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The impacts of environmental science on Bhutanese students' environmental sustainability competences

Kishore Mongar 

School of Education, University of New England, Armidale, NSW, Australia
E-mail: kthapa05@gmail.com

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Abstract

The subject of environmental science (ES) was introduced into Bhutanese schools to educate students about sustainable environmental conservation. This study aims to answer the research question: What are the impacts of studying ES on Bhutanese students for environmental sustainability? The study employed mixed methods to draw data from interviews with six principals, 14 teachers and 189 students, and surveys with 14 teachers and 563 students from six secondary schools. Participants indicated the development of students' Gross National Happiness value of sustainable environmental and socioeconomic development. However, an anthropocentric perspective appeared to be dominant among participants, suggesting a need to develop ecocentric worldviews to support sustainability. Most students noted their changed behaviours, development of optimism, stewardship and agency towards ecological sustainability from studying ES. To prepare students to take action to address sustainability issues, teachers could leverage students' optimism, agency and stewardship through action-oriented approaches to teaching ES.

Keywords: Gross National Happiness; environmental conservation; behaviour; anthropocentrism; stewardship; action orientation

Introduction

Gross National Happiness (GNH) is the guiding philosophy of Bhutan's development process. It has four pillars: good governance, sustainable socioeconomic development, preservation and promotion of culture and sustainable environmental conservation. Environmental conservation is one of the key pillars for achieving GNH (Schuelka & Maxwell, 2016), and it is emphasised in Articles 5 and 8 of the Bhutan Constitution (Royal Government of Bhutan [RGoB], 2008) that "it is the fundamental duty of every citizen to contribute to the . . . conservation of the rich biodiversity of Bhutan" (p. 11). Bhutan has strategised environmental conservation through conservation policies and the government initiatives of maintaining national parks and biological corridors (Dolkar et al., 2013). However, the shortcomings of such initiatives in environmental conservation in Bhutan have been reported by Dolkar et al. (2013) as being similar to issues prevalent in other parts of the world, such as Australia (see Hobday & McDonald, 2014). The three main issues are loss of biodiversity, pollution and forest fire. Hence, education is considered a key tool for encouraging human behaviour crucial for supporting environmental conservation both in Bhutan and the outside world (Kraft, 2017; Norbu et al., 2017).

The Bhutan Ministry of Education (MoE) introduced environmental science (ES) as an optional subject in grades IX to XII in secondary school to provide youth with the knowledge, values, skills and competences to address environmental sustainability (Department of

Curriculum Research and Development & Royal Society for the Protection of Nature [DCRD & RSPN], 2013, p. 17). Although ES was introduced with the aim of educating students to participate in addressing sustainable environmental conservation as emphasised in the Bhutanese Constitution (RGoB, 2008), to date there has been a dearth of research conducted on ES in Bhutan. Thus, drawing on the objectives from the Environmental Science Curriculum Framework (ESCF) for implementing ES in schools in Bhutan to prepare youth to address the country's vision of achieving environmental sustainability, this study explores the research question: *What are the impacts of studying ES on Bhutanese students for environmental sustainability?*

Review of Literature

Knowledge about ecological and human systems (Department of the Environment, Heritage, Water and the Arts [DEWHA], 2010), positive attitudes and values (Aslanova et al., 2017; UNESCO, 2005, p. 27) and eco/biocentric worldviews (Miller & Spoolman, 2011; Washington et al., 2017) are crucial for promoting environmental sustainability (Karpiak & Baril, 2008). However, regarding worldviews, Escobar (2016), claims an ontological divide between the global south and north. The global north perceives nature as being a commodity and external to humanity, while the global south considers that social beliefs and cultural, ecological and economic values are created in relation to nature (Escobar, 2008). Thus, Escobar (2018) claims that the world is not a universe but a pluriverse that requires consideration of multiple ontologies in terms of knowledge and epistemology.

Knowledge, values, positive attitudes (Kozar & Hiller Connell, 2013; Kollmuss & Agyeman, 2002) and worldviews (Swaim et al., 2014) are believed to influence the pro-environmental behaviour that contributes to environmental sustainability (Hungerford & Volk, 1990), but they may not lead to behavioural change that encompasses participation in environmental conservation (Jensen, 2002). According to Jensen and Schnack (1997), behaviour that directly or indirectly addresses environmental problems could be developed through action orientation. Such action-oriented teaching focuses on building students' ability to act to solve environmental issues at the local and global levels (Jensen, 2004; Schusler & Krasny, 2010). These researchers believe that teaching knowledge in the absence of taking action may result in "action paralysis", which is a condition where students believe environmental problems are intractable and difficult to solve (Jensen, 2002), so they become an "armchair critic" (Russell & Hodson, 2002, p. 498), rather than engage in taking action.

Therefore, in order to modify students' behaviours, education needs to engage them in individual or collective actions that are aimed at directly or indirectly addressing environmental challenges in the school or community (Jensen, 2002) to provide opportunities for them to exercise their citizenship rights (Checkoway, 2011). By encouraging the development of student motivation and independence, teachers can help students to determine appropriate actions for solving environmental issues (Short, 2009) rather than relying on teachers making top-down decisions that would limit the students' own decision-making (Hayward, 2012).

Students' competency in taking action to solve environmental issues could be developed through the framework of the 'Sustainability Action Process', which involves "students making a case for change, defining the scope for action, developing a proposal for action, turning the proposal into action and evaluating and reflecting" (DEWHA, 2010, p. 9). Drawing on wider literature, developing students' ecological knowledge, values, attitudes, action competence and changed behaviours is crucial when teaching ES in order to prepare students to take part in activities that address sustainability issues.

Methods

The broader PhD study from which this paper is drawn was underpinned by a pragmatic paradigm (Creswell & Plano Clark, 2018) and utilised mixed methods viz interviews and surveys to

address the research question: *What are the impacts of studying ES on Bhutanese students for environmental sustainability?*

Research context and participants

The study participants came from three middle schools and three higher secondary schools located in rural, semi-urban and urban areas of Samtse, Bhutan. They were principals or vice-principals, ES teachers and students who had experienced a varied number of years studying ES in either Grade IX or XI across the six case study schools.

Data collection processes

The study was approved by the MoE in Bhutan and the Human Research Ethics Committee of the University of New England, Australia, approval number HE17-223. Approval was sought from the District Education Officer and principals prior to visiting the schools to conduct the interviews and observations and administer the surveys.

Interviews

Semi-structured individual interviews were adopted for the teachers and principals to obtain in-depth data (Clark, Foster, Sloan & Bryman 2021). For example, principals were asked the interview question, “What changes do you observe in students’ behaviours after studying ES?”. In the interviews, I asked the teachers, “Do you think that students doing ES change their behaviour towards the environment as a consequence of studying this subject? Why do you think that they should? Is there any value in this subject if students don’t change their behaviour?” Each interview lasted around 35 minutes. They were digitally audio-recorded, and the researcher transcribed the audio-recordings verbatim using InqScribe™ version 2.2.4.

The focus group interview technique was implemented for the students to provide them with the confidence to voice views and opinions and interact, which would generate a larger amount of data (Cohen, Manion & Morrison 2018). Furthermore, focus groups allow the researcher to explore the diverse views and opinions of all participants (Clark et al., 2021), and also create opportunities for the participants to understand the views of others and critically reflect on their own opinions (Matthews & Ross, 2014). To obtain as many voices and perspectives as possible, 46 focus group interviews were conducted with 194 students, who represented 30% of students studying ES in the Samtse district (Hennink et al., 2020). The ES teachers were asked to suggest potential participants who represented the diversity of student abilities, genders and ethnicities, as certain categories of individuals may possess a unique perspective about the issues, and their representation in the sample was sought. Each focus group had an average of six students and lasted 45–60 minutes.

To facilitate later data transcription identification and tracking, each focus group participant was assigned a number from 1 to 4 and asked to state their number before responding during the focus group. I posed questions to the whole group and participants were invited to respond in their own time. The student focus group included questions that explored the perceptions of students about their ES learning. The focus group questions were based on the perceptions of outcomes from class experiences. For example, during the focus groups, students were asked, “Having studied ES, have you changed your behaviour towards the environment? Give an example”. At times, some participants appeared not to understand a question or struggled to express their views or opinions. To mitigate this, I used prompts such as “why do you think . . . ?” to help to draw out more complete responses, following guidance by Lune and Berg (2016).

Surveys

The survey was conducted with 563 ES students from the six schools. The survey contained Likert-type items that provided participants with relative freedom and anonymity to endorse specific propositions (LaMarca, 2011). The survey was piloted with 18 students studying ES from a different region. It was a cross-sectional study (Cohen et al., 2018), where the sample was drawn from all ES students in each school and was administered to the participating students during the usual class times to maximise response rates (Babbie & Wagonar, 2011) and to address any participant difficulties while completing the questions (Cohen et al., 2018).

Data analysis

Qualitative data

The interview transcripts were imported into CAQDAS NVivo 12 for in-depth analysis. They were coded by employing both deductive and inductive approaches (Elo & Kyngäs, 2008) and a constant comparison method (Williams & Moser, 2019). I commenced coding with the focus group interview transcripts from one of the schools. I read through the transcripts, iteratively coding data segments to one or multiple *a priori* or emergent codes and sub-codes, and made constant comparisons between and within codes and categories. The process of coding was also documented from the beginning using extensive codebooks for the focus groups and teacher and principal interviews. These codebooks contained code definitions and illustrative quotations and were regularly utilised throughout the analytic process to enhance the validity and reliability of the data. The coding process included discussion and review of codes and categories with three experts to detect and resolve differences, which were resolved through deliberations and revisiting transcripts and coding. This led to similar codes and sub-codes being collapsed, the deletion or addition of some codes, the definitions of codes and sub-codes being improved and the rearranging of code and category hierarchies. The representation of the results based on the codebooks involved further categorisation and refinement at times for the sake of brevity, clarity and ease of interpretation.

The initial process of intensive constant comparison and reliability checking continued for at least two cycles of coding and recoding of the sample transcripts to arrive at an agreement between my coding and that of the three experts. I then independently coded the remainder of the student focus group interviews and the interviews with principals and teachers. However, discussions with the experts continued periodically during this extended analysis process and the data reporting phase, during which codes, categories and their relationships continued to be compared, discussed and reviewed.

Coding memos were maintained within NVivo 12 as suggested by Jackson and Bazeley (2019). The memos noted the developing themes, definitions, ideas, other information and important verbatim quotations that were evident during coding. When the data were coded, a matrix coding query was conducted using NVivo 12. The frequency of response to each code was tabulated and is discussed in the results section.

Quantitative data

The responses to the Likert-style items were analysed using SPSS 24. To explore the appropriateness of conducting parametric tests such as factor analysis and comparisons of means, the student data from the Likert items were tested for normality by examining skewness and kurtosis and using Kolmogorov–Smirnov and Shapiro–Wilk statistics in SPSS 24 (Ghasemi & Zahediasl, 2012). These initial tests suggested univariate and multivariate non-normality, therefore parametric analysis was not possible (Ghasemi & Zahediasl, 2012), and it was decided to use descriptive statistics for the student data from the Likert items. The frequency of responses for both students

and teachers was calculated (Ghasemi & Zahediasl, 2012) using SPSS. The results were exported to Excel and subsequently represented as frequency histograms.

Findings

The findings on participants' perceptions about the impact of ES on students are presented and discussed under four themes: important knowledge in ES teaching and learning, values and worldviews, impact on students' attitudes and impact on students' behaviours. Each theme has associated sub-themes. Participant quotes are replicated with little change in the language structure. After each quotation, parenthetical information specifies whether the data source is a principal interview [P,I], teacher interview [T,I] or student focus group [FG].

Important knowledge in ES teaching and learning

The data summarised in Table 1 demonstrate that the kind of teaching and learning in ES most frequently cited as important was knowledge, which covered conceptual, theoretical and factual information on environmental issues, ecological systems and sustainable development or policy. Table 1 illustrates participants' views on important teaching and learning in ES.

As indicated in Table 1, *Knowledge about environmental issues*, both local and global, was cited by nine teachers and 84 students as being important. At the local level, some teachers reported teaching about the greenhouse effect and global warming. Quite a few students also referred to learning important knowledge about deforestation, pollution and forest fires: "We are learning most of the time about deforestation, pollution and . . . the destruction of the forest due to forest fire" [FG]. Therefore, both teachers and students most often described the important focus of teaching and learning on environmental issues at both local and global levels.

Knowledge about ecological systems was the next most frequently mentioned issue (five teachers and 65 students). For example, "We teach knowledge about how all the living beings and non-living beings interact with each other as a whole" [T,I], and a student reported that "I have learnt about the interaction" [FG]. The data from the teachers and students show the important focus in ES on teaching knowledge about ecological systems.

Three teachers and eight students reported *sustainable development policy* as being important knowledge. The teachers mentioned that "Students learn about the environment and a kind of sustainable development" [T,I], and the students referred to learning about the Bhutanese sustainable development policy: "This year we learned about sustainable development . . . we should equally give importance to the environment and development process" [FG]. This evidence indicates that students learn important knowledge about sustainable social economic development with environmental sustainability.

Values and worldviews

Values

Table 2 presents teachers' and students' values and worldviews.

As shown in Table 2, the responses from nine teachers and 68 students on their explanations of the importance of environmental protection particularly resonated with the conceptual framework of GNH. Hence, to facilitate comparison with GNH, the different concepts invoked by teachers and students, together with illustrative quotes, are summarised in Figure 1.

In describing why environmental protection is important, Figure 1 shows that both teachers and students value the government conservation policy to maintain 60% forest cover nationally in perpetuity to sustain the rich environmental biodiversity of Bhutan. Students also value the growing socioeconomic prosperity of the country. Importantly, overall, they value protecting the

Table 1. Teacher and student responses on important teaching and learning in ES

Sub-theme	Coded response	Teacher interviews N = 14	Student focus groups N = 194
Knowledge	About environmental issues	9	84
	About ecological systems	5	65
	About sustainable development or policy	3	8
Nexus between knowledge and values	Environmental protection	9	68

natural environment for the benefit of future generations while meeting the needs of the present generation.

Worldviews

From the exploration on the impact on students' worldviews, *utilisation: anthropocentrism* was substantially more frequent than *preservation: eco/biocentrism* in the responses of seven teachers and 72 students, who referred to predominantly human-focused reasons for conservation of the environment. For example, "If we protect our nature, we will be benefited" [FG]. Teachers' views were similar in many respects; for instance, "Without the environment, nobody can survive. All the resources are provided by the environment. In that sense, it is important to take care of the environment" [T,I]. Their views about the environment were human-centred and focused on the benefit of humankind.

Preservation: bio/ecocentrism was reported by 22 students and only one teacher. While some students reported the essence of taking action to save the environment for its own sake, others believed that solving environmental issues would also benefit other living organisms: "If students take actions to solve environmental issues, it may benefit living organisms" [T,I]. In general the data from the teacher and student interviews demonstrated some evidence of eco/biocentric worldviews.

Impact of ES on students' attitudes: Optimism and a sense of stewardship and agency

As can be observed in Figure 2a, over 95% of students agreed or strongly agreed to the top two items, suggesting they had learned in ES *optimism for the future of the environment*. Also, between 45 and 65% of students disagreed or strongly disagreed, respectively, with the pessimistic views captured in the bottom three items. However, as indicated by the negatively worded *optimism* items (Figure 2a), a positive response bias of about 30% of the cohort is evident. Only about 45 to 65% of students disagreed or strongly disagreed with the negatively worded items from the expected 95% of students that would be expected to disagree given the proportion of agreement with the positively worded items. Given this finding, this bias is also likely to have occurred in relation to other Likert items, including the stewardship and agency items. Bearing this caveat in mind, Figure 2b indicates that students reported a strong sense of *environmental stewardship* towards the environment after studying ES. The vast majority of students endorsed all the items relating to the importance of protecting and conserving the natural environment. Corresponding to their sense of stewardship, students reported that they had and had developed through ES a *strong sense of agency* towards addressing environmental problems (Figure 2c).

In general, students' responses to the survey items indicated they were optimistic about the future of the environment and had developed a strong sense of environmental stewardship

Table 2. Values and worldviews from the responses in teacher and student interviews

Sub-theme	Coded response	Teacher interviews N = 14	Student focus groups N = 194
Values	Environmental protection	9	68
Worldviews	Utilization: Anthropocentrism	7	72
	Preservation: Eco/biocentrism	1	22

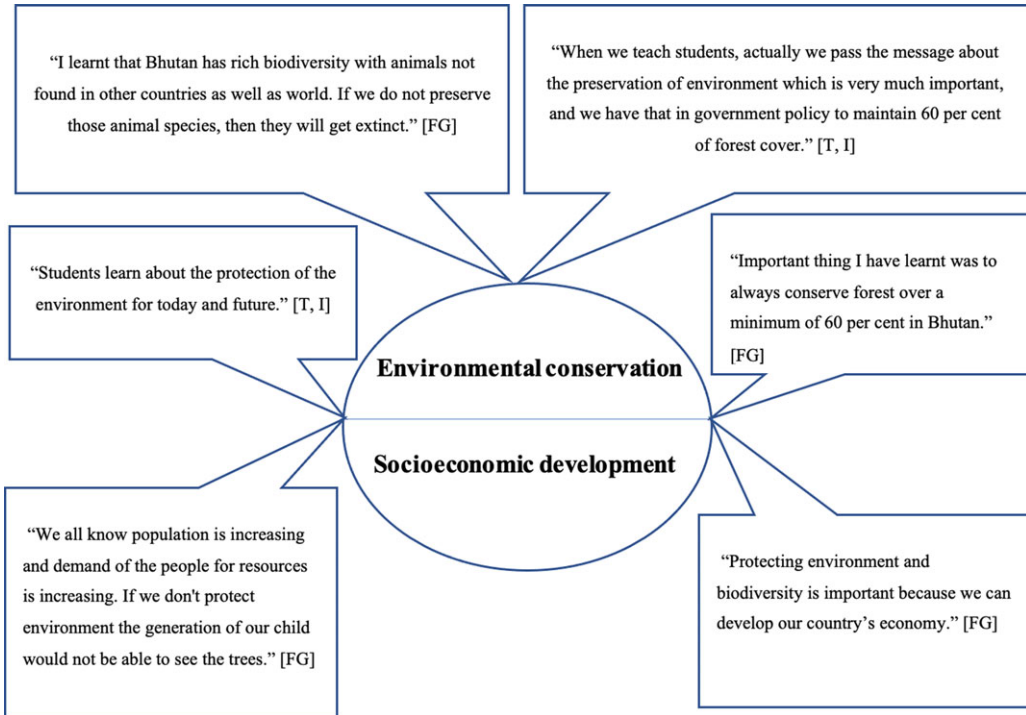


Figure 1. GNH values evident in teachers' and students' views on why environmental protection is important.

and agency towards addressing ecological issues after studying ES. These results do indicate the positive impact of studying ES on students' attitudes.

Impact of ES on student behaviours

Change in student behaviours

As shown in Table 3, 136 students reported *changed behaviours* as a consequence of studying ES, with only 25 claiming no behavioural changes. Teachers' views about the change in student behaviours that were expressed both in the surveys and interviews yielded variable results. Although 10 of the 14 teachers agreed with "I have observed change in students' behaviour towards the environment after studying ES", only five expressed this in the interviews. However, nine teachers and three principals reported in interviews that it *was difficult to determine any change* in student behaviours. Table 3 shows participants' responses about changed student behaviours after studying ES.

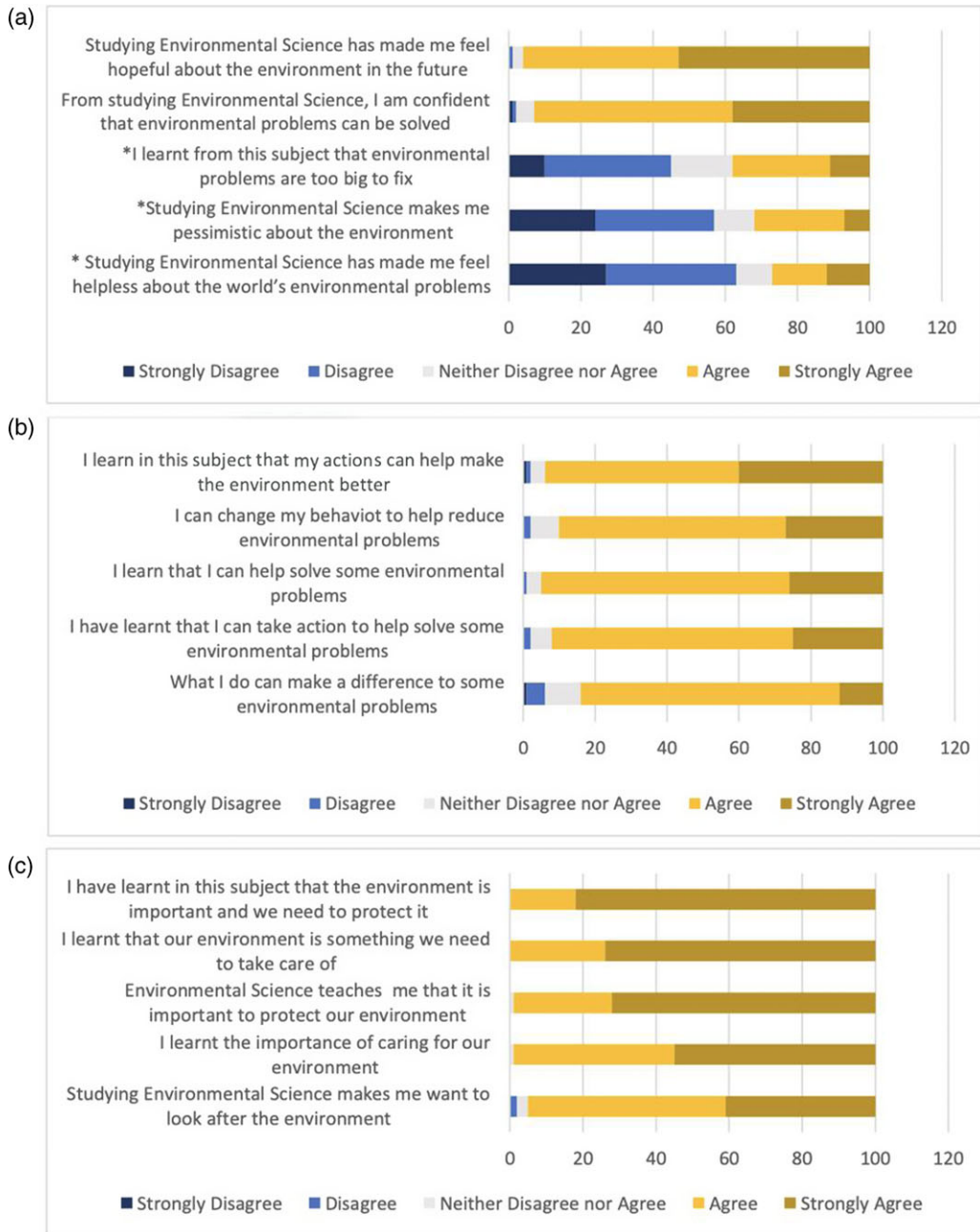


Figure 2. Student responses about (a) optimism towards solving environmental problems, (b) sense of stewardship towards the environment and (c) sense of agency towards addressing environmental problems. *Indicates negatively worded questions.

Although only five teachers noted observing changed student behaviours in their interviews, 10 hoped for or *expected positive change in student behaviours*; for example, “I think . . . the behaviour should change . . . Not 100% but maybe 50% of the students will get changed through these subjects” [T,I]. These interview responses suggest that there was more an expectation of change in student behaviours than any actual observed changes.

Table 3. Participants responses about students changed behaviours

Sub-theme	Coded response	Principal interviews N = 6	Teacher interviews N = 14	Student focus groups N = 194
Change in student behaviours	Changed behaviours	2	5	136
	No change in behaviour	1	1	25
	Expected positive change in student behaviours	0	10	–
	Difficult to determine any change	3	9	–
Reported changed behaviours	Managed waste	0	0	83
	Planted trees	0	0	18
	Stopped cutting trees	0	0	15
	Stopped killing animals	0	0	8
	Participated in social change	0	0	4
Students' reasons for behavioural change	Learning about the impact of human actions on the environment	–	–	55
	Learning about the importance of the environment in ES	–	–	45
Teachers' views of what could lead to change	Subject has limited worth if students don't change their behaviours	–	5	–
	Students' awareness about environmental problems	–	3	–
	Teaching of values	–	3	–

Student-reported positive behavioural changes

One of the significant behavioural changes reported by 83 students was that they *managed waste* after studying ES. For example, one student reported: “Even a small piece of plastic . . . I carry it in my pocket. I throw in a proper dustbin, at home or school . . .” [FG]. Further, 18 students reported they had started *planting trees*. For example, “Yes, I have changed my behaviour . . . I realised that the environment is important to us, and I am planting trees sometimes” [FG]. Other less frequent behaviour changes were not killing animals and participating in social change. These interview data confirmed the positive change in student behaviours that could be directly attributed to studying ES.

Reasons for changes in student behaviours

From the interview responses, 55 students identified learning about *the impact of human actions on the environment* in ES as the main reason for the change in their behaviours. For instance, “I have changed my behaviour . . . After studying ES, I came to know that waste is polluting the land” [FG]. Some students also suggested that they had stopped cutting trees and started planting them because of learning about the impact of these practices:

Yes, I have changed my behaviour. For example, like I am planting trees. I have also reduced my ecological footprint. I learned from ES that if we go on degrading the environment one day, we will be in trouble, that is why I changed my behaviour. [FG]

Another important reason that 45 students raised to explain their changed behaviour was *learning about the importance of the environment in ES*: “Yes, I changed my behaviour after studying . . . about the importance of the environment” [FG]. Thus, the student interview responses confirmed that they changed their behaviour because of ES learning about the importance of the environment and the impacts of human behaviours.

Teachers’ views of factors that contributed to change in student behaviours

Five teachers claimed that ES *lacked value if students don't change their behaviours*; for example, “If students do not change their behaviours, I don't think this subject is important . . .” [T,I]. Three teachers believed that students’ *awareness about environmental problems* could have led to a change in student behaviours; for example, “I think they can change their behaviour. They are more aware about the environmental challenges that our country is facing” [T,I]. Further, three teachers believed that the explicit *teaching of value* could result in student behaviour modification. These data provide evidence of teachers’ expectation of change in student behaviours from teaching knowledge about environmental issues and values in ES.

In the discussion about important teaching and learning, teachers and students frequently reported the importance of knowledge about environmental issues and ecological systems. With regard to values and worldviews, the focus group and interview responses indicated that the value of utilisation was reflected substantially more often than the value of preservation. Students also reported that ES has positively impacted on their optimism about the future of the environment, sense of environmental stewardship and agency towards addressing environmental problems. In addition to the apparent impact on attitudes, a few principals and teachers and the majority of students reported changed student behaviours, usually in the way that they manage waste, while a few have planted trees, stopped cutting trees or killing animals and participated in social change. Most teachers expected pro-environmental changes because of the students’ developing awareness about environmental problems and the teaching of values in ES, while also noting it was difficult to determine any change in students’ behaviour, and that ES had little value if students did not change their behaviours. Students claimed their positive behavioural changes resulted from learning about the impact of human actions on the environment and the importance of the environment.

Discussion

The strong focus on learning knowledge about environmental problems aligns with the emphasis in the key document, the ESCF, which guided the development of the ES course and ES textbooks. This emphasis is on teaching various environmental problems to give “students a feel of the issues and concerns of environment and human relationship with nature” (DCRD & RSPN, 2013, p. 16). However, this focus on knowledge about environmental problems alone is a concern, as according to some researchers, it is also necessary to motivate and develop a student’s competence to engage in taking action (Jensen, 2002; Kollmuss & Agyeman, 2002) to address environmental sustainability in the pursuit of GNH. Students may not participate in taking environmental action if they lack an understanding of the importance of taking action or have not developed action competence (Jensen, 2002). In fact, it is argued that knowledge in the absence of taking action may lead to “action paralysis”, whereby students feel the lack of ability to act to solve environmental problems (Jensen, 2002). The implication of this finding is that teachers may benefit from PD on how to incorporate action orientation in their ES teaching to develop students’ competencies in addressing sustainability issues.

The emphasised importance of learning about ecological systems suggests that the content of the course is aligned with the ESCF strand “Systems in nature” (DCRD & RSPN, 2013). Teachers may need to extend this knowledge base to better promote students’ understanding of ecological systems in relation to broader knowledge and values on sustainability. As argued by UNESCO

(2002), knowledge about ecological systems is important for understanding other key concepts in Education for Sustainable Development, such as ecological footprints, interspecies equity and sustaining biodiversity.

The lack of emphasis on learning about sustainable development strongly indicates the need for alignment of the ES content with the ESCF objectives of gaining the tools to act appropriately for sustainable use of natural resources for a sustainable future (DCRD & RSPN, 2013). The Bhutanese development policy is to “secure ecologically balanced sustainable development, while promoting justifiable economic and social development” (National Environment Commission [NEC], 2016, p. 7), and the national yardstick of GNH can be achieved only through sustainable development. Essentially, individual understanding and the practice of sustainable living is important for addressing the goal of sustainable development.

The participants appeared to hold strong values on the importance of protecting the environment, which aligns with the ESCF objective of instilling “positive attitudes and values towards the environment” (DCRD & RSPN, 2013, pp. 17–18) and the MoE (2014) recommendation for educating youth with the GNH values and principles necessary to support sustainable development. Teachers and students value socioeconomic prosperity and conservation of the natural environment for the benefit of present and future generations (Figure 1). This view corresponds to Bhutan’s national strategy to conserve the natural environment through “The Middle Path” (Gross National Happiness Commission [GNHC], 2011), which is to sustain the natural environment while developing socioeconomically. In order to engage students in understanding the tensions and challenges faced in conserving the environment and cultural values while pursuing sustainable socioeconomic development, teachers could employ critical approaches in ES teaching to foster students’ critical thinking competency. This competency may enable them to become critical change agents in negotiating the tensions inherent in sustainable development.

The predominance of anthropocentrism in the participants’ views, which mainly reflects values related to the utilisation, may be because 69% of the Bhutanese population live in rural areas and depend on the forest for their livelihood (GNHC, 2009), and they believe that the Bhutanese derive rich ecological services from the natural environment (Wangchuk et al., 2021). Culturally, the importance of environmental conservation in Bhutan is upheld by the Buddhist precepts:

The mountains, rivers, streams and soil are regarded as the domains of spirits. Pollution and disturbance are believed to be the causes of death and disease for those spirits. The Buddhist respect for all living things has led to the development and adoption of ecologically friendly strategies – a solid base upon which a national environmental strategy can be built. This, coupled with the Buddhist tenet that the acts of this life will be rewarded or punished in the next, provides a powerful motivational principle for sustaining Bhutan’s natural resource base. (NEC, 1998, p. 19)

In addition, the developmental plan and policy of the Ministry of Agriculture and Forests focuses on privileging the sustainable management of natural resources for human benefits, and the GNHC (2019) states the ministry will explore a sustainable natural resources management and utilisation programmes that “aims to ensure a holistic, concerted and effective approach towards sustainable use and management of natural resources for economic, environmental and social well-being of the present and future generations” (p. 52). Utilisation supports Escobar’s (2008) claims that worldviews in relation to nature are created based on social beliefs and cultural, ecological and economic values. Further, utilisation also reflects the interdependence of human livelihoods with the environment and the goals of various UNESCO statements, for example:

[S]ustainable development requires us to acknowledge the interdependent relationship between human needs and the natural environment, which means that . . . the environment cannot be protected in ways that leave half of humanity in poverty. (UNESCO, 2004, p. 28)

The students' strong sense of optimism, agency and stewardship bodes reasonably well for Bhutan's future and underscores the key role of ES in the curriculum. The students' optimism could enable them to commit to participate in solving environmental problems in anticipation of resolutions for a sustainable future (Rauch & Steiner, 2013). The apparent impact of ES on students' sense of stewardship is encouraging given that stewardship is essential for participating in addressing environmental sustainability (Schusler & Krasny, 2010). Nonetheless, although important, the development of students' sense of stewardship alone may not be adequate, because stewardship without action does not change anything. Therefore, it is desirable for students to capitalise on their sense of stewardship by taking actions such as creating nature reserves in schools, reforestation, developing community gardens and adopting sustainable consumerist behaviours as suggested by Bennett et al. (2018). In addition, teachers could implement the critical pedagogy suggested by Giroux (2010) to develop competencies (UNESCO, 2017). For example, teachers could engage students in more classroom experiences and student-directed actions that provide opportunities for students to question existing policies, practices and assumed societal norms to prepare them to be critically active future-orientated citizens who are capable of addressing the GNH pillar of sustainable environmental conservation.

Students' strong sense of agency indicates that students are developing a normative competency, which enables them to understand and recognise their own potential to participate in addressing environmental problems (UNESCO, 2017). Thus, there are opportunities for teachers to leverage students' sense of agency by engaging them in taking collective actions towards solving sustainability issues in schools or the community, capitalising on the strength and power of working together to achieve the goals and aspirations of Bhutan (RGoB, 2012; Tobgye, 2015).

The evidence of more positive student behaviours towards the environment suggests the ES outcome stated in the ESCF for students to demonstrate "environment friendly behaviours in the sustainable management of the environment" (DCRD & RSPN, 2013, p. 17) has been achieved to some extent. Although it was noted that there was a lack of students taking action, particularly as part of their ES learning activities, it is worth noting that these behavioural changes could also have resulted from their participation in general school activities of cleaning, managing waste and planting trees through various school club activities. Further, increased awareness about the environment from ES could have had a positive impact on student behaviours, as Fielding and Head (2012) found in a study on secondary students in Australia that increased environmental awareness had a positive influence on students' pro-environmental behaviours. Therefore, the specific impact of ES on student behaviours is difficult to isolate from other environmentally focused school activities.

As pointed out by Zsoka et al. (2013), it is problematic observing, identifying and quantifying the impact of environmental curricula on student behaviours. In this respect, it is of interest that the self-reported changes in the students' behaviours have been a direct consequence of learning in ES about the impact of humans on the environment and the importance of the environment. This finding that knowledge of environmental problems alone has prompted action contrasts somewhat with the widely established view (Arbuthnott, 2009; Kollmuss & Agyeman, 2002) that environmental knowledge is necessary but not sufficient to change behaviours, because changing behaviours requires participation in solving real-world environmental problems. Evaluating the impact of ES could be a potential, if challenging, area for future research in its own right.

Conclusions

The implementation of ES in Bhutanese schools was found to be effective in developing students' optimism, sense of agency, stewardship and positive behaviours towards the environment, which can support the country's vision of achieving GNH. These competencies are crucial for engaging students in addressing environmental sustainability (Schusler & Krasny, 2010). The findings

provide teachers with the opportunity to leverage students' optimism, sense of agency, stewardship and more positive behaviour to engage in addressing environmental sustainability. This could be achieved through the implementation of transformative teaching approaches such as action orientation (Jensen, 2002; Mogensen & Schnack, 2010), the 'Sustainability Action Process' (DEWHA, 2010, p. 9) and ecopedagogies (Giroux, 2010), which are believed to be effective in fostering students' competencies that will enable them to address sustainability issues and become critical change agents.

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Kishore Mongar received his PhD from the School of Education, University of New England in Australia. He has specialised in teaching science and science education. He has experience teaching in higher education and at the secondary school level for over 14 years. He experienced in teaching science, teaching pedagogies, educational assessment and evaluation, curriculum development, IT education and research.

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