindset education for individual, voluntary action (turn off the tap while brushing teeth)	stop interfering in the balance of nature	preserve capitalist structure while adjusting regulations & use of resources sustainable development	green technologies organic food produced by private enterprise profitable reuse and recycling of industrial and domestic waste by private enterprise	nature reserves - scientific conservation human population control	individual & corporate power privatisation
Eco-marxism			social/political/economic revolution to abolish all forms of inequality common ownership of means of production planned economy - planned development for the common good	end planned-obsolescence, produce long-lived recyclable products encourage scientific temper - science for people, not for profit - historical dialectical materialist science	scientific control over natural resources and social relations, equal distribution of resources	very systemic changes strong or collective governance critical scientific literacy

Table 4: Solutions to the environmental crisis, according to different environmental philosophies.

APPENDIX A: Environmental Philosophies - a critique

Gandhian Environmental Philosophies

According to a Gandhian philosophy, modern western civilisation itself is problematic. But some say that Gandhians tend to sentimentally romanticise village life and pre-modern times as being more in harmony with nature. Although the extent and rapidity of environmental disturbance caused by humans is now greater than ever before, even in ancient times entire peoples were wiped out as a result of human actions which caused droughts, extinctions of species, and other environmental problems (Spence 2001).

Mahatma Gandhi himself wrote very little about pollution, soil degradation, dwindling natural resources, or other such problems, just mentioning them in passing (Gandhi 1937). However, his associates and followers have applied his philosophy to understand environmental problems, their causes and solutions (Guha 2007).

The Gandhian understanding is basically idealist, in that it takes ideas and beliefs as being basic to both the cause and the solution of the environmental problem (Guha 2007). For example, Gandhi wrote, 'Corporate cleanliness can only be ensured if there is a corporate conscience and a corporate insistence on cleanliness in public places' (Gandhi 1933). This indicates his concern for cleanliness, and his belief that the problem was caused by the beliefs of the community (which is what he meant here by 'corporate'). The solution is for the people in the community to change their mind-set, start thinking about cleanliness, and adopt habits of cleanliness. He did not mention the interdependent physical reasons why people may not be cleanly, such as not having adequate access to water.

If we use a more materialist way of analysing the problem, we realise that even if individuals or groups believe that cleanliness is desirable, and even if they try to be cleanly, they may not succeed because some material conditions may prevent it. Uncleanliness is caused by individuals throwing plastic bags, but plastic bags are caused by industries trying to make profits. Industries cause uncleanliness because they necessarily have to be concerned about profit (otherwise they will go out of business), and they will clean up only if they are forced by the community or by government regulations, or if they can do so without a significant loss of profit. However, this does not at all imply that there is no need for individuals to do whatever they can do to prevent and reverse environmental damage. A Gandhian philosophy insists that we all take responsibility and do actual physical labour in order to clean up after ourselves and change the world. This philosophy is reflected in the Gandhian conception of the Nai Taleem common school system in which all students engage in productive work (Gandhi 1937).

Appropriate Technology

This philosophy is related to a Gandhian philosophy, although idealist causes of environmental problems (attitudes such as greed and selfishness) are less emphasized, and material conditions are more likely to be seen as being the basis for both causes and solutions to environmental problems. The emphasis is on distinguishing between needs and desires as the driving forces behind the development of technology. Thus all forms of mechanisation or modern technology in all situations for all people are not opposed. Rather than advocating a universal technology, an Appropriate Technology philosophy

advocates low cost, labour-and-not-capital-intensive, easy maintenance, small scale, low environmental impact technology (Abrol 2005; Pursell 1993; Schumacher 1973; Smith, Fressoli, and Thomas 2014). This philosophy is evident in the efforts of some educationists to develop and use inexpensive materials and methods for use in village and lower-class urban schools, and to concentrate teaching efforts on local rather than global environmental problems.

Some might argue that an Appropriate Technology philosophy tends to preserve hierarchies - especially class division in which inferior technology is seen to be good enough for some people at the bottom of the heap. However, a counter-argument is that it is not inferior technology, it is technology which addresses the needs of the poor. Also, alternative technologies must be developed from as sound a base of fundamental science and basic engineering as is required for Western technologies (Reddy 1975, 338).

Eco-spirituality

Eco-spirituality (Berkes 2012; Cummings 1991; Jamieson 2001; Nelson 1998; Dwivedi and Tiwari 1987) is related to Gandhian environmentalism, but is less secular, and is sometimes focussed on certain types of Hinduism, e.g. tantric vedanta. Although it usually is not explicitly called 'Eco-spirituality' (except perhaps by westerners and non-resident Indians), we might consider this category to include philosophies which identify environment-friendly or ecological ideas or practices in ancient times or in 'indigenous knowledge' that is considered to be religious or spiritual. It is mainly concerned with instilling a spirituality which will generally improve ecological harmony. However, one critique is that Eco-spirituality may have a significant influence on maintaining a pedagogy which relies more on believing a guru than questioning based on observations and evidence.

Deep Ecology Philosophies

Although the label 'Deep Ecology' has been mainly confined to the west (Devall and Sessions 1999; Wall 1999), it shares some similarities with Gandhian, Appropriate Technology, and Eco-spirituality philosophies (see **Tables 2-4**), as well as with Indian groups such as those affiliated to the western organisation, People for the Ethical Treatment of Animals. The latter enjoys considerable political leverage in India, with some politicians and fundamentalist religious groups using it to further their agenda, for example by denying people the right to engage in trades and customs related to the use of animal products (Chigateri 2011).

Eco-feminist Philosophies

Eco-feminism is a very diverse category, including somewhat Gandhian, Eco-capitalist, and Eco-marxist strands (Datar 2011; Nhanenge 2011; Plumwood 1997; Warren 1990). In Tables 2-4, we have just listed the main factors which distinguish it from other categories. One controversial point is whether gender attributes, including the characterisation of nature as being feminine, are biological (and thus essential and immutable?) or socially constructed - and variable across different cultures. Some eco-

feminists claim that patriarchal attitudes cause domination over nature, and nature is feminine in that it is both regenerative (life-giving and nurturing) and wild (uncontrollable, irrational, and needing constraint). While some argue that this femininity is indispensable and needs to be integrated with the masculine aspects in order to maintain environmental integrity, others argue that the female/male dichotomy is a misconception which needs to be rejected (Gaard 2011).

However, only a few Eco-feminists address the problem of the material basis for male/female dichotomies of nature, its origin, historical development, and how it can be changed. For example, Bina Agarwal (1992) attempts to raise causal links to political economy and connections to other forms of oppression, while admitting that proposing a blue-print and uniting women to find solutions is not easy. She stresses the need for 'an alternative, transformative approach to development'. Other Eco-feminists, such as Vandana Shiva (1988), mention an idealist basis for the environmental crisis as lying in a neglect of a 'feminine principle' in traditional Hindu philosophy, with the solution lying in a return to traditional Hindu cosmological views. However, Agarwal points out that this fails to acknowledge the presence of a diverse range of communities (e.g. Muslims and other non-Hindus).

Ecological Modernisation and Eco-capitalist Philosophies

Since the late 1960's, in response to the growing environmental movement, governments throughout the world have adopted voluntary and market-based incentives for environmental protection, set up environmental protection agencies, and passed laws to regulate pollution and environmental damage. According to these types of environmental philosophies, known as 'Ecological Modernization' and 'Eco-capitalism', the main cause of the problem is that people have mismanaged, and not analysed or correctly predicted the environmental impact of their actions (Andersen and Massa 2000, 2000; Friedman 2009). The solutions (**Table 4**) are in line with this perception of the causes:

> Ecological modernization does not call for any structural change but is, in this respect, basically a modernist and technocratic approach to the environment that suggests that there is a techno-institutional fix for the present problems. Indeed, ecological modernization is based on many of the same institutional principles that were already discussed as solutions in the early 1970s: efficiency, technological innovation, techno-scientific management, procedural integration, and coordinated management. (Hajer 1995)

The belief is that 'environmental improvement can take place in tandem with economic growth' (Fisher and Freudenburg 2001) For example, Mol, Sonnenfeld, and Spaargaren (2009) argue that 'environmental problems can best be solved through further advancement of technology and industrialization.' It is capitalism with a greener tinge - and therefore it is sometimes called 'green capitalism'. According to its critics, it is essentially 'a managerial approach that sees sustainable technology, sustainable consumption, and market-based solutions - indeed "sustainable capitalism" - as providing the answers' (Foster, Clark, and York 2010, p. 19).

Eco-marxist Philosophies

According to more materialist philosophies, beliefs cannot be changed unless the underlying material causes also change. Eco-marxist solutions are therefore more systemic (**Table 4**, last column). According to many of the philosophies, decentralised solutions are stressed, some of which may attempt to reverse modern development (e.g. 'go back to nature'). Such individualised solutions are based on an idealist assumption that individuals are autonomous, with freedom to choose their lifestyle and in sole possession of their agency (Sharma and Buxton 2015).

According to an Eco-marxist philosophy, the environmental crisis is a sort of alienation - a widening gap or 'ecological rift' between humans and nature - which is due to the capitalist mode of production and its expansionary requirements (Foster, Clark, and York 2010). The requirement for endless accumulation (Marx 1867) cannot be compatible with environmental sustainability:

> [Industrial capitalism] has always destroyed the land upon which it depends for raw materials, and it always will...When most people in this culture ask, 'How can we stop global warming?' that's not really what they are asking. They're asking, 'How can we stop global warming without significantly changing this lifestyle [or deathstyle, as some call it] that is causing global warming in the first place?' (Jensen and McBay 2009)

Thus, the responsibility for the ecological crisis is placed mainly on international finance, and its resolution therefore calls for structural changes, which will also resolve the interlinked political economic problems (Engel 2014).

Marxism has faced the criticism that it is essentially anti-ecological, since under communism, production also grows and humans also control nature for their benefit. A counter-argument is that, 'Marx and Engels...envision a "real human freedom" based on "an existence in harmony with the established laws of nature"... (They) do not identify free human development with a one-sided human domination or control of nature. Freedom...consists in the control over ourselves and over external nature which is founded on natural necessity' (Burkett 2005). One might argue that Burkett's reasoning sounds suspiciously like an idealist 'Balance of Nature' argument. But according to historical dialectical materialism (which is what we mean by marxism), everything is seen to be interdependent, and everything, including any eco-system, is having various kinds of inherent inner-conflicts which cause everything to keep changing (Cornforth 1975). Applied to biology, this is called 'biological dialectics' (Levins and Lewontin 1985), and is incompatible with a 'Balance of Nature'. Thus, Eco-marxism cannot see environmental problems as being caused by people acting against some 'laws of nature'. However, this does not mean that humans are not causing an environmental crisis. It means that humans need to take immediate action to stop causing the crisis and find material rather than idealist solutions, as shown in **Table 4**. The problems cannot be corrected by just ceasing to do more damage.

APPENDIX B: A Balance of Nature?

Most environmental philosophies have some concern for a 'Balance of Nature'. For example, according to the Ecological Modernisation philosophy expressed in the popular book, Earth in the Balance (Gore 1992), environmental problems are characterised by people upsetting the 'Balance of Nature', and the solution is for people

to realise that they should care for nature and stop upsetting the balance.

The idea of a Balance of Nature has a long history, and can be found in various cultures throughout the world (Cuddington 2001). Its prevalence and persistence is perhaps because people have a longing for a harmonious, unchanging, unending existence. In the past, some researchers claimed that population dynamics (e.g. differential rates of reproduction of predators and prey), provided evidence for a Balance of Nature (Egerton 1973a). However, they paid insufficient attention to randomness in nature, the extinction of species, and large oscillations in population density. Some early ecological studies also tried to accommodate the concept in their analysis, and even today some population ecologists conflate the meaning of mathematical equilibrium to imply a balance (Cuddington 2001).

Even Charles Darwin mentioned some sort of Balance of Nature at several places in his writings, denying that there is a perfect balance:

> For as all the inhabitants of each country are struggling together with nicely balanced forces, extremely slight modifications in the structure or habits of one species would often give it an advantage over others; and still further modifications of the same kind would often still further increase the advantage, as long as the species continued under the same conditions of life and profited by similar means of subsistence and defence. No country can be named in which all the native inhabitants are now so perfectly adapted to each other and to the physical conditions under which they live, that none of them could be still better adapted or improved ... (Darwin 1872)

Darwin found evidence that non-teleological natural selection is a mechanism of evolutionary change. With an understanding of evolution and its mechanisms, it becomes clear that if nature did adhere to a strict 'balance', life could not exist or evolve. Indeed, interdependent and continuous change and imbalance is an essential characteristic of nature.

Darwin also mentioned the 'law of compensation or balancement of growth' according to which 'in order to spend on one side, nature is forced to economise on the other side.' But he wrote that while this law may hold true to some extent in artificial selection, 'With species in a state of nature it can hardly be maintained that the law is of universal application.'

The idea of a Balance of Nature in the study of ecology stems in part from a view which dominated the field in the west in the first half of the 20th century. The belief was that 'biological communities are in a state of equilibrium, a more or less stable balance, unless seriously disturbed by human activities' (Campbell et al. 2008, 1211). A community was thought to have a tendency to reach and maintain a particular and stable composition of species. For example, if a forest was converted into farmland and then deserted, it was believed that the vegetation had a tendency to return to its original state of equilibrium (which depended only on the climate).

This tendency towards 'balance' or 'harmony' was not explained as being due to any material cause. A Balance of Nature is thus a kind of teleological idealism. It is teleological because it means that natural processes are governed by what is essentially a 'desire' or necessity of nature - a need to adhere to an abstract principle of balance. It is idealist rather than materialist because scientists have not been able to find physical evidence for either the existence of a Balance of Nature, or of how a balance is maintained. They have not even been able to hypothesize the existence of any physical mechanism whereby it might be maintained.

The Balance of Nature paradigm can be contrasted to a reductionist paradigm, in which there is no balance regulating different elements of an ecosystem. Instead, each species is regarded as a separate element in its environment, each species reacts to and evolves in response to its environment, and the sum of all the individual species and the abiotic environment determines the ecosystem. However, in this paradigm, observed changes in the environment in response to the species is not given due attention (Levins and Lewontin 1985).

Accumulating evidence indicates that a biological community is neither balanced nor reductionist (Levins and Lewontin 1985; Cuddington 2001; Egerton 1973b; Wu and Loucks 1995). If reasonably long enough time periods are taken into consideration, we do not observe steady state equilibriums in nature. We observe rather a system of interdependent parts (organisms and abiotic factors within and to some extent also outside of the community), in which neither the whole nor the parts completely determine each other. The whole is more than the sum of the parts, contrary to what an overly reductionist paradigm would claim. The whole is dependent not upon some abstract principle, but upon interdependent processes occurring in physical reality. As Egerton (1973, p. 347) states, 'Mutations and natural selection gradually change species. Extinctions, species evolution, changes in species composition, and environmental alterations change natural communities.'

Of course, humans do disturb nature, and realising that there is no Balance of Nature does not excuse or justify the destructive effects. It would be a mistake to site the absence of a Balance of Nature in order to rationalise or deny the existence of the environmental crisis. That would be like saying that there is nothing wrong with poisoning a person since their eventual death is inevitable. There is overwhelming evidence that humans have been disturbing natural (unbalanced) processes. The problem with believing in a Balance of Nature is that it may lead people to propose faulty solutions to environmental problems, such as just leaving an 'unbalanced' ecosystem to go back to its 'balanced' state. Abandoning a community which has been disturbed by human actions will probably not result in it returning to any previous state, or going to a state of equilibrium at any relevant scale of measurement. Since there is no force which will cause a Balance of Nature, the solution to environmental degradation cannot be to just leave things alone and let them go back to their natural balance.