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Alignment of the Environmental Science Textbooks, Examinations, and Curriculum Framework to Achieve the Teaching Objectives

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ABSTRACT

Education is considered to be one of the key tools for addressing sustainable environmental conservation while balancing sustainable socio-economic development to achieve Gross National Happiness in Bhutan. The Environmental Science subject was introduced to prepare students with knowledge, values, and skills to address sustainability. This study aimed to investigate the alignment of Environmental Science textbooks, examinations, and the Environmental Science Curriculum Framework with each other and with Education for Sustainable Development. Four environmental textbooks, five examination sample papers, and the curriculum framework were used for the document analysis. The method involved the analysis of selected chapters from the four textbooks for classes IX to XII, followed by an analysis of the examination sample papers and finally skimming the content in all four textbooks. The textbooks and examinations were well aligned in knowledge focus, and the values related to utilization were more evident than the values on conservation. The textbooks were also well aligned with the principles and strands of the curriculum framework. However, the textbooks and assessments lacked information on students' community participation and the action-oriented content required to develop students' action competence in solving environmental problems, which is the tenet of Education for Sustainable Development.

Introduction

Sustainable environmental conservation is one of the key pillars for achieving Gross National Happiness (GNH) in Bhutan (Schuelka & Maxwell, 2016). The Constitution of the Kingdom of Bhutan emphasizes that every citizen plays an important role in environmental conservation (Royal Government of Bhutan [RGoB], 2008, p. 11). The government policies mandates to "secure ecologically balanced sustainable development while promoting justifiable economic and social development" (Tobgye, 2015). In particular, Bhutan's Development Policy aims to "secure ecologically balanced sustainable development, while promoting justifiable economic and social development" (National Environment Commission [NEC], 2016, p. 7). Bhutan also aspires to maintain 60% forest coverage in perpetuity (RGoB, 2008). The Bhutanese Ministry of Education (MoE) shoulders the key responsibility to support sustainable environmental conservation (Tenzin & Maxwell, 2009, p. 280). According to its guidelines, every graduating student is expected to possess the knowledge, skills, values, and attitudes to face real-world challenges and commit to sustainable preservation of the environment (MoE, 2014). Thus, the Environmental Science (ES) subject was introduced in 2015 with the overarching goal "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). Bhutan's Environmental Science Curriculum Framework (ESCF) guided the development of ES supported by four nationally prescribed ES textbooks, one for each class IX-XII. These textbooks are the primary resource for both teachers and students.

In this study, the analysis of the ES textbooks and sample examination papers paid particular attention to their alignment with relevant knowledge, skills, values, and attitudes to achieve the goals and objectives of teaching ES to the Bhutanese students. Also, the analysis of the textbooks considered their alignments with six specific "criteria" which are referred to in the curriculum framework as principles, four strands, and two embedded perspectives, "From local to global" and "From understanding to action" (DCRD & RSPN, 2013, pp. 15-16).

Knowledge about ecological systems (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2010) is believed to promote students' understanding that the relationships between humans and nature, and between humans and the planet as a living, self-regulatory system (Stone, 2009). This knowledge could potentially empower students to work towards environmental conservation as it facilitates their understanding of their own place and roles within their environment (Farmer et al., 2007; Stone, 2009). Further, this knowledge may empower students and develop their confidence to address issues of sustainability (Hungerford & Volk, 1990; Stone, 2009). However, studies claim that simply having knowledge about environmental issues and the environment does not necessarily lead to behavioural change (Kollmuss & Agyeman, 2002). Therefore, it is important to also identify strategies that promote behavioural change. Several studies confirm that teaching in-depth knowledge about the environment can lead to students developing positive attitudes towards environmental sustainability (Aslanova et al., 2012) such that knowledge and positive attitudes may enable the students themselves to identify, select and decide on appropriate actions to address sustainability issues (Palmberg & Kuru, 2000). Also, according to Kozar and Hiller Connell (2013), both knowledge and attitudes influence students' sustainable environmental behaviours, while positive attitudes influence students' pro-environmental behaviours (Kollmuss & Agyeman, 2002, p. 243).

Vicente-Molina et al. (2013) believe that one's culture can influence behaviour towards the environment. Further, the teaching of values and attitudes is believed to influence positive behavioural change (Bonnett & Williams, 1998). Jensen and Schnack (1997) and Jensen (2002, 2004) claimed that action orientation, in particular, can help students to develop action competence that results in a change in their behaviour. Therefore, students' competence to take action to solve environmental issues could be developed through the 'Sustainability Action Process' suggested by DEWHA (2010). Many specific actions of these kinds can be undertaken by students in schools. One appropriate could be advocating for policy change through participating in community action (Schusler et al., 2009); such as, collecting waste, writing petitions, making compost containers, designing posters related to environmental issues, planting trees (Jensen, 2002) and conserving electricity (Short, 2009). Such activities could also influence positive environmental attitudes (Özalemdar, 2021) and the sustainable consumption behaviours of others (Duvall & Zint, 2007).

Within the socio-emotional domain, attitudes, worldviews and values are foundational to enact behavioural change. A pro-environmental attitude defined as "a psychological tendency expressed by evaluative responses to the natural environment with some degree of favour or disfavour" (Milfont & Duckitt, 2010, p. 80) is pivotal towards the sustainable conservation and utilization of natural resources.
Gök and Afyon (2015) assert the importance of developing a positive attitude in addressing environmental sustainability. Further, studies claim that positive environmental attitudes can influence students' concerns for the environment and responses to environmental issues (Gifford & Sussman, 2012) that can create long term social change (UNICEF, 2018).

A worldview is referred to a belief about the natural world (Miller & Spoolman, 2011), and a student's worldview can influence how they engage and respond to sustainability issues. Anthropocentric or human-centred worldviews value other lifeforms and ecosystems for the benefit of human wellbeing (Washington et al., 2017), whereas eco- or biocentric worldviews believe in the moral responsibility of protecting all the life forms irrespective of their prospective value to humans (Miller & Spoolman, 2011). For example, utilization and preservation of the environment are the two values that reflect anthropocentric and ecocentric worldviews respectively (Wiseman & Bogner, 2003, p. 787). Other values include: (i) a responsible attitude to live in harmony with nature through environmental protection; (ii) conserving and promoting a sense of intergenerational responsibility; and, (iii) respecting and committing to social and economic justice for all (Lewis et al., 2008). Such values prepare students to respond to the complex sustainability issues they experience in their everyday lives (UNESCO, 2014) and may motivate them to engage in positive and informed decision-making to resolve sustainability issues (De Leo, 2012). Thus, the development of positive attitudes, ecocentric worldviews and values related to preservation could help them understand the intrinsic value of the environment in itself to develop pro-environmental behaviours to support sustainability.

Assessment of students' learning in general and in ES particularly should be aligned with curriculum planning, content and the teaching pedagogies designed to teach towards the intent of the curriculum (Biggs, 2003; UNESCO, 2017, 2018). Assessments may evaluate students' knowledge, skills, attitudes, dispositions, and participation in taking actions and projects in both the school and the community and should produce authentic evidence of students' performances and accomplishments (UNESCO, 2018). Assessments that focus on testing higher thinking can engage students in in-depth learning of the subject content (Bezuidenhout & Alt, 2011), whereas testing of low-level thinking leads to surface learning which is an adaptive measure for passing examinations (McLachlan, 2006). Stevenson (2007) believed testing theoretical knowledge through examinations may not be relevant to students' present and future life experiences. Thus, to assess the development of students'action competencies this author suggests the inclusion of a final action-orientated project report in addition to mid-term, year-end or high-stake final examinations (UNESCO, 2018).

Method

The research goal was to answer the research question: How well do the components of ES (textbooks, examinations and the ESCF) align with each other and with ESD? When undertaking research, document analysis has been found to be a more reliable, stable and objective way of analysing the data compared to other methods, and it is also considered to be inexpensive and efficient (Bowen, 2009). The method suggested by Elo and Kyngäs (2008) for deductive content analysis was employed in this study to analyse the documentswhich included the ESCF (DCRD & RSPN, 2013), the four ES textbooks used for grades IX, X, XI and XII and three samples of school-based examination and two Bhutan Council for School Examination and Assessment (BCSEA) examination papers.

Analysis of Selected Chapters from Class IX–XII Textbooks

The content of the ES textbooks was analysed using the computer-assisted qualitative data analysis software NVivo 12 and a four-step process that was designed to sample the voluminous textbook content. The class IX textbook contained 11 chapters and 230 pages, while the class X textbook contained 10 chapters and 209 pages, the class XI textbook contained 11 chapters and 320 pages, and class XII contained 13 chapters and 275 pages. The chapter and topic headings were almost the same across the textbooks for all four classes which suggest a spiral curriculum with progression in content. The first step involved the selection of four representative broad chapters, and identification of some *a priori* codes and detailed coding of one of those four chapters. The four selected chapters included "Environmental Pollution" from grade IX, "People and Environment" from

grade X, "Biodiversity Conservation" from grade XI and "Environmental management" from grade XII (see Appendix 1). The second step was a reliability analysis of the coding of the first sample chapter, and the third step was a detailed coding of the three subsequent sample chapters using the codes derived from the first step. In the fourth step, a targeted search was conducted for some selected codes across all the other chapters in all the textbooks. This step was included to check that the absence of some codes was not simply an artefact of the content focus of the specific sample chapters coded in detail. The following text expands on these steps.

In the first step, a chapter on "People and Environment" (see Appendix 1) for class X was imported into NVivo 12. In this document analysis, 'theme' was used to refer to the "pattern of meaning across the data set" (Braun et al., 2014, p. 57) that helped to address the research questions. The codes were considered to be the "building blocks of analysis that identify and provide a label for a feature of the data that is potentially relevant to the research question" (Braun et al., 2014, p. 61). Coding involved deductive and inductive approaches (Elo & Kyngäs, 2008) using both *a priori* and emergent coding.

Secondly, because the ES objectives are broad and holistic, some specific *a priori* codes relating to knowledge, skills and values were drawn from aspects of the ESCF (DCRD & RSPN, 2013), and the relevant literature relating to ESD. Two *a priori* categories of knowledge were identified: types of knowledge relevant to teaching ESD, that has been drawn from relevant literature and, the subject-specific knowledge of different disciplines. While coding subject-specific knowledge, when the content shared relatedness to two or more disciplines (which was not uncommon, e.g., geography and life science), then it was coded to all the related subject codes. In this analysis, the two skills of critical thinking and taking action were selected for coding, as these were identified as being particularly relevant to the ESCF (DCRD & RSPN, 2013) objectives around students solving environmental problems and supporting sustainable environmental conservation. In addition to knowledge and the two targeted skills, three kinds of values: Bhutanese cultural values, utilization and preservation were identified as being potentially valuable *a priori* codes. The process of analysis involved reading, scanning and skimming through the chapter texts. During the process of coding, the meaning of the text was carefully interpreted (Ryan & Bernard, 2000), and sentences, paragraphs or whole sections of the text were assigned to a relevant code by matching the text to the most relevant code and definition.

The reliability of the document analysis findings reflected how well the categories cover the data (Graneheim & Lundman, 2004). According to Weber (1990), to make valid inferences from the text, it is important that the classification procedure be reliable in the sense that it should be consistent, and different individuals should code the same text in the same way. As Weber (1990) further notes, "reliability problems usually grow out of the ambiguity of word meaning, category definitions or, other coding rules" (p. 15). Hence, in the second step, the entire process of document analysis was carefully scrutinized through ongoing discussions with the supervisors. Assigning sections of text to codes went through several rounds of discussion until a consensus was established. To test intercoder reliability, two supervisors coded in detail a text chapter previously coded by the researcher (Schreier, 2014). This step was undertaken using a coding comparison query in NVivo 12 to obtain a value for the Kappa co-efficient based on the percentage of agreement. The resulting Kappa value for each code is shown in Table 1.

Table 1

Intercoder Reliability for Coding of the "People and Environment" Chapter, Class X Textbook

Theme	Code	Kappa
Knowledge	Knowledge about causes of environmental problems	0.84
	Knowledge about effects of environmental problems	0.69
	Knowledge about conservation	0.66
	Knowledge about policies, government initiatives, rules and regulations	0.81

	Knowledge about action	0.5
	Knowledge about socio-economic elements	0.5
	Knowledge about political elements	0.5
	Knowledge about individual action	1
	Life science	0.96
	Geography	0.65
	Chemistry	1
Subjective specific knowledge	Mathematics	0.99
	Agriculture	1
	Economics	0.63
	Physics	1
	History	1
Skills	Critical thinking	0.73
	Taking action	1
Affective or cultural values	Utilization	0.71
	Bhutanese culture	1
	Preservation	1

As shown in Table 1, the Kappa value for most nodes fell between the range of 0.5 to 1. However, the cut off value for the Kappa coefficient was set to 0.6 for this study, with the rationale to establish higher intercoder reliability and because coding involved more than one coder (Vaismoradi et al., 2013). The researcher and the other expertise jointly revisited the codes that had a Kappa value below 0.6 and resolved inconsistencies by discussing and reviewing the codes together.

In the third step, the codes and sub-themes derived from step 1 together with example excerpts from the text, became the initial coding manual, which was subsequently used to code, manage and organise segments from the additional three ES textbook chapters, that were chosen as a representative sample of the texts, given that analysing all of the textbooks in their entirety, was beyond the scope of this study. The three additional chapters were coded independently, and the frequency of each code was calculated. The frequency results suggested that some of the *a priori* codes that would be expected to be seen under the theme GNH did not occur in the four selected chapters.

Hence in the fourth step, a targeted search was conducted across all the other chapters of all the four textbooks to determine whether the following codes (knowledge about action, knowledge about individual action, taking action to solve environmental problems, Gross National Happiness, sustainable development, Bhutan culture and, preservation and utilization) were represented. The textbook excerpts used as examples in the reporting of the results were accurate and any grammatical errors were in the original.

Analysis of Examination Papers

To determine if the summative assessments were aligned with the content and objectives of the ES textbooks, five sample examination papers (including school-based and external high stakes papers) were analysed. This analysis employed the same codes as those used for the four ES textbooks and followed an iterative process of reading re-reading and coding each question in the sample papers, according to the coding manual.

Analysis of the ES Textbooks Against Principles and Strands of the ESCF

A further analytic step was undertaken to identify how well the textbook content was aligned with the six principles and four strands of the ESCF (DCRD & RSPN, 2013), to which the ES textbooks are intended to relate. This analysis differed in purpose and process from the in-depth analysis of the four selected chapters in the four ES textbooks. Some of the principles are broad and complex statements that could not be captured or only partially captured using specific codes developed. Thus, a broader overview of the chapters was required to supplement the existing coding and determine if the principles and strands were represented in the content. Each chapter from all the textbooks was

skimmed and it was established, on the basis of the content viewed as a whole, whether or not each chapter incorporated each principle or strand.

Findings

The findings are presented under two themes that discuss how the document related to the goals and objectives of the ESCF and ESD.

Theme 1: Content Alignment of ES Textbooks and Examinations

The results obtained from the in-depth analysis of the four chapters, the scan of the other chapters from across all the ES textbooks and the sample examination papers are presented in Table 2.

Table 2

Frequencies of Content Codes in the Four Textbook Chapters, Wider Textbook Scan and Examination Papers

Sub-theme	Code	In-depth analysis of four textbook chapters	Scan of additional chapters (where relevant)	Examination
Knowledge	Knowledge about causes of environmental problems	50	-	35
	Knowledge about effects of environmental problems	46	-	56
	Knowledge about conservation	27	-	28
	Knowledge about policies, government initiatives, rules and regulations in Bhutan	15	-	15
	Knowledge about actions	14	34	13
	Knowledge about socio-economic elements	14	-	3
	Knowledge about sustainable development	11	30	4
	Knowledge about political elements	5	-	1
	Knowledge about individual action	4	24	4
	Gross National Happiness	2	15	0
Subject-specific knowledge	Life Science	33	-	104
	Geography	18	-	94
	Chemistry	17	-	18
	Mathematics	9	-	6
	Agriculture	5	-	12
	Economics	4	-	1
	Physics	3	-	0
	History	2	-	0
Skills	Critical thinking	20	-	14
	Taking action to solve environmental problems	1	0	0
Affective or cultural values	Utilization	10	31	7
	Bhutanese cultural values	2	15	6
	Preservation	2	9	4

Note. Zero represents that no data related to the selected code were identified in the selected ES chapters. Dashes indicate codes not included for target scanning.

Knowledge

The *a priori* knowledge codes used to explore the knowledge focus of the textbooks and examinations were all represented, but some much more frequently than others. For example, knowledge about causes and knowledge about effects of environmental problems were the most frequently represented kinds of knowledge in both the ES textbooks and the examinations. A sample examination question that targeted knowledge about the effects of environmental problems was:

"How does environmental degradation impact carrying capacity of an ecosystem?" (Class X, 2017, p. 17).

In addition to these strongly represented codes, knowledge about conservation was somewhat less frequently apparent in the in-depth analysis of the four textbook chapters. This kind of knowledge was also assessed relatively frequently in examinations, for example: "Name any TWO National Conservation initiatives in our country that protect and conserve biodiversity" (Class X, 2016 p. 18).

In addition, knowledge about policies, government initiatives, rules and regulation were also apparent. The nationally based examination includes relevant assessment questions, for example: "State at least THREE evidence to prove that our government has initiated the project and programs to enhance sustainable development in the country" (Class X, Bhutan Certificate of Secondary Education (BCSE), 2017, p. 25).

Knowledge about actions taken to ameliorate environmental problems was also quite frequently represented and examined in ES. Potential actions that can be taken in general by society were represented in examinations, such as "Agricultural activities bring about significant impacts on the climate change. In this regard, suggest at least two ways to reduce the effects on climate change caused by agricultural activities" (Class X, BCSE, 2017, p. 9).

The codes knowledge about socio-economic elements and knowledge about sustainable development were also represented. Knowledge about sustainable development was often linked to GNH and included specific strategies being adopted by Bhutan. For example: "Explain with a reason each to show how sustainable development is dependent on these three factors (factors included in the diagram are Social, Environment and Economic)" (Class X, BCSE, 2016, p. 17).

Albeit relatively infrequently, the code knowledge about political elements was represented in the ES textbooks. Further, the code knowledge about individual actions that students could take appeared, albeit somewhat less frequently than knowledge about causes and effects of environmental problems. An examination question related to this code was: "As an environmental student, how would you replenish the extracted natural resources? State at least two measures" (Class X, BCSE, 2017, p. 10).

Finally, the code Gross National Happiness was represented across the ES textbooks, although again somewhat less frequently than other knowledge. However, no question explicitly mentioned GNH in the sample examination papers analysed in this study. These different kinds of knowledge included in the ES textbooks and examinations complemented and were expressed in relation to different subject-specific knowledge. Essentially, the subject-specific knowledge most frequently mentioned were life science, geography and chemistry, with a range of other subject-specific knowledge contributing in a smaller way to the textbook content. The examinations predominantly assessed life sciences and geography knowledge, and less frequently chemistry and agriculture, with minimal or no apparent assessment of other subject-specific knowledge.

Skills

The two skills specifically explored in relation to the ES materials were critical thinking and taking action to solve environmental problems. As indicated in Table 2, the critical thinking code was represented in the ES textbooks, but far less frequently than the *a priori* knowledge-based codes. An examination question intended to assess critical thinking was: "Bhutan has many endangered animals that are protected in large parks and sanctuaries. Should the government continue to protect these animals? Justify with THREE reasons" (Class X, BCSE, 2016, p. 11).

However, the code taking action to solve environmental problems was not apparent in any chapters in the four textbooks other than a single activity. It is possible that other actions may have been present but were not detected in the textbooks. However, even if this were the case, the frequency of this code was very low in relation to the other codes explored in this theme. Taking action was not assessed in the examination.

Affective or Cultural Values

The content in the ES textbooks reflected three effective or cultural values that were the coding focus in this domain. Of these codes, utilization was represented five times more frequently than the other two codes in the in-depth analysis (Table 2), and twice as frequently in the textbook scan thus reflecting the importance accorded to natural resources for their use-value for humans as represented in the ES textbooks. An example of utilization value reflected in the nationally based examination was: "State TRUE or FALSE for the statements given below: Biodiversity conservation provides a wide range of ecological services" (Class X, BCSE, 2016, p. 10).

Considerably less frequent was the code Bhutanese cultural values. An examination question relating to Bhutanese cultural values was: "What is the role of 'risups' in the village?" (Class X, BCSE, 2017, p. 22). A risup is a person appointed by the community to prevent people from visiting specific areas during particular months because of cultural beliefs related to the protective role of deities.

The value code preservation was much less frequently apparent than utilization both the in-depth chapter analysis and textbook scan than the utilization code. Relatively few examination questions related to preservation, and the following provides one example: "Bhutan has many endangered animals that are protected… Should the government continue to protect these animals? Justify with THREE reasons" (Class X, BCSE, 2016, p. 11).

Theme 2: Alignment of ES Textbooks with the Principles and Strands of the ESCF

The results obtained from the analysis of the occurrence of the principles and strands of the ESCF in the ES textbooks are presented in Table 3.

Table 3

Occurrence of the Five Principles and Four Strands of the ESCF Apparent in Textbook Chapters

ESCF Elements	Name	Numbered chapters indicating the presence of content related to the elements				Total number of chapters examined
		Class IX	Class X	Class XI	Class XII	
Principles	Environment in totality	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	1, 2, 3, 4, 5, 6, 8, 9, 10	1, 3, 4, 8, 9,10, 13	1, 3, 6, 8, 10, 12	33
	Inter-disciplinary	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13	47
	Lifelong process#	?	?	?	?	?
	Environmental issues-based	4, 7, 8	1, 2, 3, 4, 5, 6, 7, 8, 10	5, 6, 8, 9, 10	2, 6, 7, 10	21
	Pursuit of GNH	11	10	13	13	4
	Community involvement	8	0	6	1	3
Strands	Environmental issues and concerns	3, 4, 5, 6, 7, 8, 9, 10, 11	3, 4, 5, 6, 7, 8, 10	2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13	3, 4, 5, 6, 7, 8, 9, 12	35
	Systems in nature	1, 2, 3, 4, 5, 6, 9, 10, 11	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13	1, 4, 8, 9, 10	33
	Sustainable development	1, 2, 4, 9, 11	3, 5, 6, 7, 8, 9, 10	3, 4, 6, 9, 10, 11, 12, 13,	1, 3, 4, 6, 8, 9, 10, 11, 12, 13	30

Natural resource management	9, 10	3, 5, 8, 9, 10	3, 9, 10, 11, 13	8, 9, 10, 11, 12	17

Note. Content representing the life-long process principle could not readily be determined.

Principles of the ESCF

The content in several ES chapters reflected the principle of the environment in totality. For example, Class IX; Chapter 2, (pp. 5–20) explained Earth systems, biomes and ecosystem organization and Chapter 4 (pp. 49–51) described socio-economic provisions as well as cultural and spiritual provisions which demonstrate integrated ES knowledge across physical, biological, social, cultural and spiritual disciplines.

Although most of the content related to life sciences and geography, some interdisciplinarity was evident, at least in the sense defined by the ESCF (DCRD & RSPN, 2013) of the multiple disciplines represented. However, it is important to note that rarely were these disciplines integrated across a single theme in a way that establishes interrelationships among these perspectives which UNESCO-MGIEP (2017) indicates is a part of interdisciplinarity.

The environmental issues-based principle was apparent in a total of 21 chapters. However, the pursuit of GNH was explicitly described in only four chapters. The principle community involvement which is referred to in the ESCF (p. 13) as engaging "students with the local communities to gain a better understanding of the local environment" (p. 13) was very infrequently represented in the ES textbooks. Finally, it was not possible to determine the extent to which Lifelong processes was reflected through this analysis, because the breadth and temporal nature of this concept meant that it could not readily be identified through textbook analysis.

Four Strands of the ESCF

The four strands of the ESCF were evident in numerous chapters across all four ES textbooks. The strand environmental issues and concerns was the most frequently evident, as it was coded in 35 chapters. Systems in nature was apparent in 33 chapters and Sustainable development was evident in 30 chapters. Finally, Natural resource management was clearly evident in 17 chapters. The above data indicate the clear alignment of content in ES with all four strands.

Discussion

Content and Alignment of ES Textbooks and Examination Papers

Teaching students about the effects, causes of environmental problems, strategies for change, and alternatives and visions are crucial. They help students develop action competence enabling them to engage as active citizens to solve environmental problems. The imperative of students' action competence is flagged indirectly in many Bhutanese policy documents. For example, the Bhutan Education Blueprint (MoE, 2014) mentions fostering skills in students that would make them capable of solving problems both inside and outside their academic life. Action competence is also key in relation to several ESCF objectives (DCRD & RSPN, 2013), including (i) "to develop … skills for conserving the natural heritage including rich biodiversity"; and, (v) "to empower them to make right choices for sustainable future with global perspectives and to transform them to be responsible and productive citizens in the 21st-century world" (pp. 17–18).

The knowledge about the effects of environmental problems, which was well represented in the textbooks, may well arouse students concerns and motivations to solve environmental problems, while the knowledge about causes may help them to understand the influence of the socio-economic,

cultural and political factors on human behaviours that cause environmental problems (Schusler et al., 2009; Tilbury, 1995). However, according to the argument of key theorists in EE/ESD (for example, Hungerford et al., 1989; Jensen, 2002), the paucity of knowledge relating to visions and strategies, and actions for change in the ES materials suggests that action competency is unlikely to be developed through the study of ES. As such, knowledge about alternatives empowers students to develop a vision for their sustainable futures (UNESCO, 2017) and is important for motivating students to engage in taking action at their individual or community level, and knowledge about change strategies (how to plan, implement and evaluate actions) is also important for developing action competency. The content of ES may, therefore, require more effective incorporation of the knowledge of visions and strategies.

The finding that ES content knowledge is drawn predominantly from the life sciences and geography disciplines is unsurprising, as these are the traditional focus areas of environmental science as a subject area (O'Riordan, 2014) and is in line with the conception of ES as a science subject. It could also be because the teachers who were engaged in writing the ES curriculum were specialized in teaching either sciences or geography. Certainly, knowledge related to ecology from science and geography is relevant for helping students to learn informed and evidence-based decision making for solving environmental problems; however, the relative paucity of some other subjects, like economics and history, suggests that ES only partially accords with the ESCF (DCRD & RSPN, 2013) definition of interdisciplinarity.

For ES to be a more interdisciplinary subject, so that students may better understand the complex sustainability issues, the science and geography content may need to be reduced to make room for other disciplinary areas. However, how far interdisciplinarity can and should go within a subject intended to be a "Science" requires careful consideration. The different disciplines have their own characteristic ways of knowing and thinking, as well as their own terminology and other conventions, and understanding the distinctions between disciplines needs to be an important part of school learning (Shanahan & Shanahan, 2008). There is a risk that these important distinctions can be obscured in holistic integrated approaches.

Moreover, the specific definition of the principle of interdisciplinarity in the ESCF (DCRD & RSPN, 2013, p. 11) is more in line with multidisciplinarity because it does not emphasize the interrelationships between different disciplinary areas. The ESCF also uses the terms interdisciplinarity and multidisciplinary interchangeably and, in fact, the term multidisciplinary is used in the following excerpt in a way that reflects genuinely integrated interdisciplinary approaches: "the multidisciplinary nature of the study integrating physical, chemical, biological and social sciences, peppered with a cultural and spiritual belief of human societies brings the holistic perspective" (DCRD & RSPN, 2013, p. 6). Therefore, it is important that the distinction between the multidisciplinary and interdisciplinarity concepts be recognized and clarified, as genuinely interdisciplinary knowledge is important for developing students' system thinking abilities that will allow students to view complex issues more holistically from ecological, social, economic, and political perspectives (UNESCO, 2017).

The incorporation of knowledge about environmental conservation that aligns with the strand "natural resource management" in the ESCF (DCRD & RSPN, 2013) is important, given the conservation mandates of the constitution of Bhutan (Tobgye, 2015), the conservation pillar of GNH (Gross National Happiness Commission [GNHC], 2011), and the aspiration of Bhutan to maintain 60% of forest cover for eternity (RGoB, 2008). Given the importance of environmental conservation in Bhutan, it is very appropriate that ES content includes knowledge about conservation; however, as Kollmuss and Agyeman (2002) remind us, knowledge is necessary but not sufficient for change to take place. Students also need to develop important attitudes, skills and abilities to be able to act on that knowledge and participate in environmental conservation. Including student participation in conservation activities in their school or the community as a part of learning in ES may help the country champion its sustainable ecological conservation goals as well as further develop students' action competency.

The evidence from the ES textbooks relating to the ESCF strand "sustainable development" (DCRD & RSPN, 2013) is important in the light of the sustainable socio-economic development pillar of GNH. Bhutan's constitution mandates that the government "secure ecologically balanced sustainable development while promoting justifiable economic and social development" (Tobgye, 2015, p. 80). Hence, it is important to provide students with relevant knowledge about the concept of sustainable development which involves balancing socio-economic development while sustaining the natural environment. Further, the knowledge about sustainable development enables students to balance the competing imperatives of development and environmental conservation. This knowledge needs to be complemented by associated content that fosters critical thinking and action competence.

Although, the ES content related to critical thinking was aligned with the ESCF goal, and associated learning outcomes, of fostering students' critical thinking skills to facilitate their decision-making related to sustainable development (DCRD & RSPN, 2013, p. 34) and GNH. One example of these intended outcomes is for students to "critically evaluate urban planning rules and norms of Bhutan for sustainability aspects and point out the areas for change" (DCRD & RSPN, 2013, p. 45). Developing students' critical thinking competency together with action competence is crucial for empowering them in decision making and solving sustainability issues

Although the ES course materials were voluminous, only one indirect action-related activity on creating awareness to reduce environmental pollution was evident in ES textbooks. This indirect action, while at least something specific, could be construed as putting the responsibility onto other people, especially as easy direct action that students could take themselves to reduce pollution would be possible. Moreover, the learning outcomes for ES outlined in the ESCF (DCRD & RSPN, 2013) state that students should "participate in actions for conserving their locality" (p. 23); "take actions at their level leading to environmental stewardship" (p. 28); "appreciate the uniqueness of Bhutan and take actions to safeguard the local environment" (p. 41) and "apply environmental management practices in their context" (p. 61). The ES materials could, therefore, incorporate activities that relate to practical and effective direct actions that students could take themselves in relation to reducing pollution; for example, by recycling; however, although the knowledge was part of the textbook content, it was not linked to actions. The textbooks could possibly help students to put this theoretical knowledge into practice; by, for example, scaffolding some kind of related "Sustainable Action Process" (DEWHA, 2010). In short, the ES materials could usefully broaden the content to incorporate relevant action-oriented skills to more fully achieve the range of intended ESCF teaching objectives.

The environmentally-related values of utilization, preservation and Bhutanese cultural values were evident in the ES materials, and therefore, to some extent, they aligned with the ESCF objective (DCRD & RSPN, 2013) "(iii) to instil positive attitudes and values towards the environment so that they demonstrate environment-friendly behaviour in the sustainable management of the environment" (pp. 17–18). However, it is not clear what might constitute "positive attitudes" and whether they would include the utilization values expressed by many participants. According to Wiseman and Bogner (2003, p. 787), preservation is "a biocentric dimension that reflects conservation and protection of the environment" and utilization is "an anthropocentric dimension that reflects the utilization of natural resources". By this definition, the ES content emphasized the importance of nature from the perspective of utilization rather more frequently than preservation and, frequently, both values were evident in tandem. This recurrent anthropocentric perspective was consistent with directions found in other Bhutanese policies subsuming eco/biocentrism. For example, the GNH Development Policy of Bhutan aims to "secure ecologically balanced sustainable development, while promoting justifiable economic and social development" (NEC, 2016, p. 7). The concept of GNH itself could be considered anthropocentric, given that other imperatives are subsumed under the ultimate goal of human happiness. However, it does acknowledge that human happiness depends on environmental preservation and protection.

For the GNH pillar of sustainable environmental conservation to be achieved, it is important that the ES content reflects attitudes and values towards the preservation and protection of the environment. The apparent infusion of utilization in the ES materials may instil or reify

anthropocentric worldviews which result in students considering the natural environment important predominantly as the source of natural resources and ecological services for human survival (Wiseman & Bogner, 2003). The ecocentric worldviews may better contribute to sustainable environmental conservation as they would help students to understand the importance of preserving biodiversity and life-support systems for the benefit of all life forms in the present and the future (Miller & Spoolman, 2016, p. 474). More emphasis on preservation may be pivotal for allowing students to develop more ecocentric attitudes, fostering their understanding of the intrinsic value of the environment and empowering them to adopt behaviours that support sustainable environmental conservation, such as protecting natural resources and biodiversity. Such an approach could result in the necessary balance between development and conservation so that the genuinely sustainable development called for in GNH can take place.

The ES content also reflected Bhutanese cultural values about the environment. This finding is consistent with the policy document National Education Framework (MoE, 2009, p. 19) which states that "the entire foundation of [the] school curriculum is based on the principles, culture and values and the objectives of GNH that the country aspires for its citizens" (p. 19). Further, this framework accentuates teaching Bhutanese cultural values about the environment so that the students can understand the importance of human-nature relationships, respect all life forms and value environmental conservation all of which may support the GNH pillar of preservation and promotion of culture (GNHC, 2011). According to Vicente-Molina et al. (2013), one's culture influences behaviour towards the environment. Therefore, students' understanding of the importance of the natural environment in relation to Bhutanese culture may influence their pro-environmental attitudes and behaviour and empower them to protect and conserve the local environment in their community. They may learn to live in harmony with nature and pass on the environmental cultural values that favour ecological conservation to future generations.

With respect to the alignment of the examinations and the textbook content, the analysis of the examinations showed a strong alignment with the textbook content. The examinations focus on assessing knowledge about environmental problems, and knowledge from lifesciences and geography was evident with no apparent inclusion of action competence. The examination papers reviewed did not include much coverage of the GNH elements of the ES materials. Given the importance of teaching ES for nationally achieving the tenets of GNH, assessing students' GNH knowledge, values, attitudes and skills would also be important in assessment related to ES.

Assessment, especially high stakes assessment, most often drives learning and teaching (Biggs, 2003), hence examinations should align constructively with the teaching objectives of the curriculum. The declarative knowledge focus of many summative examinations is a well-known limitation of this form of assessment (Biggs & Tang, 2010), particularly for the transformative learning that is emphasized in ESD. Written examinations rarely assess attitudes, values or practical skills such as action competence. Therefore, the examinations, like the ES materials, were not fully supporting some of the intended ESCF learning outcomes (DCRD & RSPN, 2013): (i) "to develop … skills for conserving the natural heritage including rich biodiversity; (iv) to motivate them to take actions towards environmental conservation and uphold the principles of GNH; and, (v) "to empower them to make right choices for sustainable future with global perspectives and transforming them to be responsible and productive citizens in the 21st-century world" (pp. 17–18). Further, the assessment task in ES did not align with some of the necessary areas of assessment outlined in the ESCF (DCRD & RSPN, 2013, Sect. 7.1) including competencies relating to resolving environmental issues, citizen participation and action strategies, and dispositions, such as personal responsibility, motivations and intentions.

Considering these limitations of the examinations, ES could usefully incorporate other forms of assessment to assess those skills relevant to the ESCF objectives. For example, the weighting of examinations for assessing students' knowledge and understanding of the course content could be reduced, which could provide an opportunity for class-based assessment of both the relevant action-oriented skills, and of students' engagement in conserving the environment through class

participation in community initiatives, as advocated by the ESCF. However, realistically, this balance may be difficult to achieve in practice, as assessment policies especially in senior secondary contexts often have very little flexibility, as they need to fulfil multiple credentialing functions and the same policy usually applies across subject areas. This is the case in Bhutan.

Although the examination questions illustrated above represented all levels of Bloom's taxonomy, the lower order remembering and understanding questions (Anderson & Krathwohl, 2001) may not be particularly generative in fostering the wider transformative objectives of the ESCF. An increased focus on assessing higher-order thinking skills, in line with the advice of the MoE (2014) may foster students critical thinking skills in ES and improve student learning related to the ESCF objectives. Further, it may help students understand the expectations of the learning objectives of the ES course and enhance their learning.

Alignment of ES Textbooks with the Principles and Strands of the ESCF

From the analysis, the ES content was aligned with most elements of the ESCF principles and strands to achieve the ESCF objectives (DCRD & RSPN, 2013) (i) "to develop knowledge … for conserving the natural heritage including rich biodiversity and (iii) to contribute towards the general education of learners" (pp.17–18). In relation to the principle "pursuit of GNH", the content was evident in one chapter of each of the four textbooks. However, the ESCF (DCRD & RSPN, 2013, p.12) stated that "environmental sciences while deliberating on the elements of the environment need to incorporate the principles of GNH in the delivery process of the content". It appears that the ESCF is less than explicit which leaves the integration of GNH up to teachers who are expected to embed GNH into every subject (MoE, 2010). Therefore, in one sense, teachers are familiar with the strategies required to embed GNH. They are able to scaffold understandings of the relevance and importance of GNH in relation to the conservation of the environment and enable students to implement these understandings in their everyday life.

In relation to community involvement, the focus of this principle in the ESCF is ambiguous. Although the ESCF (DCRD & RSPN, 2013) expects students to "participate in the community's endeavours to safeguard the local environment" (p. 18), at other points in the ESCF, the community involvement is about engaging students in learning knowledge about the local environment from their communities (DCRD & RSPN, 2013). The intent of the ESCF is for students to acquire indigenous knowledge about the environment, and the traditional practices of environmental conservation, and also to understand the ecological challenges faced in their local community. However, there are other important advantages of community engagement, as it not only provides the opportunity for the students to participate in taking action to solve environmental problems in their local community (Schusler & Krasny, 2010), but it is also valuable in relation to the ESCF objectives as students are expected to develop skills and take action towards environmental conservation and become responsible and productive citizens of the country.

The ES materials could be enhanced by incorporating more activities fostering community engagement and engaging students in solving real-world problems through community participation or at least creating space for this opportunity to be taken. Community participation could empower students (UNESCO, 2017) and develop their action competence in solving environmental problems (Duvall & Zint, 2007; Mannion & Adey, 2011) and upholding GNH principles. Furthermore, their participation in taking action to solve-environmental problems through community participation could change their behaviours to be responsible and productive Bhutanese citizens. As is stated by the MoE (2009) "learning should take place through interactions with the environment, nature and people, both through actions and language" (p. 11). Furthermore, the Bhutan Education Blueprint (MoE, 2014), states the expectations that students participate in the community to protect and take care of the environment and ensure the value of equity and justice, which could be possible through taking action. The implication of this finding is Royal Education Council (REC) may consider somewhat more of an emphasis on community involvement in engaging students in solving

environmental problems to develop their action competence, as part of the ES materials. However, this change in emphasis would come with resourcing and logistical implications and may need to rely on teacher connections and willingness. Moreover, the summative examinations discussed earlier in this chapter clearly have limited potential for assessing and, therefore, fostering students' interactions with the environment, nature and people. Given that examinations drive teaching and learning (Biggs & Tang, 2010), community participation is likely to be minimized or absent from teaching.

Alignment of ES Content with ESD

There are many aspects of ES, both in the ESCF and in the textbook content, that align ES closely with important competencies and approaches of ESD (UNESCO, 2017). The ES objectives expect student transformation in terms of their values, attitudes and behaviours to be responsible and productive citizens and thus ensure a sustainable future that relates to UNESCO's guidelines (UNESCO, 2017). One of the principles of the ESCF is lifelong learning which is a component of ESD (UNESCO, 2017). The ES content includes knowledge about ecological systems and knowledge about sustainable development which comprises socio-economic and political systems. The content is multidisciplinary (albeit dominated by science and geography), with some limited interdisciplinarity that may enable students to understand the interdependence of the ecological, social, economic and political dimensions of sustainability (UNESCO, 2002). Also, ES focuses on developing students' critical thinking skills to solve environmental problems and address sustainability, which relates to the critical thinking competencies in ESD (UNESCO, 2017).

Although the aspects of ES outlined above were consistent with UNESCO's (2017) articulation of ESD, there were some important elements of ESD that were not apparent in the ES materials. The ES textbooks and summative assessments did not include action-oriented content to engage students in taking action to solve environmental problems, which is an essential component of ESD (UNESCO, 2017). Further, the ES materials did not incorporate activities that engaged students to collaborate with people in the community to solve sustainability issues beyond their classroom learning. The absence of such community participation is another point of difference between ES and the characteristics of ESD (UNESCO, 2017).

Conclusion and Implication

The focus of the ES textbook and examination content was on teaching knowledge about environmental issues and lacked strategies for change alternatives and visions. These strategies are considered necessary for students to develop action competence, so they can engage as active citizens in solving environmental problems. Hence ES content was misaligned in some ways with the ESCF objectives, as well as many Bhutanese policy documents. The ES content focused predominantly on knowledge from science and geography, and interdisciplinarity could possibly be enhanced to develop students' ability to view sustainability issues holistically. Also, values related to preservation could be more richly infused into the ES materials. This strategy may provide greater potential for students as citizens to balance environmental conservation while pursuing socio-economic development, as advocated by The Middle Path development plan.

The examinations aligned with the knowledge focus of ES content and, in so doing, were misaligned with several ESCF objectives and some of the desired areas of assessment outlined in the ESCF itself. As assessment is such an important driver of learning, better alignment of the assessments with the areas of assessment outlined in the ESCF would be a powerful option for enabling students to achieve those objectives.

The ES content could be enhanced with the inclusion of activities involving community participation and action, which are also in line with the apparent expectations outlined in the ESCF. In terms of the alignment of the ES materials with the objectives and principal elements of the ESCF (DCRD & RSPN, 2013), a future study could be an in-depth content analysis. For example, an analysis

of examination papers according to Bloom's taxonomy could provide further clarification of the extent to which examinations test (and therefore promote) critical thinking in ES.

Acknowledgement

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Appendix 1: Four Selected Chapters from the ES Textbooks

ENVIRONMENTAL Pollution

6
Chapter

Pollution is mainly as a result of human actions. Almost all human actions generate pollutants. Pollutants are released into air, water and soil, altering the nature of these natural resources. As a result, the quality of these resources degrades. Since all the components of nature are constantly interacting, resource degradation adversely affects the environment as a whole. Environmental degradation, particularly the quality of natural resources on which life depends, threatens the health of living beings, including humans. Resources become unfit for the survival and sustenance of life. Pollution also occurs due to natural phenomena like volcanic eruption, wild fire, and landslide.

Nature has ability to absorb pollutants and thereby maintains the balance. This is the self cleaning capacity of the nature. However, in recent years, human activities are releasing enormous amount of pollutants into the environment. Nature is unable to absorb these huge amounts of pollutant at the rate at which they are being released.

People & Environment

3
Chapter

The environment supports all forms of life found on the Earth. There has been mutual interconnection and interdependence between people and the environment. It has supported the human race since the early periods of human settlement. People rely on the environment to meet their needs, whether vital or secondary. The dependence of human beings on the environment is so great that people are destroying the environment at a rate which the environment is not able to replenish itself. This is due to the increasing population pressure, change in lifestyle, and factors like industrialization, which have resulted in exploitation of environmental resources for economic purposes. Hence, humans have greater role to play in the conservation of environment and the natural resources. Some human culture and tradition has helped in conservation of the environment. In Bhutan, most of the natural features like rivers, lakes, rocks, and trees are considered important religious sites.

In this chapter, you will learn about the relationship between people's way of life, resources consumption, their impacts on the environment, and measures to tackle overharvesting of natural resources.

9 BIODIVERSITY CONSERVATION

CHAPTER

The natural world is composed of biotic and abiotic constituents. Its health is largely dependent on the existence of varieties of flora and fauna and their interactions amongst themselves and with their physical world. All life forms depend on biodiversity for various purposes, including the flow of genes. The changing anthropogenic and natural events threaten the health of the biodiversity.

The biodiversity conservation is about saving life on the Earth in all its forms and keeping the natural ecosystems functioning. Biodiversity conservation ensures that natural landscapes with their range of ecosystems are maintained, and the species, populations, genes and the complex interactions in the natural world continue into the future.
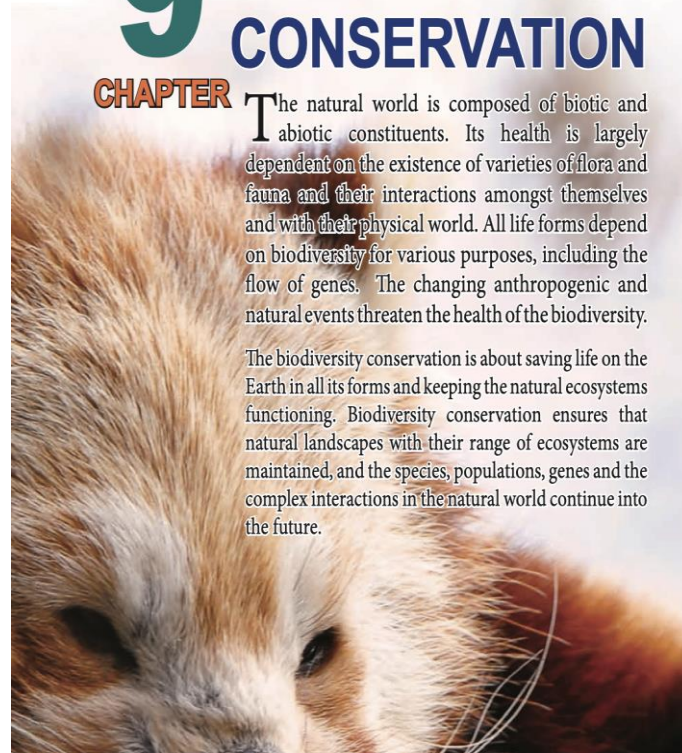
12 ENVIRONMENTAL MANAGEMENT

CHAPTER

In the past, while planning policies and implementing developmental activities, environmental factors were not taken into consideration. The developmental activities were based on the concept of economic efficiency. The new dimension of development emphasises on the co-relationship among environmental, social and economic development. This has led the governments around the world to integrate various environmental components into developmental policies, plans, programs and projects that ensure sound and sustainable use of ecological resources. Environmental Impact Assessment (EIA) is one of the measures implemented as a means to efficiently reduce environmental degradation and to attain sustainable development.