Interdisciplinary Journal of Environmental and Science Education
2022, 18(2), e2272
ISSN 2633-6537 (Online)
https://www.ijese.com

Research Article

Bhutanese Teachers' and Students' Perspectives on Approaches to Teaching ESD Through Environmental Science

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Citation: Mongar, K. (2022). Bhutanese Teachers' and Students' Perspectives on Approaches to Teaching ESD Through Environmental Science. *Interdisciplinary Journal of Environmental and Science Education, 18*(2), e2272. https://doi.org/10.21601/ijese/11894

ARTICLE INFO

Received: 23 Jan. 2022

Accepted: 6 Mar. 2022

ABSTRACT

This study investigated the teaching pedagogies deployed in teaching environmental science (ES) to adequately prepare Bhutanese youth with the knowledge, values, attitudes and skills to engage in sustainable environmental conservation that supports the country's pursuit of Gross National Happiness. A mixed-method research strategy was employed that collected data in the form of surveys and interviews with 14 teachers, surveys with 563 students, interviews with 194 students through (46) focus groups and six classroom observations. The data indicated that the transmissive approach (teacher talk), discursive activities (presentation and group discussions), and textbook-based activities of reading and solving problems from ES textbooks are the most predominant teaching approaches implemented in teaching ES. Students are engaged in critical thinking, empirical real-world and book-based research and maintaining an environmental profile; however, there is a lack of hands-on activities of projects, experiments, fieldwork, exhibitions and surveying and interviewing people. Teachers identified that lack of time, examination-based assessments, the large syllabus and a lack of resources are the factors that impede learning activities in ES. Therefore, there is a need for more emphasis on teachers' professional development on transformative teaching pedagogies for effective implementation of ES that will prepare students for the pursuit of environmental sustainability.

Keywords: environmental conservation, Gross National Happiness, transmissive pedagogy, discursive pedagogy, action-oriented, transformative pedagogies

INTRODUCTION

The Gross National Happiness (GNH) of Bhutan reflects four sustainable development dimensions: environmental conservation, sustainable and equitable socioeconomic development, preservation and promotion of culture, and good governance (Schuelka & Maxwell, 2016). An emphasis on ecologically sustainable development is also evident in the Bhutanese education policy documents.

For instance, the *National Education Framework* (Ministry of Education [MoE], 2009, 2013, 2014) aims to educate students to be citizens who are creative, skilful and capable of addressing environmental challenges and socioeconomic development.

Further, the education policy states that students are to "understand the legal, political and economic systems, including contemporary institutions and practices in local, national, regional and global contexts to ensure a sustainable future for all" (MoE, 2009, p. 27).

A new optional environmental science (ES) subject for classes IX to XII was introduced into Bhutanese schools in 2015 in order to

> build a cadre of young people equipped with knowledge, skills and values to engage them in the conservation of natural heritage, promoting sustainable and equitable use of natural resources, preventing all forms of environmental degradation in the pursuit of GNH. (Department of Curriculum Research and Development & Royal Society for the Protection of Nature [DCRD & RSPN], 2013, p. 17).

The environmental science curriculum framework (ESCF) that guided the development of the ES course states that the objectives of ES teaching were drawn from the UNESCO-UN Environment Programme (UNEP) Intergovernmental Conference held in Tbilisi in 1977, and that ES plays a crucial role in supporting Bhutan to address the SDGs submitted to the 1992 Earth Summit in Rio (DCRD & RSPN, 2013). In ES, students study the UN Millennium Development Goals (MoE, 2013) and the concepts, principles and practices of sustainable

development and their relationship to the GNH pillars. Therefore, ES is an avenue for teaching education for sustainable development (ESD) (Kemmis & Mutton, 2012; Warburton, 2003) to achieve the goals and objectives of the MoE to prepare future citizens with the knowledge, values, attitudes and competencies to address sustainability (UNESCO, 2017b). Thus, ESD is perceived as being more than a transmission of knowledge. Rather, it is characterised by action-oriented and transformative approaches to teaching and learning, such as self-directed, participatory and collaborative learning and problem-oriented and interdisciplinary or transdisciplinary pedagogies (UNESCO, 2017b).

LITERATURE REVIEW

Although UNESCO (2012) recognizes transmissive teaching to be one of the conventional methods of teaching in ESD, a serious concern with transmissive pedagogies is that they do not promote realisation of the full potential of constructivism, and therefore limit the student activity and discourse that are important in constructing new understandings (Piaget & Cook, 1952; Vygotsky, 1962). Moreover, transmissive teaching tends to rely heavily on textbooks; therefore, it constrains the implementation of hands-on and experiential learning activities and, potentially, promotes poor attitudes among learners (Tytler, 2007). Such pedagogies may not produce the desired student behavioural changes (Wood et al., 2016) or develop students' ESD key competencies of systems thinking and anticipatory, normative, strategic, collaborative, and critical thinking that are crucial for participating in addressing sustainability (UNESCO, 2017a). Hence, UNESCO (2017b) emphasizes the implementation of the pedagogies of critical thinking, transformative thinking, learner-centred thinking, and action-oriented thinking in ESD to empower and motivate students to become citizens who are capable of addressing sustainability.

Constructivism can be described as a theoretical underpinning that can promote effective teaching of ESD. Pass (2004) refers to constructivism as the process of "the student perceiving the problem, constructing a mental model to solve the problem, and then forming a solution" (p. 110). Through constructivist approaches, students enjoy learning through active involvement and can transfer knowledge from one situation to another, take control of their own learning, are motivated and engaged in addressing real-world problems and have opportunities to interact and share their ideas (Bada & Olusegun, 2015). Importantly, in the Bhutanese context, the *National Education Framework: Curricular Perspective* (MoE, 2009) emphasises that teachers should be adopting constructivist approaches to teaching students in Bhutanese classrooms. Problem-based learning (PBL) is a constructivist pedagogy that provides opportunities for teachers to play the role of a learning facilitator to encourage students to engage in and actively construct their own learning (Bholah, 2017). PBL can also positively impact on students' achievements, attitudes and motivations (Wijnia et al., 2015), which may foster their development as active citizens with positive behaviours toward sustainable futures (Wheeler & Thumlert, 2007). Developing these competencies among students is deemed important for addressing the emerging sustainability issues in Bhutan (Royal Education Council [REC], 2012).

In addition to constructivism, critical theory that is "oriented towards critiquing and changing society as a whole" is effective in enabling students' in-depth understandings of the working of the world (Elliott & Davis, 2018, p. 16). Critical pedagogy in ESD engages students in examining the primary causes of sustainability issues, reflecting on their beliefs and socio-cultural values, identifying ways they are accustomed to their socio-cultural system, building their capacity as an agent of change and empowering them to critically reflect on their ability to take action to address sustainability (Elliott & Davis, 2018; UNESCO, 2018). Critical pedagogy is believed to facilitate the change in students' thinking and behaviours that are essential for addressing sustainability issues that cannot be resolved through political agreement, financial incentives or technological solutions (UNESCO, 2014, 2018, p. 54). This requires teachers to be imaginative and challenge their own thinking (Davis & Elliott, 2014) as well as engage students in critically reflective thinking to realise the importance of sustainability and participate in being an active, critical and global change agent (UNESCO, 2017a).

Critical thinking competency is one of the key competencies in ESD that is required to achieve sustainable living (UNESCO, 2017b, p. 11). Critical thinking is referred to by UNESCO (2017b, p. 11) as "the ability to question norms, practices and opinions, to reflect on one's values, perceptions, and actions to take positions in the sustainability discourse". Critical thinking can also be viewed in relation to Bloom's taxonomy of higher-order thinking (Anderson & Krathwohl, 2001), which is widely applied in education. The higher-order thinking levels of analysis, evaluation and synthesis are considered to contribute to students' critical thinking (Miri et al., 2007). Engaging students in activities and actions that require higher-order thinking prepares them to offer reasonable and reflective judgments to plan solutions for environmental issues (Brookhart, 2010). Critical thinking may also empower students with autonomy and the capacity to make decisions to solve complex sustainability issues at local, national and global levels (Braun-Wanke, 2017; MoE, 2014; Taylor et al., 2015). Students' critical thinking competency can be enhanced through small group discussions, thinking aloud, debates on real-life problems or any controversial socio-political issues and sharing their views and opinions (Vong & Kaewurai, 2017).

In addition, using socio-scientific issues (SSI) in ESD teaching enhances students' critical thinking, system thinking and anticipatory and normative competencies and skills by encouraging them to participate in societal sustainability debates (Eilks, 2015). The use of SSIs is a sociocultural approach that connects the science, social, economic and political aspects around issues (Zeidler & Kahn, 2014). This strategy supports students in their understandings and in seeking solutions to complex issues (Gresch et al., 2013) and matters that cannot be resolved only by scientific means (Robottom, 2012). Through this strategy, students may become scientifically literate citizens who are capable of reasoning about real-world sustainable issues, researching into and analysing information, deliberating thoughtfully and

understanding the moral and ethical implications of their decisions (Zeidler & Kahn, 2014, p. 4).

Experiential learning such as outdoor teaching and learning is one of the pathways towards ESD (Irwin, 2008) that contributes to the holistic development and learning of students about ESD (UNESCO, 2011). For example, outdoor learning may promote awareness of local environments, knowledge and understanding, skill development, shifting of attitudes and values, and exploration of ways of taking action to address sustainability issues (Prince, 2017). Outdoor learning can also facilitate students' in-depth learning and understanding of the sustainability issues in the local natural environments (Lloyd & Gray, 2014) and generate positive attitudes to the environment (Mokuku & Jobo, 2017). Further, Sobel (1996) emphasizes the importance of the outdoors in connecting students with their immediate natural environment so that they can take relevant, local sustainability action rather than try to engage with environmental problems prevailing in distant places. Specifically, through outdoor learning, students could be engaged in pro-environmental activities that can facilitate pro-environmental behavioural change as reported by Prince (2017).

Field trips/nature excursions are integral to outdoor learning and have long been part of traditional nature and conservation education. More recently, they have become part of outdoor education and place-based education (Sandell & Ohman, 2010). The field trip as a teaching method can be effective in diverse cultural contexts (Takano et al., 2009). Field trips can also potentially enhance students' motivation to learn new knowledge and apply previously acquired knowledge to a suitable context (Braund & Reiss, 2006) by linking to their everyday life, community and environment (Braun & Dierkes, 2017). Therefore, taking students on field trips to appropriate places provides them with an opportunity to learn, understand and practise sustainability (UNESCO, 2017b).

Closely related to outdoor learning, place-based learning is one of the pedagogies of ESD that may transform learning from teacher-centred to learner-centred, in line with constructivist approaches, and from rote to participatory (UNESCO, 2018). This pedagogical strategy connects the school to the local community (Smith & Sobel, 2014) and promotes students' understanding about the environment as a place that is rich in socio-cultural, economic, political and historical evidence, rather than just a place where humans interact with the ecological systems (Smith & Sobel, 2014). This requires teachers to facilitate student participation in various actions/activities of investigating sustainability issues in a school or local community to strategically construct/implement potential solutions (Smith & Sobel, 2014; UNESCO, 2018), which may potentially prepare them to contribute to sustainability in their own community (Goralnik & Nelson, 2011).

Teaching through scientific experimental methods can also stimulate students to investigate sustainability issues and practices in the natural environment (Green & Somerville, 2015). Environmental investigations that focus on the students' surroundings can reinforce science process skills such as observing, measuring, predicting, and describing as well as problem solving (Plevyak & Mayfield, 2010), which could potentially develop their individual or social agency in addressing sustainability issues related to science. Students can also conduct laboratory experiments that may provide evidence of issues in the local environment such as air and water quality or engage in experimental renewable energy technology projects (UNESCO, 2017b).

METHOD

The PhD study from which this paper is drawn was underpinned by a pragmatic paradigm (Creswell & Plano Clark, 2018). This study utilised the mixed-methods research strategy and carried out surveys, interviews and classroom observations to investigate what teaching pedagogies are being deployed in teaching ES. Participants were drawn from six middle or higher secondary schools in the rural and urban areas of Samtse, Bhutan. The survey respondents were 14 teachers and 563 ES students from Class IX to Class XII. The interview participants were 194 of the students and the 14 teachers who participated in the surveys.

Data Collection

Surveys

The surveys were employed to collect a wide range of quantitative and qualitative data on the views of both teachers and students within a very short time span (Stangor, 2011). The survey instruments included both closed-ended and open-ended questions. For all surveys, the closed-ended questions consisted of Likert-type items that were designed to tap into the views of teachers and students about various aspects of the research questions, which is a common and useful practice in data collection (Cooksey, 2020). This strategy also provided the participants with relative freedom and anonymity in terms of whether they agreed with, were neutral or disagreed with specific propositions (LaMarca, 2011). The closed-ended items were followed by open-ended questions that invited the respondents to express their views more expansively than is possible with the pre-set response categories (Cohen et al., 2018). The survey was a cross-sectional study that drew on samples from all ES students and teachers in each school (Cohen et al., 2018). The 563 ES students and 14 teachers participated in the survey, which was administered directly to the participating students during their usual class time to maximise the response rates (Babbie & Wagenaar, 2011) and to address any difficulties, particularly language difficulties, that the participants may encounter while completing the survey questions (Cohen et al., 2018). The teachers completed the surveys when it was convenient for them.

Interviews

The interviews were conducted in conjunction with the classroom observations and surveys to gain an in-depth understanding of participants' perceptions about ES teaching and learning activities. One-on-one semi-structured interviews were held with the teachers and focus groups were conducted with the students. Interviews were utilised as they elicit richer data than surveys (Bryman, 2016) and allow in-depth study and understanding of the lived experiences of the

participants (Brinkmann & Kvale, 2018). The 14 teachers were interviewed individually and the 194 students were divided into 46 separate focus groups. To facilitate a more conducive environment with more time for each participant to contribute, the focus group interviews were conducted with an average of four students in each group. This enabled me to hear as many voices as possible within a limited time frame, albeit at the cost of more focus groups. In recruiting participants for the student focus group interviews, the ES teachers were requested to suggest potential participants to represent the diversity of student abilities, genders and ethnicities. This approach, as recommended by Mason (2010), was implemented because certain categories of individuals may have unique and different perspective about the issues, and their representation in the sample was sought.

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 interviews. I posed questions to the whole group and participants were invited to respond in their own time. To obtain as many voices and perspectives as possible, the 46 focus groups involved at least 30% of the ES student population in each of the schools in the Samtse geographical study region (Guest et al., 2006), as they represented the diversity of student abilities, genders and ethnicities. The interviews with the teachers and principals were about 35 minutes each and each focus group was around 45 minutes to one hour. All of the interviews with the 14 teachers and 46 focus groups were digitally audio-recorded. Each interview recording was transcribed using the computer application InqScribe™ version 2.2.4.

Classroom observation

The observations focused on first-hand data collection from real classroom settings (Cohen et al., 2018) on the types of teaching methods implemented and the variety of activities organised to engage students in learning the knowledge and skills needed to take action to solve environmental issues. Further, the data collected through observations were used to triangulate the self-reported data provided by the participants from the interviews and surveys (Denzin & Lincoln, 2011). This augmented the validity and reliability of these data. However, one possible significant disadvantage of the classroom observations was the Hawthorne effect, which is where the participants are aware of being observed and may modify their behaviour and classroom practice accordingly (Paradis & Sutkin, 2017). Although this problem was relatively difficult to avoid, the researcher endeavoured to reduce its impact by explaining the purpose of the project to the teachers, emphasising that their teaching effectiveness was not being studied. The observational framework was used, which included cues to record observations of the general teaching strategies and specific activities employed by the teachers. This framework was used to observe six ES lessons, which consisted of one ES class lesson of 45 to 50 minutes in duration in each school.

Data Analysis

Qualitative data

The 14 transcripts from the teacher interviews and the 46 transcripts from the student focus groups were imported into CAQDAS NVivo 12 for in-depth analysis. Both deductive and inductive approaches were employed to code each interview and focus group transcript (Elo & Kyngäs, 2008) using a constant comparison method (Leech & Onwuegbuzie, 2011). Throughout the process, coding memos within NVivo 12 were used as suggested by Corbin and Strauss (2014) and Polit and Beck (2006). The memos noted the developing themes, definitions, ideas, other information and important verbatim quotations that were evident during coding. The open survey responses were also coded using Nvivo 12 and using the same constant comparative deductive and inductive approach outlined for the interviews. The matrix coding query was conducted using Nvivo 12 to calculate the frequency of each code and category for each group of participants and to tabulate the frequencies of codes together with pertinent data from other data sources, such as interviews and classroom observations.

The data collected during the six classroom observations were manually analysed directly from the hard copy observation framework entries. The frequency of codes from the classroom observations was calculated, tabulated and presented together with corresponding data from the surveys and interviews to answer the research question.

Quantitative data

The survey data 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 in SPSS 24 for normality by examining skewness and kurtosis and using Kolmogorov-Smirnov and Shapiro-Wilk statistics (Ghasemi & Zahediasl, 2012; Pallant, 2013). Because these initial tests suggested univariate and multivariate non-normality and the small teacher sample size did not allow parametric analysis (Ghasemi & Zahediasl, 2012; Pallant, 2013), the decision was made to use descriptive statistics to represent the data from the Likert items for both the student and teacher data. Thus, the frequency of responses was calculated for both students and teachers (Ghasemi & Zahediasl, 2012; Pallant, 2013) using SPSS 4. The results were exported to Excel and the data were subsequently represented as frequency histograms.

RESULTS

The results are discussed under three themes: fostering critical thinking, specific teaching and learning activities implemented, and challenges to teaching. After each quotation, parenthetical information shows the data source, which is either a teacher interview [T, I], a student survey [S, S], or focus group [FG].

Table 1. Teachers' responses and classroom observations on critical thinking activities in ES classes

Sub-theme	Coded response	Teacher individual interviews (N=14)	Class observations (N=6)
Critical thinking activities	Engaged students in critical thinking activities	12	5
	No critical thinking activities	2	1
Ways teachers engaged students in critical thinking activity	Asking students to explain or justify their answer to questions	11	5

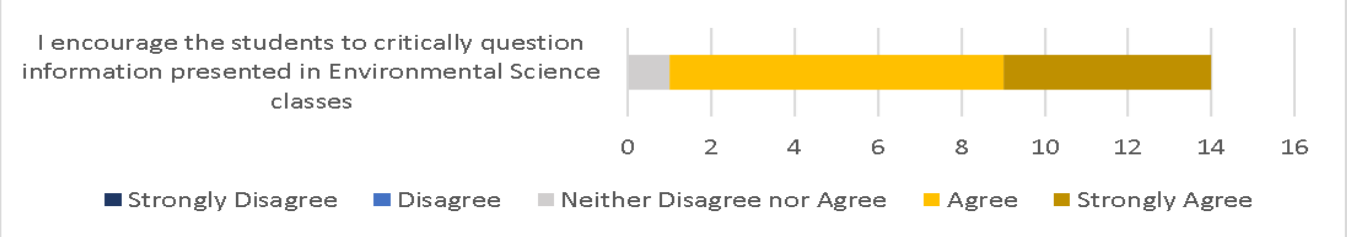

Figure 1. Frequency of teacher responses about engaging students in critically questioning information presented in ES classes

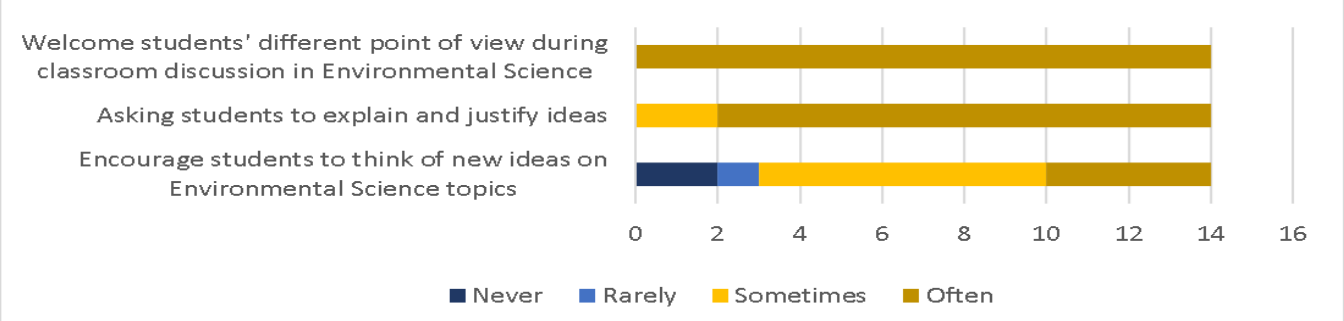

Figure 2. Responses of teachers about the frequency of classroom approaches that may cultivate critical thinking

Fostering Critical Thinking

Teachers' & students' views about fostering critical thinking

The interview and observation results on critical thinking are outlined in **Table 1**.

The explicit exploration of this aspect of ES in the interviews as presented in **Table 1** show that most teachers claimed that they *engaged students in critical thinking activities* by asking students to explain or justify their answer to questions. For example:

> I ask how and why questions; in that way they build critical thinking. For example, I asked students how genetic diversity is related to species diversity or how species diversity is related to the whole concept of biodiversity. It involves them in thinking from lower level to higher level [T, I].

Also, in five of the six classrooms, teachers asked questions of students that apparently tapped higher-order thinking skills. **Figure 1** indicates that most teachers agreed to the survey item that they engage students in critical thinking.

Further, the teachers indicated that they implemented different approaches in ES classes to cultivate students' critical thinking (**Figure 2**). The data from the surveys, interviews, and classroom observations indicated that most of the teachers engaged students in critical thinking in ES classes, usually by welcoming students' different points of view and engaging them in explaining and justifying their opinions and ideas.

Figure 3 shows that the students' views agreed with those of the teachers that they had participated in various critical thinking activities in ES. The most frequent activity that students referred to was supporting their ideas with reasons and thinking of new ideas from different points of view. Most students did feel they were able to question the ideas presented by their teachers. Further, about half of the students reported they questioned the ideas presented in the textbooks.

The data from the surveys, interviews and classroom observations clearly indicate that the students participated in some higher-order thinking activities in ES. From the survey responses shown in **Figure 2** and **Figure 3**, both the teachers and students generally agreed that the teachers welcomed and solicited students' different points of view and asked students to explain and justify their views. These two strategies appeared to be relatively frequently implemented when fostering critical thinking skills in the ES classes.

Specific Teaching & Learning Activities Implemented

Hands-on experiential learning activities

Information on the teaching and learning activities organized in the ES classes as evident from the interviews and a classroom observation is presented in **Table 2**. The interview data show that over a quarter of the students reported *no hands-on experiential learning activities* in ES classes in their focus group interviews. For example, "We are not doing practical activities like coming out in the field and experimenting things" [FG]. Corresponding to the lack of

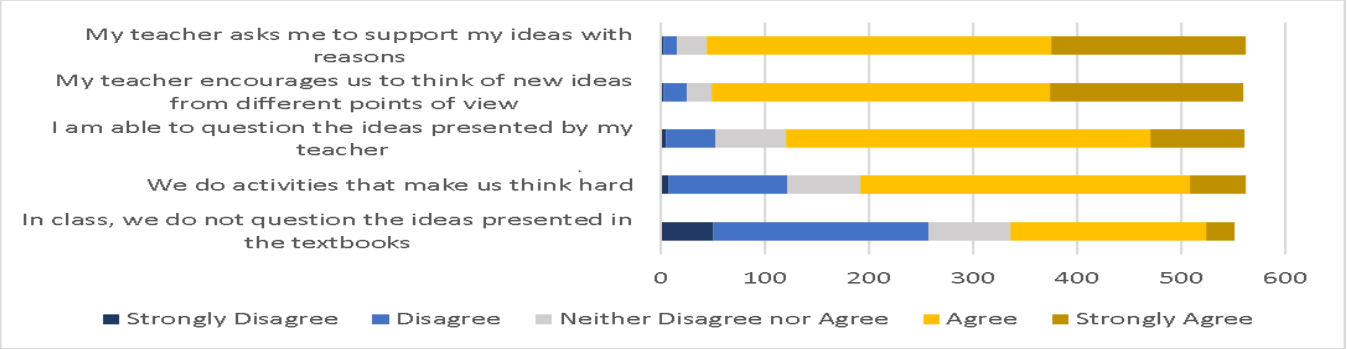

Figure 3. Frequency of student responses about their participation in critical thinking activities in ES classes

Table 2. Responses about teaching and learning activities organized in ES classes

Sub-theme	Coded response	Teacher individual interviews (N=14)	46 student focus groups (N=194)	Classroom observations (N=6)
Hands-on experiential learning activities	No hands-on activities	0	61	N/A
	No project	4	75	N/A
	Empirical real-world project	8	18	0
	Fieldwork	2	10	0
	Experiments	2	0	0
Discursive activities	Group discussions	14	29	5
	Presentations	9	27	5
	Debates	1	3	0
Wider research and reflection	Environmental profiles	7	13	N/A
	Book-based research project	3	5	N/A
Textbook-based individual activities	Students reading passages from textbooks	2	3	4
	Solving questions from the textbook	0	18	1
Transmissive activity	Teacher lectures	0	2	6

Note. *Environmental profile: Reflective journal based on personal experiences and reading

hands-on experiential learning activities, four teachers and one-third of the students reported *no project* in ESC, "To be frank, we have not done any project in ES" [FG].

Although a relatively high proportion of the students had not yet been involved in a project, a minority of students and a majority of teachers did report conducting *empirical real-world projects*. For example, "We are doing a project on phenology. We are observing one plant every day and keeping the record of plants" [FG]. In short, the interview data from the majority of teachers and the minority of students provided some evidence of research projects being carried out in schools, but the relative paucity of project work reported may reflect the timing of the interviews, which were conducted early in the school year.

Doing *fieldwork* was relatively infrequent, being reported by only 10 students and two teachers in their interviews, which is consistent with the survey data previously outlined in **Table 2**. The teachers explained they only sometimes implemented fieldwork due to time constraints, "Fieldwork, we use it but not often because we do not get time to go out unless we find our own time on Saturdays and Sundays" [T, I].

No students reported during the interviews that they had conducted *experiments* and only two teachers reported they conducted experiments in class. Further, it was apparent from both the teachers' and students' responses to the Likert items in **Figure 4** and **Figure 5** that these empirical activities of surveys or interviewing other people, fieldwork and experiments were relatively rarely conducted in class. Furthermore, these findings of relatively infrequent experiential activities were supported by the classroom observations, where hands-on experiential learning activities were not observed in the classroom teaching.

Given the apparent scarcity of experiential hands-on activities, surveys, projects, fieldwork and experiments in ES, it is noteworthy that almost all of the students who offered suggestions for improvement suggested *hands-on experiential learning activities*. For example, "Teachers should organise more practical activities like going outside, showing the environment and planting some trees which will help students to concentrate more and learn more about the environment" [S, S] and "It would be better if we could maintain an area for a practical experience like conserving a forest involving some species of animals" [S, S]. These students' suggestions from the open-ended survey responses substantiated the lack of hands-on ES experiential learning shown in **Figure 4** and **Figure 5**.

Discursive activities

Of all the activities coded in **Table 2**, discursive activities were the most frequently reported in both the teachers' and students' interview data. For instance, the conduct of *group discussions* in ES was apparent in all teacher interview responses and 29 student interviews. All of the teachers declared that they often organise group discussions in ES classes; for example, "Most of the time, I practise discussion and explanation" [T, I]. Similarly, students resonated that "We did group discussion. We discussed some environmental problems" [FG].

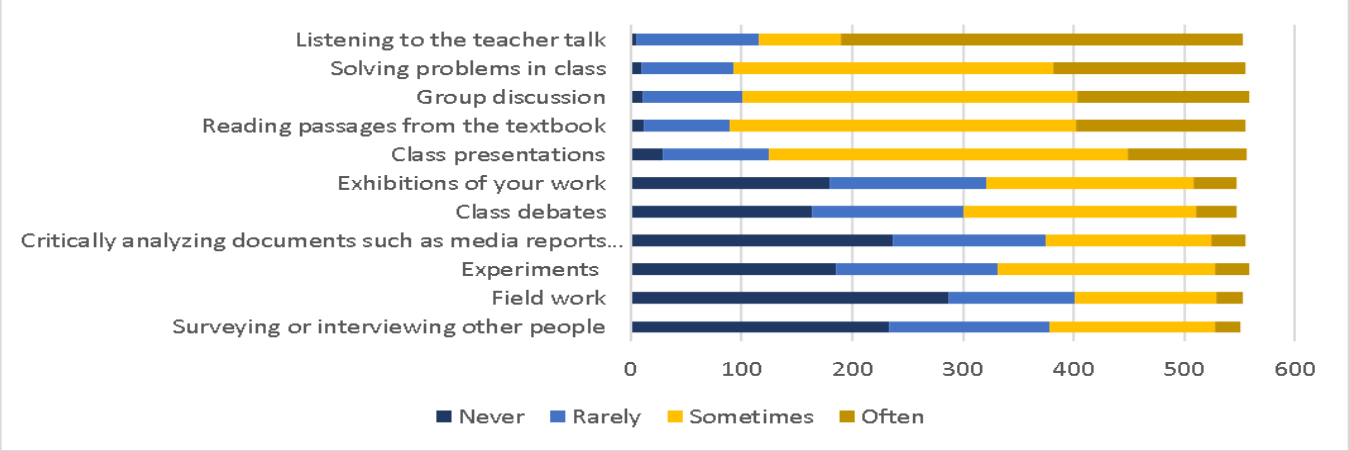

Figure 4. Frequency of activities in ES classes, ranked by frequency of 'often' responses from students

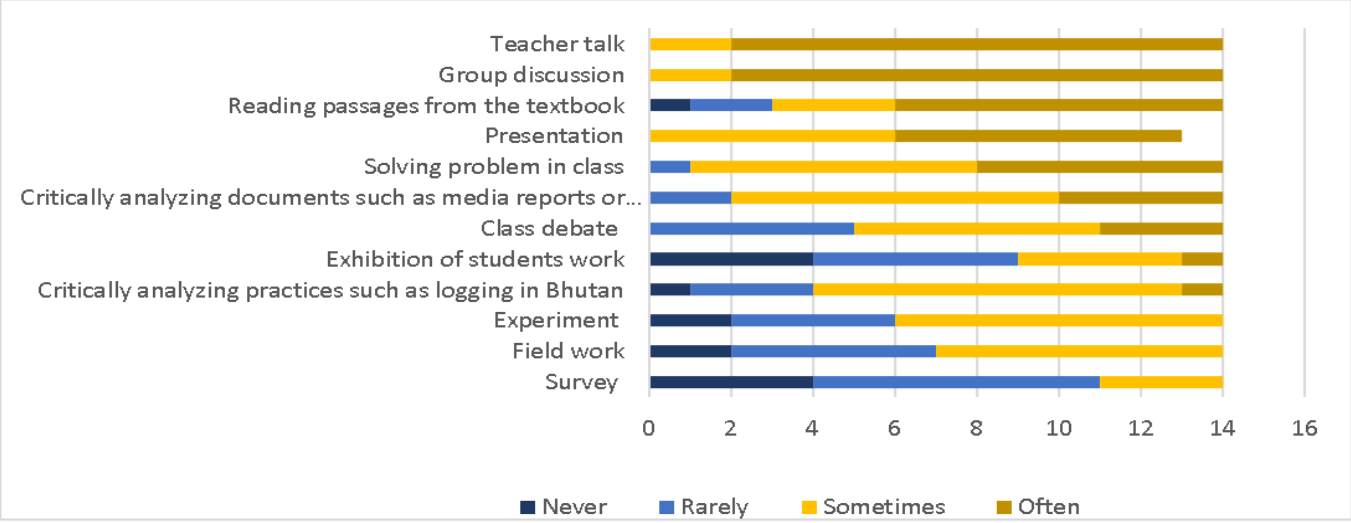

Figure 5. Frequency of activities in ES classes, ranked by frequency of 'often' responses from teachers

Nine teachers and 27 students mentioned the activity of *group presentations*; for example, "Whenever it is possible, we go by the presentation" [T, I]. Some students explained that "We do a group presentation. Teacher gives us the topic, and we have to research and give our presentation on that particular topic" [FG]. Finally, there were very few instances of *debate* as a discursive teaching and learning activity in ES classes. In the observations, in five of the six classes, the teachers frequently engaged students in group discussions and presentations. Further, in **Figure 4** and **Figure 5**, planned group discussions, solving problems in class and reading passages from the textbook were noted by both students and teachers as happening relatively "often" in class. While the interview data indicated that teachers and students reported discursive activities occurring the most frequently, these data do differ from the survey responses, where discursive activities were reported much less than teacher talk. It is likely that the interview participants did not consider teacher talk/listening to the teacher talk as an 'activity' so did not mention this kind of activity in interviews.

Wider research and reflection

Two forms of research and reflection that were reported infrequently in the interviews were *keeping environmental profiles* and *book-based research projects.* Half of the teachers raised the use of *environmental profiles,* where students collect and provide written reflections on information related to the environment, supported with evidence such as media excerpts:

> We have sort of activity where students must keep an environmental profile that is exactly like writing something on the journal. When children come across a topic which they feel is related to ES, they should always come with the picture or cut out from newspapers, and they can paste them in the book. They should write their point of views, opinions and be in a position to relate how that problem has arisen. So, I think that has brought some sort of realisation in children that ES is very important if we are to keep our earth safe. [T, I]

From a student's perspective:

> In ES, we have to maintain the environmental profile. In the environmental profile, we collect general knowledge, news from anywhere and incidents that happen. We describe them in our own words expressing our thoughts with examples. We have to submit to the teacher [FG].

Table 3. Teachers' responses about the barriers and support for ES teaching

Sub-theme	Coded response	Open survey responses (N=14)	Individual interviews (N=14)
Time and time tabling	Inadequate teaching hours	12	11
Subject/teaching related barriers	Large syllabus	6	7
	Rigid curriculum	1	0
Support requirements of teachers	Teaching and learning resources	10	11
	Budget for field trips	0	6

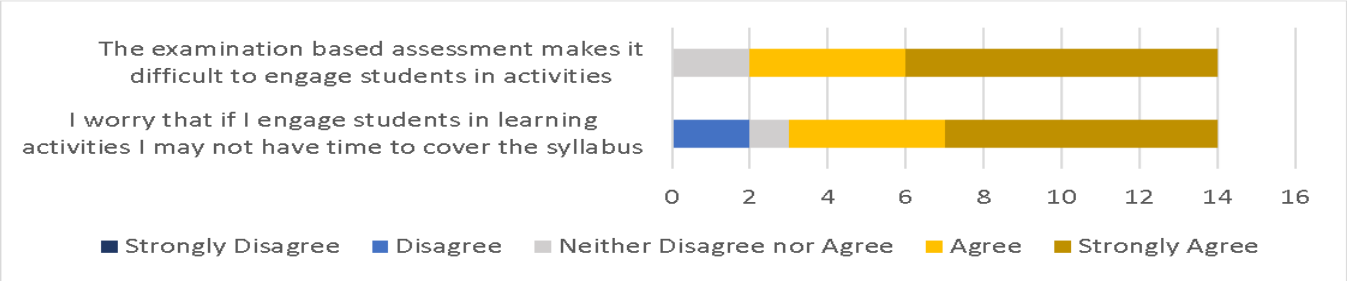

Figure 6. Teachers' responses regarding challenges to teaching ES

Other *book-based research projects* in ES were mentioned. For instance, students reported "I am doing a project on land management and writing about negative impacts to produce write up" [FG]. Similarly, a teacher stated "Last year, I provided a project on writing about environmental issues" [T, I]. These activities were not observed in class, which is unsurprising given that students worked on them in their own time. They had not been anticipated when initially developing survey tool, so no survey data relating to the activities were provided.

Textbook-based individual activities

As shown in **Table 2**, only a few teachers and students raised the activity of *students reading passages from textbooks* in ES. Although these interview data suggested textbook-based activities were relatively infrequent, the observation data indicated that teachers engaged students in reading passages from the textbooks in four of the six classes. In addition, *reading passages from the textbook* was the third most frequent type of activity in the teacher survey data and fourth in the student data. Similarly, the activity *addressing questions from the textbooks* in ES classes was reported by only 18 students; for example, "In ES, we do an activity like solving question and answers" [FG]. These data are also inconsistent with the survey data (**Figure 4** and **Figure 5**), where *solving textbook problems in class* was the second most frequent activity "often" experienced by students. It may be that participants may not have thought of this as an 'activity' when responding to the interview questions because during the classroom observations, it was observed that textbook-based individual work, including reading and solving questions from the textbook, did seem to occur.

Transmissive activities

Only two students reported listening to *teacher lectures* as an activity in their interviews, and none of the teachers mentioned it. However, teacher lectures were evident in every class in the observations. Further, *teacher talk* was the most reported teaching activity in the survey responses of both the teachers and students. The issue here may be with participant interpretation of the word 'activity' during the interviews. Participants perhaps did not consider teacher talk as an activity in the same way as other more 'active' classroom 'activities'. Therefore, although the data in relation to this point are inconsistent, the very high number of responses to the survey in **Figure 4** and **Figure 5** indicated that teacher talk happened often. The corroborating evidence from the classroom observations suggests that this was the most likely characteristic of the ES classes in this study.

Challenges to Teaching

Time and timetabling

Most teachers reported *inadequate teaching hours* as causing difficulty in ES teaching. For example, teachers mentioned, "ES being an optional subject have assigned only two periods" [T, I] and "There is no time allocated for students to go outside and practice whatever concepts they have learned in a class" [T, I]. **Table 3** presents the challenges faced and support required for effective teaching in ES.

Subject-related barriers

About half of the teachers identified the large size of the ES syllabus as being one of the challenges in engaging students in learning activities, which is consistent with the survey data in **Figure 6**. In addition, most teachers reported that "*the examination-based assessment makes it difficult to engage students in activities.*"

Support required

Table 3 shows that most teachers reported that they need more *teaching and learning resources,* and about half of the teachers identified that they need a *budget for field trips* to support effective teaching. For example, "We require budget to support field trips and outdoor learning in ES" [T, I], "If we have to organise a field trip then we need transportation facilities, we need lodging, spend for food and everything. They are very difficult to arrange, and we need more resources" [T, I] and

> I think the delivery will be more effective. In the textbook there are lots of topics related to field trip where we have to explore the environment or the community nearby. So, the disadvantage is we do not have enough resources [T, I].

These data from the teacher interviews and survey data revealed that lack of resources, inadequate time, the large size of the syllabus and examination-based assessments are the factors that impede effective implementation of learner-centred and transformative approaches to teaching ES.

DISCUSSION

Teachers' & Students' Views about Fostering Critical Thinking

The finding that teachers asked students to justify ideas and engaged them in sharing different points of view about sustainability topics indicates some alignment with the requirement of the ESCF (DCRD & RSPN, 2013) to engage students in critical thinking to foster their ability to solve problems through their involvement in complex issues. It is also in accordance with the *National Education Framework* (MoE, 2009) and the *Bhutan Education Blueprint* (MoE, 2014) expectation that every Bhutanese student is to develop critical thinking and problem-solving skills to prepare them to shoulder the responsibility of creating harmony in society. In ES, the students' ability to think critically about sustainability issues to address them could be developed through further involvement in activities that engage them in higher-order thinking from Bloom's taxonomy, which could foster students' capacity to solve environmental problems (Miri et al., 2007). In addition, Braun-Wanke (2017), MoE (2014) and Taylor et al. (2015) claim that critical thinking empowers students with autonomy and the capacity to make decisions to solve complex sustainability issues at all levels. Student involvement in activities such as debates on real-world environmental problems and controversial socioeconomic issues (Vong & Kaewurai, 2017) could engage them in higher-order thinking to come up with sustainable solutions to problems (Brookhart, 2010). Teachers could connect their teaching to a local sustainability issue to stimulate students' higher-order thinking in the identification, planning and implementation of sustainable solutions to address problems.

Although teachers engaged students in higher-order thinking by justifying and sharing their views or opinions and questioning, this may not be adequate to achieve the ESCF (DCRD & RSPN, 2013) learning outcomes of the ability to "investigate and analyse the impacts of human actions on the environment and natural resources, and their effect on socio-economic development" (p. 18) and to "critically evaluate urban planning rules and norms of Bhutan for sustainability aspects and point out the areas for change" (p. 23). Achievement of these outcomes may be better realised if teachers were to adopt a more critical pedagogy in teaching ES, as this pedagogy may develop more sophisticated critical thinking skills in students that are in line with UNESCO's (2017b) definition of critical thinking being "the ability to question norms, practices and opinions, to reflect on one's values, perceptions, and actions to take positions in the sustainability discourse" (p. 11).

As suggested by Elliott and Davis (2018) and UNESCO (2018), critical pedagogy could foster students' critical thinking by engaging them in activities that involve critical examination of the primary causes of sustainability issues. This could involve reflection on their personal beliefs and socio-cultural values and their ability to take action to address the issues. A socially critical approach is believed to provide the opportunity for students to critique current theory and practice and empower them to make decisions and formulate appropriate solutions to address sustainability in their communities (Blewitt, 2014). There are some instances of this approach in the ESCF. For example, to engage in critical thinking about the impact of socioeconomic development on the natural environment and the kind of sustainable development that could support ecological sustainability, students are expected to critically evaluate the "urban planning rules and norms of Bhutan for sustainability aspects and point out the areas for change" (p. 23). The teaching of ES may require engaging students in more activities that provide them with the opportunity to critique existing policy and practice, think deeply and reflectively about the causes and impacts of interrelated issues and propose ways of enhancing sustainability in their community.

Hands-on Experiential Learning Activities

The lack of hands-on experiential learning activities in ES classes that is reported by the teachers and students contrasts starkly with the experiential learning that is clearly advocated throughout the ESCF (DCRD & RSPN, 2013). For example, the perspective "From understanding to action" in the ESCF (DCRD & RSPN, 2013) demands that teaching of ES should foster:

> [V]arious skills among students through activity-based approach including indoor, outdoor activities, hands on experiences, experiments, case studies, surveys, debates, discussion, teamwork, folk art and so on. It encourages teachers to engage students continuously in experimentation, investigation, and project works (p. 17).

Moreover, ES "connects the concepts and principles of various science to the real-life situations promoting practice" (p. 6), and the ESCF (DCRD & RSPN, 2013) asserts that:

> [T]he content needs to be effectively conveyed when embedded in a local context, giving students a chance to explore and experience what is around them ... empower students with skills to address environmental issues, with a sense of personal and civic responsibility (p. 12).

The results from this study indicate a significant mismatch between these experiential elements that are so frequently and strongly emphasised in the ESCF and the implementation of ES. The lack of hands-on experiential activities could be due to the several factors previously alluded to: teachers' lack of pedagogical content knowledge in teaching ES, the large size of the syllabus, lack of resources, lack of class time and the

influence of knowledge-focused examination-based assessments. Examination-based assessment could be driving teachers to focus on "covering" the content in the voluminous textbooks. The teachers identified field trips as good practice in teaching ES, so the absence of field trips in their teaching and learning activities was due to lack of resources rather than teachers considering them unimportant.

The apparent lack of experiential learning in ES despite its prominence in the ESCF is a significant issue. Teaching ES through hands-on experiential learning activities may allow students to construct their own understanding and develop essential values, attitudes and skills. Students' learning through their own exploration and construction of knowledge is believed to be more effective than listening to transmissive teaching (Piaget & Cook, 1952). Moreover, the social interaction that often accompanies experiential learning could be more effective in achieving the aims of the ESCF, as students also construct their knowledge through social interactions with teachers and peers (Vygotsky, 1962). Moreover, the need for teachers to adopt constructivist approaches to teaching students in Bhutanese classrooms is recognised and emphasised in the *National Education Framework: Curricular Perspective* (MoE, 2009).

Such experiential learning activities could provide the opportunity for students to learn about the environment through observation, critical thinking, constructing new knowledge and applying it in real situations to address sustainability issues (Kolb et al., 2001). Further, experiential learning may promote students' in-depth understandings of their local natural environment and sustainability issues (Lloyd & Gray, 2014), potentially transforming the way they view and comprehend their natural world (Slavich & Zimbardo, 2012). It has been widely reported that experiential learning is believed to develop the positive values, attitudes and skills required to participate in addressing sustainability (Prince, 2017).

One way of expanding experiential learning in ES could be by engaging students in field trips, as advocated by the ESCF, to allow them to develop knowledge and skills in relation to the environment and sustainability issues in their local community. Through field trips, students could learn and implement their knowledge in a local context (Braun & Dierkes, 2017). For example, students could be engaged in conducting experiments to scientifically investigate environmental problems in their community, such as air and water pollution, as suggested by UNESCO (2017b). According to Prince (2017), hands-on experiential learning can also develop the pro-environmental attitudes and behaviours of students. Teachers may consider organising a variety of experiential learning activities, as suggested by the ESCF, to transform students into responsible and productive citizens who can solve environmental problems in order to achieve the GNH pillar of sustainable environmental conservation.

Transmissive Activities

The majority of teachers and students indicated that "teacher talk" was frequently implemented in ES. The teachers' apparent pedagogical orientation towards the traditional method of lecturing could possibly be due to teachers' lack of professional development, little instructional time, the large syllabus, lack of resources and lack of support. Further, teachers' pedagogical orientations could be influenced by their own schooling and experiences of lecture-based teaching during pre-service training (Maxwell et al., 2008). There is some evidence for teacher educators' predominant use of lectures with pre-service teachers in Bhutan (VanBalkom & Sherman, 2010), which suggests that the teacher educators at the colleges of the Royal University of Bhutan need to implement more learner-centred teaching methods in their classes. However, there are also cultural influences on teachers' choice of transmissive approaches to teaching ES. In Bhutanese culture, teachers are considered a repository of knowledge and students the passive learners of knowledge (Rinchen, 2014), which may impede the adoption of more student-centred approaches that are at odds with prevailing teaching practice as embedded in the culture of the education system.

Teachers' pedagogical orientations towards teacher-centred approaches could also relate to the examination-based assessment. Redman (2013) stated that examinations that require students to regurgitate knowledge can lead to teacher-centred approaches. According to Powdyel (2005), students' examination results play a significant role in the Bhutanese context for determining the success of the education system, the status of the school, students getting promoted to higher levels or pursuing professional studies and the quality of teachers' performances and their opportunity to pursue further training or studies. Further, Powdyel (2005) noted that examinations impose pressures on teachers for timely completion of the syllabus and effective preparation of students for their examinations. Hence, ES examinations that are extremely knowledge-focused could be impeding teachers from implementing the hands-on experiential and constructivist teaching strategies in ES that are explicitly advocated by the various relevant policies and documents [e.g., MoE (2009) and ESCF (DCRD & RSPN, 2013)]. Reducing the weighting of end-of-year examination assessment in ES in favour of alternative formative assessments might remove the pressure on teachers to teach to the exams through extensive knowledge transmission. However, the requirements of a range of stakeholders must be considered in assessment and credentialling, and this possibility warrants further exploration and consideration within the bigger and more complex picture of school assessment practices in Bhutan.

Discursive Activities

Discursive activities were also relatively frequently conducted in the ES classes, and teachers' views on the frequent implementation of discursive activities were that they provided students with the opportunity to interact and construct their knowledge through group interactions. This finding is consistent with the discussion and teamwork elements of "From understanding to action" in the ESCF (DCRD & RSPN, 2013, p. 17). Further, the ESCF (DCRD & RSPN, 2013) suggests creating a "learning environment built around students in the constructivist approach that complements the textbooks" (p. 19). The discursive elements of the ESCF that appear to be implemented in the classroom (unlike the experiential elements) reflect the idea of Vygotsky (1962) that students construct knowledge through social

interactions with teachers or peers and learn to authenticate and validate knowledge constructed through their social interactions. In addition, Rogoff (1990) explained that when students are involved in problem-solving activities through social interactions, they could engage in collaborative thinking processes with their peers, support, motivate and respect the thinking capability of peers, and consider each other's perspectives and opportunities for creative elaboration of the activities of their community. In this respect, the discursive aspects of ES have positive implications for student learning. It may be, however, that teachers' frequent implementation of discursive approaches and traditional lectures and the relative paucity of experiential approaches may create monotony and reduce students' motivation to learn ES. Further, it may not be appropriate for teaching all of the content to promote deep learning and develop skills required to achieve the aims and objectives of teaching the subject. It may be beneficial for teachers to vary the teaching approaches to further motivate students' learning and provide diverse learning opportunities to achieve different learning outcomes.

Challenges to Teaching

The limited instructional time, lack of budget, large syllabus and examination-based assessment in ES reported by teachers represent barriers to outdoor teaching (Anderson et al., 2006). The teachers seemed to prioritise teaching and covering the examined syllabus during the limited time available. However, the teaching of ES needs to provide students with the knowledge, skills, values, attitudes and experiences necessary to identify and solve environmental issues and foster the sustainable environmental conservation that is so prominent in Bhutanese policy documents (MoE, 2014). Outdoor experiential learning supports the fostering of these aptitudes (Prince, 2017). If teachers believe that they lack the support, resources and time necessary to teach ES, it is argued that the effectiveness of ES in achieving its objective of educating students to take actions to solve environmental problems and uphold GNH is compromised. The implication of this finding is that the REC and principals may need to enhance the resources and increase the amount of time allocated for ES teaching to ensure quality teaching.

Further, given the impact on the ability to undertake field trips of the absence of funds, lack of time, the large syllabus and pressure to complete the syllabus to prepare students for examination-based assessment, teachers could initiate field trips within a short walking distance from the school campus. Most Bhutanese schools have campuses that are rich with natural environment and located close to the forest and the community, which provide ideal settings for teaching ES. The on-campus field trips would make the learning of ES more enjoyable and create opportunities for hands-on experiences of conducting research and exploring local ecological issues, which would allow students to practise taking initiatives with sustainable environmental conservation and action to address the ecological issues. The field trip provides the opportunity for students to apply and connect the knowledge and skills learnt in the classroom to the environnent and local community (Braun & Dierkes, 2017), and allows them to practise addressing sustainability (UNESCO, 2017b) in their real-life situations, which is essential for achieving environmental sustainability.

In addition, half of the teachers perceived examination-based assessment as being one of the challenges in teaching ES, which affirms a substantial body of literature. The requirements of examinations can impact on teachers' choice of teaching strategies, including the elimination of time-consuming activities (Crocco & Costigan, 2007). The teachers in this study did appear compelled to "complete" the syllabus rather than make the learning of ES interesting and effective through activities. Another potential impact of examinations is to constrain innovation in teaching, with teachers more inclined to adopt traditional transmissive teaching strategies to save time and finish teaching the syllabus. In such situations, teachers may not consider teaching the important skills or competencies required for the students to most effectively learn during classes (Crocco & Costigan, 2007). The traditional examination-based summative assessment predominantly assesses students' declarative and theoretical knowledge (Biggs & Tang, 2010) as well as a range of skills. There are, therefore, significant limitations in examinations for assessing the transformative learning required by the ES objectives in the ESCF (DCRD & RSPN, 2013, p. 17-18). Given these objectives and considering the importance of ES in educating and preparing the youth of the future Bhutan to solve sustainability issues and uphold GNH pillars, there are significant implications for the Royal Education Council and MoE to reconsider the influence and role assessment plays in ES. It is argued that ES teaching would be more effective if the assessment provided somewhat more freedom for teachers and students to experience a range of different teaching and learning opportunities, including community participation and taking action.

CONCLUSION AND IMPLICATION

The teaching of ES through transmissive and discursive approaches with a paucity of hands-on experiential learning demonstrates low efficacy in terms of achieving the teaching objectives to contribute to GNH. It is critical for teachers to draw more on transformative and action-oriented approaches to teaching ES to accomplish the laudable aim and objectives of preparing young people with the appropriate knowledge, values, skills and competencies of taking action towards sustainable environmental conservation in the pursuit of GNH. Importantly, the Bhutan Ministry of Education and the teacher education colleges may require to provide professional development for both the pre-service and in-service teachers on pedagogical content knowledge, skills and practice in teaching ESD through the school curriculum. The stakeholders may require to review the ES curriculum and assessment to create avenues for teachers and students to engage in transformative learning to support environmental sustainability, which is a tenet of GNH for the future of Bhutan.

Funding: No external funding is received for this article.

Acknowledgements: The author would like to thank to Dr. Frances Quinn, Dr. Sue Elliot, and Prof. Neil Taylor from the School of Education, University of New England, Australia, for their guidance in writing and completion of the PhD thesis and the University for providing an IPRA scholarship.

Declaration of interest: The author declares that there are no competing interests.

Ethics approval and consent to participate: Not applicable.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

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