Key Stage III Geography Students' Environmental Knowledge: A Mixed-Methods Study

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ABSTRACT: *In recent decades, the world has experienced escalating global environmental crises resulting from widespread environmental degradation. The magnitude of this degradation underscores the urgent need to foster environmental knowledge, particularly among school children, who represent the future leaders and custodians of our planet. In Bhutanese school education, environmental education primarily takes place within the geography curriculum. Therefore, this study aims to assess the level of environmental knowledge among students in Key Stage III within the Bumthang district. To achieve this goal, the study employed an explanatory sequential mixed-methods design. Two hundred Key Stage III students participated in the survey, and 32 students were purposefully selected for four focus group discussions. Descriptive analysis was employed to analyze the quantitative data, while the qualitative data underwent coding and identification of emerging themes. The findings of this study indicate that students possess a low level of environmental knowledge. This low level of environmental knowledge is attributed to a lack of motivation in learning, the use of the same teaching strategies, and limited information in the text. Hence, efforts should be made to enhance motivation, diversify teaching strategies, and highlight the need for curriculum reforms to enhance students' environmental knowledge.*

1. Introduction

Environmental education is fundamental in constructing knowledge, attitude, and behavior of students towards the natural environment. Environmental education aims to develop a world population with knowledge, positive attitude, and favorable behavior as well as individual and social tasks and responsibilities to provide contribution to solutions of present environmental problems and to prevent possible future ones (Kim, 2003; Moseley, 2000). Human behavior, including social, political, and economic actions, has an impact on the natural environment and is responsible for causing many of the current environmental challenges and issues. This raises the importance of education, particularly environmental education, as a necessary tool to equip people to address environmental issues and move towards environmental sustainability (Hashemzadeh, 2016). Therefore, today, environmental education is gaining so much importance across the world.

Our delicate environment is today facing a danger of destruction on a scale as never before in the history of mankind. This is because advancement in the field of science and technology created a competitive world, making man become one of the selfish masters as a result of his wisdom (Nagra, 2010). The population explosion along with hasty industrialization, urbanization, indiscriminate use of chemical fertilizers, pesticides, and fossil fuels and construction of barrages and dams has led to the depletion of forest covers, pollution, waste accumulation, soil erosion, floods, and above all global warming. If left unchecked, younger generations will be affected by environmental problems arising from present actions, so they need to be provided with accurate environmental knowledge to develop sustainable solutions to those environmental problems.

In Bhutan, high priority is always given

to the preservation and conservation of the environment, which is reflected as one of the pillars of the nation's overarching developmental philosophy, Gross National Happiness (GNH). However, Bhutan is challenged with numerous environmental problems as a result of humans' interaction with nature. For this reason, providing the right information to young people on environmental issues and involving them in community and national conservation projects would help in environmental conservation. In addition, involving every citizen especially the youth as a part of ensuring the sustainability of our fragile environment for future generations is of utmost importance. Therefore, the education system can play an important role in imparting environmental education, which could enhance students' environmental knowledge.

Although there are numerous subjects such as science, social studies, and language arts which try to impart environmental education in the Bhutanese education system, geography is regarded as the most important subject. This is because geography has been taught as an independent discipline since the 1960s (Royal Education Council [REC], 2018) and contains very rich content on the environment. Moreover, the Geography Curriculum Framework of Bhutan (Class PP-XII) is based on nine important goals out of which five focus on imparting environmental education highlighting the importance of the geography subject in imparting environmental education to students. In addition, comprehensive environmental education content in the geography subject also helps Bhutan to realize its goal of conservation of the natural environment which is one of the most important pillars of the developmental philosophy of Gross National Happiness. Therefore, the educational outcomes of geography education in Bhutan have the potential to broaden students' environmental knowledge which will ultimately lead to building a positive attitude and conservative behavior.

Pertaining environmental knowledge, Frick et al. (2004) asserted that there are three types of environmental knowledge, namely environmental system knowledge, environmental action knowledge, and environmental effective knowledge. However, scholars such as Janmaimool and Khajohnmanee (2019) and Moore et al. (1994) have examined only one type of environmental knowledge, while studies by Hines et al. (1987) and Schultz (2002) focus only on two forms of environmental knowledge. Omitting any one form of environmental knowledge as informed by Frick et al. (2004) indicates that the study is incomplete in understanding the participants' environmental knowledge. Therefore, in order to ensure comprehensive assessment of participants' environmental knowledge, it is found necessary to study all three types of environmental knowledge as informed by Frick et al. (2004).

Although no studies have been conducted to assess students' environmental knowledge in Bhutan, extensive research has been conducted in various regions around the world. Harun et al. (2011) found that secondary students generally possess good environmental knowledge, while Meerah et al. (2010) reported a low level of environmental knowledge among secondary school students. Similarly, Tayci and Uysal (2013) noted that nearly half of the students were unable to answer the environmental knowledge test correctly. In contrast, Ahmad et al. (2015), Sultana et al. (2017), and Al-Rabaani and Al-Shuili (2020) reported that their participants demonstrated a high level of environmental knowledge during the test. This indicates that the level of environmental knowledge varies from country to country and grade level.

Considering the significance of environmental education within the geography curriculum of Bhutan, it becomes essential to evaluate the extent of environmental knowledge among Key Stage III geography students. Thus, the primary aim of this mixed-method study model is to examine the environmental knowledge level of Key Stage III students in Bumthang district. The study is guided by two main objectives that align with the overall aim: 1) Evaluate the environmental

knowledge level of Key Stage III students, and 2) Investigate the factors contributing to their proficiency in environmental knowledge.

2. Literature review

2.1. Environmental knowledge

In order to confront environmental issues effectively, and make informed decisions, people must be equipped with fundamental knowledge of basic environmental concepts and processes. "*Informed environmental decisions and actions are crucially needed in solving environmental problems and in the management of the quality of the environment*" (Alp et al., 2006, p. 210). Fryxell et al. (2006) define environmental knowledge as general knowledge about the facts, concepts, or relationships regarding the surrounding environment and its ecosystems. Knowledge implies a collection of facts and data (Hashemzadeh, 2016) and is regarded as essential for successful action (Frick et al., 2004). Hence, knowledge was defined as a source from which environmental attitudes were formed and environmental behavior manifested (Kollmuss & Agyeman, 2002). Regarding knowledge, Palmer (1998) emphasized that students should acquire an appropriate range of knowledge, understanding, and concepts about the environment so that critical judgment can be achieved.

Frick et al. (2004) asserted the existence of different forms of environmental knowledge. Frick et al. identify three types of environmental knowledge forms that must work together in promoting conservation behavior as follows:

• System knowledge: The understanding of the natural states of ecosystems and the processes within them.

• Action-related knowledge: When people know what can be done about environmental problems.

• Effectiveness knowledge: The knowledge about the benefit (effectiveness) of environmentally responsible actions.

It is imperative to study all three forms of environmental knowledge as suggested by Frick et al. (2004) in order to understand students'

environmental knowledge comprehensively. However, Moore et al. (1994) and Janmaimool and Khajohnmanee (2019) focused on only one form of environmental knowledge while Hines et al. (1987) and Schultz (2002) focused on only two forms of environmental knowledge. Omitting any one form of environmental knowledge does not show the relative effects of different knowledge forms on behavior comprehensively. This negligence also results in a lack of understanding of the ways in which different knowledge forms work together in promoting conservation environmental behavior (Kaiser & Fuhrer, 2003). Therefore, it is important to study all three forms of environmental knowledge as suggested by Frick et al. (2004).

2.2. Environmental system knowledge

"*Environmental system knowledge (ESK) refers to the natural characteristics of environmental and ecological systems regarding the relationship between organisms and ecosystem functions*" (Janmaimool & Khajohnmanee, 2019, p. 4). It is also referred to as declarative knowledge. Declarative knowledge usually contains answers to the question of how environmental systems work. Therefore, ESK describes basic scientific knowledge (Frick et al., 2004), such as knowledge about the relationships of ecosystems, the interaction of organisms, and reasons for environmental problems (Kaiser et al., 2008). Human-environment relationships such as causes of environmental problems due to human development are also a part of environmental system knowledge. For instance, people who are educated with this part of knowledge should be able to understand why pollution is a problem, where the river comes from, why ozone depletion is a problem, how to reduce carbon dioxide in the atmosphere, what is the food chain and food web, and what is an ecosystem (Janmaimool & Khajohnmanee, 2019).

2.3. Environmental action knowledge

Environmental action knowledge (EAK) refers to knowledge of potential behavioral

options which might lead to a specific conservation goal. This specific knowledge dimension can also cover a range of behavioral alternatives, including the knowledge needed to carry them out correctly (Kaiser & Fuhrer, 2003). "*EAK is relevant to behavioral choices and the course of environmental actions that can reduce the environmental problems we face*" (Frick et al., 2004, p. 4). Kaiser and Fuhrer (2003) define EAK as a type of environmental knowledge that should be understood by individuals and organizations to create the capacity to minimize and eliminate environmental problems. EAK is also referred to as procedural knowledge. It refers to behavioral options and possible courses of action. EAK addresses the issue of how to achieve a particular conservation goal, for instance, how one can reduce his or her household waste (Kaiser & Fuhrer, 2003). People who are educated with this type of knowledge should be able to understand the type of actions that would solve environmental problems (Janmaimool & Khajohnmanee, 2019).

2.4. Environmental effective knowledge

Environmental effective knowledge (EEK) refers to the effectiveness of environmental actions or behaviors in solving environmental problems or protecting the environment. It emphasizes the qualification of actions that can contribute to the greatest environmental benefit (Frick et al., 2004). EEK is relevant for choosing behavioral alternatives (Kaiser et al., 2008) because it involves understanding the relative effectiveness of different behaviors and their potential for protecting the environment (Kaiser & Fuhrer, 2003). For instance, "*people with these types of knowledge should be able to recognize the type of package that is more damaging to the natural environment*" (Janmaimool & Khajohnmanee, 2019, p. 5). According to Kaiser et al. (2008), EEK is the environmental knowledge dimension which is most often missing in environmental knowledge.

3. Methodology

3.1. Research approach and design

Guided by the pragmatic paradigm, this research employs a mixed method approach to effectively address the research problem of assessing the level of environmental knowledge among Key Stage III students in the Bumthang district. The district is located in the central part of Bhutan and is dominated with rural settlement. It has a total area of 2667.76 sq. km with a total population of 17820 with 9396 male and 8424 female (PHCB, 2017). There are 19 schools in the district of which 4 are secondary schools. At present there are 270 teachers and 4291 (male-2113 and female-2178) students.

Recognizing that a comprehensive understanding requires both qualitative and quantitative data, the integration of these methods offers additional insights beyond what either approach can provide individually (Creswell & Creswell, 2018). This approach validates its implementation in the current research context, enabling an in-depth understanding of the environmental knowledge of Key Stage III students. To guide the study, an explanatory sequential mixed methods research design is employed, involving a two-phase data collection process. In the first phase, quantitative data is collected, analyzed, and used to inform the planning and development of the second qualitative phase. This design facilitates a deeper comprehension of students' environmental knowledge, with qualitative data serving to elaborate on the initial quantitative findings (Creswell & Creswell, 2018).

3.2 Sample and general procedure

The research study administered an environmental knowledge test comprising 30 multiple-choice items (MCIs) to 200 Key Stage III students (Grade Eight) from four secondary schools in the Bumthang district. The sample consisted of 100 male and 100 female participants. Using the scores obtained from the environmental knowledge test, Focus group discussions (FGDs) were conducted in each of

the four schools, involving eight participants in each FGDs (four males and four females).

3.3 Measures

After extensive reading on Frick et al.'s (2004) work on the types of environmental knowledge, the researchers developed environmental knowledge multiple choice test items (MCI) based on three types of environmental knowledge as proposed by Frick et al. (2004). The test comprised of 30 MCIs divided into three parts. The first part targeted students' environmental system knowledge (ESK) with 10 items, followed by the second part focusing on students' environmental action knowledge (EAK) with another 10 items, and concluding with the third part addressing students' environmental effective knowledge (EEK), also consisting of 10 items. The MCIs were strategically designed by the researchers with varying levels focusing on grade VIII standard students. The difficulty level was guided by the principles of Bloom's taxonomy. To ensure the validity and quality of the questions, they underwent review by three teachers specialized in teaching Key Stage III geography in Bumthang district. In addition, researchers explained the test items in the national language to ensure that the language barrier did not affect the data during the respondents' test responses.

3.4 Data analysis

The data obtained from the environmental knowledge test was analyzed using Statistical Package for the Social Sciences-22 (SPSS 22). SPSS 22 was used for performing descriptive statistics, including measures of central tendency such as the mean, as well as measures of variability like the standard deviation. To categorize the participants' competency levels in the environmental knowledge test, a scale adapted from the Royal Education Council (2019) was utilized (Table 1). The competency levels were classified as Beginning (19.9 and below), Approaching (20 to 49.9), Meeting (50 to 79.9), and Exceeding (80 and above). Regarding the analysis of the FGDs, Braun and Clarke's (2006) six-phase thematic analysis approach were employed. The researchers transcribed FGD data and read more than once to get familiar with the transcribed data followed by the generation of initial codes from the data. Themes were generated from the codes generated, reviewed themes, define and name themes. Finally, the report is produced based on the themes generated. This approach facilitated a systematic and comprehensive exploration of the qualitative data collected during the FGDs, ensuring a rigorous analysis and interpretation of the themes emerging from the discussions.

4. Results

4.1. Environmental system knowledge

The overall mean score for ESK is 48.9 (SD = 1.80), indicating students' low level of ES. Figure 1 shows that the majority of respondents were in the meeting (56.5%) and approaching (36.5%) categories. Only 2.5% of the respondents scored less than 19.9% in their ESK test. The data shows that respondents have low ESK in general.

Table 1. Categorization of students' competency in environmental knowledge

Sl. No	Competence level	Range	Categorization of knowledge
1	Beginning	19.9% and below	Poor
2	Approaching	20%-49.9%	Low
3	Meeting	50%-79.9%	Good
4	Exceeding	80% and above	Excellent

Note: Adapted from Continuous formative assessment guidebook, by Royal Education Council, 2019, Royal Education Council. Copyright [2019] by Royal Education Council.
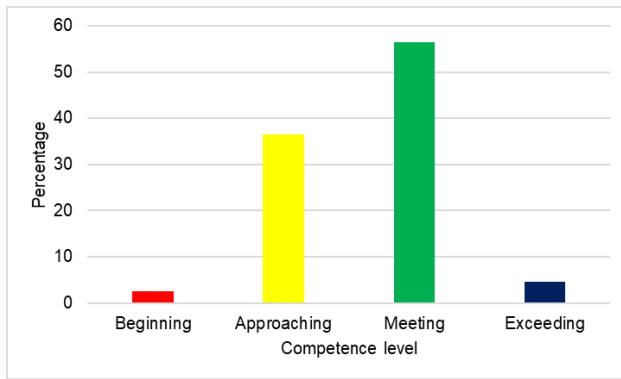
Figure 1. Students' competency in ESK

Based on their low level of ESK, focus group discussion participants were asked to share their views. The participants agreed that their ESK level is low. The response of the focus group discussion participants can be categorized into three different themes: lack of motivation in learning geography (all FGDs), use of the same teaching strategies (FGD 1, 3, and 4), and limited information in the text (FGD 1 and 2).

Firstly, the FGD participants agreed that their low ESK is due to the lack of motivation to learn geography. Participants from FGD 2 said, "*We do not attach great importance to geography because it is neither a major subject (English and Dzongkha) nor of Science, Technology, Engineering and Mathematics (STEM) subjects. Therefore, we do not attach great importance to learning about the environment.*" They believe that learning geography does not offer many career opportunities compared to STEM subjects. Participants consider too much focus given by the government on STEM subjects as one reason for lack of motivation to learn geography resulting in their low ESK level.

Secondly, teachers' consistent use of the lecture method when teaching environmental content is cited as another reason for their low ESK (FGD 1, 3, and 4). Participants shared that if teachers could allow students to explore more than just lecturing, they would learn more about the natural environment. They also shared that limited self-exploration on the content hinders them from thinking broadly and applying their knowledge. For example, FGD 1 participants said, "*We lack a broad understanding of the topic or we cannot go deep into the topic to*

understand more about the environment due to teachers lecturing us. We lack the ability to learn independently.*"

Lastly, limited information on the environment in the text was also highlighted by the participants (FGD 1 and 2). They believe that their textbook has limited information on ESK. Participants shared that the content they are learning in Key Stage III is just a repetition of what they have already learned. For example, FGD 2 stated, "*The content we learn is similar to what we have already learned in our elementary school classes. The information in the text is insufficient.*"

4.2. Environmental action knowledge

The mean score of the respondents in their EAK test is *40.5 (SD = 2.04)*, which shows students' low level of EAK. Fig. 2 shows that, only *6%* of the participants are in the exceeding level, whereas, the majority of respondents *(49.5%)* were in the approaching level. *11.5%* of the respondents achieved less than *19.9%*. The higher proportion of respondents at the beginning, approaching and meeting indicates the low level of competence of the respondents in EAK. Based on their low EAK level, the FGD participants were asked to share their views. The views of the FGD participants were categorized into three themes; lack of interest and motivation (all FGDs), use of the same teaching strategies (all FGDs), and limited information in the text (FG4).

Firstly, all FGDs participants pointed out that they lack interest and motivation in learning geography. FGD 1 participants stated that they are not interested in learning geography. They also said they were not serious about EAK. The participants confirm their claims as follows:

"Our EAK score is low because we lack interest and motivation in learning geography. Although our geography teachers teach about the environment, we don't take it seriously. We are not serious because we do not see environmental problems around us as a serious threat."

Participants also added that their lack of interest and motivation is due to a lack of awareness on the importance of geography subject. Participants in FGD 2 said,

"It is important to learn about the environment, but our teachers advise us that if we are to be the front-runner in the class and get a good job in the future, we must have good grades in STEM subjects. Therefore, we do not attach great importance to geography. The lack of interest in geography led to our low EAK."

Secondly, due to a lack of interest and motivation, students have developed a negative attitude towards the geography subject. The participants of FGD 2 unanimously agreed that they generally do not like geography. They also mentioned that geography is not an important subject and is not given great importance. Participants said, *"Geography is not an important subject for us. We don't care much about it. Hence, our EAK score is also low."*

Finally, the participants were also of an opinion that the use of the lecture method in every lesson is responsible for their low competence level in EAK. FGD 3 participants said, "*We have a low competence level in EAK because our teachers always lecture in the class.*" They also mentioned that they lack exploratory learning as they have never been given the opportunity to explore on their own. In addition, limited information regarding EAK in the geographic text is also highlighted by FGD 4 participants. They claimed that the geography textbook lacks detailed information regarding EAK.
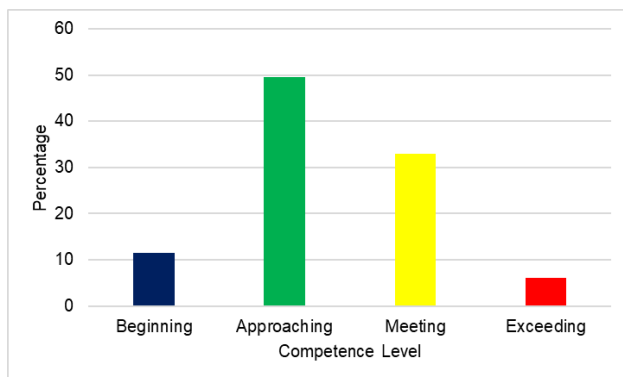

Figure 2. Students' competence in EAK

4.3. Environmental effective knowledge

The mean score for EEK is *36.3 (SD = 1.82),* indicating low level of EEK. Fig. 3 shows that majority of students fall in approaching *(57%),*

followed by meeting *(29%),* and beginning *(11%).* The overall result showed that the respondents have a low competence level in EEK.
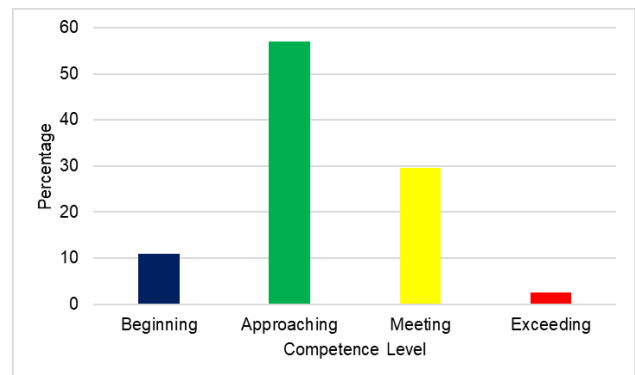

Figure 3. Students' competency in EEK

Based on the low EEK level, FGD participants were asked to provide their views. Their views can be categorized into three different themes; lack of interest and motivation in learning geography (all FGDs), less focus on effective knowledge (FGD 1 and 3) and limited information in the text (FGD 3).

Participants from all FGs believe that their lack of interest and motivation in geography learning hampered their competence in EEK. They also shared that teachers' use of the same teaching strategy (lecture method) during geography class made them lose interest in the subject. FGD 3 participants said, *"It is because our teachers do not teach us in any other ways. They always give lectures, which makes us lose interest in geography classes."* They also backed up their claim by saying that, *"Teachers should change their teaching strategies. They shouldn't always lecture us. They only explain what is in the textbook. There is a lack of exploratory and experiential learning, which has made us lose interest."*

Less focus on EEK in the classroom teaching and learning was also mentioned by the students as a factor for their low EEK level. They stated that teachers focus more on ESK than on EEK. The participants in FGD 1 shared their opinion on this, claiming that, *"Our teachers focus more on environmental system knowledge when teaching. Environmentally effective knowledge*

is not given much importance." The participants in FGD 3 were of the opinion that the textbook contained less content on the subject of EEK. They supported their claim stating that, *"Our textbook does not contain sufficient information on EEK."*

5. Discussion

The test result for ESK confirms that students' level of ESK is low *(M = 48.9)*. This result shows that the students lack basic scientific knowledge (Frick et al., 2004), such as knowledge of the interrelationships of ecosystems, the interaction of organisms and causes of environmental problems (Kaiser et al., 2008). In addition, it also indicates that the students lack declarative knowledge about the ecosystem and the laws of nature (Geiger et al., 2019). The current findings of the study contradict with the findings of Frick et al. (2004) and Janmaimool and Khajohnmanee (2019), where they found participants with a high level of ESK. This difference in results could be attributed to the different study participants in whom they conducted their research among university students and adults respectively.

Students' level of ESK is influenced by various factors, such as: lack of motivation in learning geography, use of same teaching strategies and limited information in the text. This reveals external factors hindering the students' acquisition of ESK. Warsani and Ruhimat (2016) found in their study that a greater interest and motivation in learning geography leads to a higher level of knowledge among students. However, a comprehensive examination of the students' motivation and level of knowledge is beyond the scope of this study. Preparing students for their future life requires active classrooms and successful learning. Studies by Djudin (2018) and Mohammadjani and Tonkaboni (2015) have found that the teaching method -cooperative learning has a higher effect on student learning than the lecture teaching method, and the students who have received direct lessons show a higher satisfaction rate and academic performance than those who have received this lecture method. Similar studies by Kostova and Atosoy (2008) on methods of successful learning in environmental education have also revealed that teaching strategies such as expert learning, conferences, laboratory experiments, field studies and field trips support student learning. As a direct student resource, the textbook should be informative and up-to-date. The findings suggest that information in the Key Stage III geography textbook pertaining to the natural environment is limited. This result is inconsistent with the study by Laaloua (2021) where they found EE in geography textbooks in the compulsory education system is adequate and helps in improving students' EK. Caution is advised here, as students' low level of ESK could have an impact on the preservation and protection of the natural environment in the future, as described by Alp et al. (2006). In addition, the results also provide a clear picture of where we are missing in providing ESK to the students.

The low EAK test result strongly suggests that the students lack knowledge of possible behavioural options that could lead to a specific nature conservation goal (Kaiser & Fuhrer, 2003). In addition, it also indicates that students are unable to understand the type of measures that would solve environmental problems (Janmaimool & Khajohnmanee, 2009). So far, there is only little literature on this specific type of knowledge, as indicated by Fuhrer and Kaiser (2003). Students in general, believe that lack of interest and motivation in learning geography, use of same teaching strategies and limited information in the text resulted in their low competence level in EAK. These results suggest that there are deficits in helping students achieve a higher level of proficiency in EAK. The finding of the current study is similar to Fatima's (2016) study carried out in Pakistan, which showed that students generally lack interest and motivation, as geography is viewed as a less important subject for starting a professional career compared to other subjects. There is a general stereotype among young people that instead of geography, other frontline subjects such as chemistry, physics, biology, engineering and economics are

more convenient for them to achieve professional success. The similarity in finding is evident from the response of FGD which states, *"...we want to have good grades in the STEM subjects if we want to give the best in class and get a good job in the future. Therefore, we do not attach great importance to geography"*. To promote EAK, teachers should be able to use different teaching strategies instead of always lecturing. Although the current result contradicts with Bala et al. (2017), it is in line with the results of Gokce (2009) and Umar et al. (2016). Gokce and Umar et al. reported that the use of the lecture method in teaching concepts is less effective. In addition, Gokce reported that all geography teachers should have pedagogical training and teacher training opportunities. However, the result of this study is only a one-sided view of the students and the opinions of teachers have not been solicited as they are beyond the scope of this study. On the other hand, the results of Bala et al. (2017) showed that the teaching method with lectures was more effective than an intelligent teaching method. This difference in results can be attributed to a different study method in which the quasi-experiment was used as a method as opposed to the method of the current study. The current finding raises fascinating questions about the nature and extent of preparation of our young people to cope with increasing environmental challenges since EAK is a more appropriate determinant of environmentally conscious behaviour. In addition, the result also raises the question of whether the current environmental content in geography curriculum of key stage III contains sufficient information with regard to EAK.

The students' test result for EEK *(M=36.3)* is lower compared to ESK and EAK. The results suggest that students lack the ability to understand the relative effectiveness of different behaviours and their potential to protect the environment (Kaiser & Fuhrer, 2003). It could also shed light on students' behavioural options and possible approaches to reduce human impact on the environment (Diaz-Siefer, 2015). The low EEK level is attributed to a lack of interest and motivation in learning geography, less focus on EEK and limited information in the text. As mentioned earlier, student motivation to study a particular subject plays an important role in the acquisition of knowledge. Ababio (2013) reported that efficient classroom learning would be impossible without motivation but that seems to be the case in many geography classes. Ababio (2013) went on to suggest that there are geography teachers in such unmotivated classes who leave their students with half-formed and fuzzy concepts; teachers who make no attempt to select teaching methods that develops curiosity and excites students; teachers who criticize students negatively rather than constructively; such classes are also characterized by strained personal relationships between students and their teachers. In addition, since students are motivated to learn STEM subjects than geography subject, it is invaluable for STEM curriculum developers to integrate more content on EEK to enhance students' EEK.

Looking at the available results of the study, this strongly suggests that the students are not motivated to learn at all. The study also showed that their teachers do not give much focus on EEK. For example, the FG participants shared that their geography teachers focus more on ESK and do not attach much importance to EEK. This could be due to the teachers' level of knowledge about the types of EK and its importance. One implication of low competence level in EEK is the possibility that students may not understand behavioural options that could actually reduce both human and natural environmental degradation.

6. Conclusions and recomendation

In conclusion, the MCI test results and findings from the focus group discussions (FGDs) on students' level of EK indicates that Key Stage III students' EK level is low. The mean scores for ESK, EAK, and EEK were *M=48.9*, *M=40.5*, and *M=36.3*, respectively, highlighting the overall low competence level of the students in these areas. The FGDs revealed several

factors contributing to the students' low level of ESK, EAK, and EEK. Lack of interest and motivation in learning geography was identified as a common theme across all focus groups. The participants expressed a belief that geography is not as important as other subjects, particularly those related to STEM. They also mentioned that the teaching strategies employed by their teachers, primarily the lecture method, hindered their learning and exploration of the natural environment. Additionally, limited information in the geography textbooks was mentioned as a barrier to acquiring knowledge in all three areas.

The findings of this study are consistent with previous research that highlights the importance of motivation, varied teaching strategies, and comprehensive textbook content for enhancing students' environmental knowledge. It is evident that the students' lack of motivation, combined with the dominant use of the lecture method and inadequate information in the textbooks, contributes to their low level of ESK, EAK, and EEK. The results of this study also highlight the potential implications of the students' low environmental knowledge for future environmental preservation and protection efforts. The students' limited understanding of ecosystems, interrelationships, and environmental problem causes could hinder their ability to address environmental challenges effectively.

To improve students' environmental knowledge, it is essential to address the identified factors hindering their acquisition of ESK, EAK, and EEK. This may involve promoting greater interest and motivation in learning geography, implementing diverse teaching strategies that encourage exploration and experiential learning, and ensuring comprehensive and up-to-date information in the geography textbooks. In addition, curriculum officers should also look towards integrating more content related to environmental education in STEM subjects to ensure environmental knowledge is imparted. Future researcher could explore the perspectives of teachers and investigate effective teaching methods that promote environmental knowledge acquisition. Additionally, examining the students' motivation and knowledge levels in more depth would provide a comprehensive understanding of the factors influencing their environmental knowledge development. Overall, addressing the deficits in students' ESK, EAK, and EEK is crucial for preparing them to tackle environmental challenges and fostering a more environmentally conscious and responsible society.

The study reported that students have low competence in EK due to lack of motivation in learning geography. Therefore, it is recommended that teachers should focus on motivating students to learn geography through creating awareness on the importance of geography in building their competence in EK. Another factor that limits students' competence in acquiring EK is the use of the same teaching strategy/method (i.e. lecture) by geography teachers. Therefore, it is recommended that geography teachers should use more student centred teaching methods which will actively involve students in learning. Further, geography teachers could also use different principles of Place Based Education to enhance students' learning and learning experiences.

As reported in the study, students in general lack knowledge in all three types of EK (ESK, EAK and EEK). This is due to limited information in the text and lack of awareness amongst the teachers on different types of EK. Therefore, Department of Curriculum and Professional Development could provide a professional development program for geography teachers on how content related to the environment should be taught in order to enhance students' competence in EK.

This study investigated the students' level of environmental knowledge. Although this study provided me with lots of perspectives regarding students' EK, I felt that there are still room for further research. Future researchers should continue to study about the students' EK with special attention on the following issues;

Although this study tries to look into the factors responsible for students' low competence

level in EK in Bumthang district, comprehensive examination of the students' motivation and level of knowledge is beyond the scope of this study. Therefore, a further study could be carried out to comprehensively examine how interest and motivation of students in learning geography affects their acquisition of EK in Bumthang district.

The study also found that students' low competence level in EK is due to limited information on EK in the text and teachers' using the same teaching strategy (lecture) while delivering the lesson which is one sided view of the students. Therefore, future researchers could try to seek teachers' perspectives on the adequacy of information on environment in the text and teaching methods employed by teachers while teaching environmental related topics.

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