

Environmental Education in Singapore: An Analysis of Environmental Knowledge in the Lower Secondary Geography Curriculum

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Abstract

Geography is a discipline believed to be a potential platform for the delivery of Environmental Education (EE) in Singapore. Most local research investigating EE in schools reveals a gap between students' 'knowing' and 'doing' in relation to the environment. This naturally calls for attention towards raising environmental knowledge (EK) among students such that they can be empowered to act for the environment. However, what exactly do we mean by EK in the geography discipline? This paper examines the cognitive aspect of EE by creating a framework to analyse the form of EK present in the Singapore's Lower Secondary Geography curriculum. The main finding shows that the curriculum reflects positive strides towards the incorporation of EK although the disproportionate emphasis of the EK dimensions might impede the effectiveness of instigating environmental actions among students. It is argued that to achieve the desired outcome of geography education - one that promotes responsible environmental stewards through EE - there needs to be serious considerations of what sorts of EK geography teaching and learning should emphasise.

Introduction

Curricula Goals of Environmental Education

Environmental education (EE) was first developed at a time when environmental degradation became widely prominent (UNESCO, 1976). EE becomes even more relevant today as we are ever pressured by pressing environmental issues such as those arising from pollution, waste management, and climate change, both locally and globally. The 1975 Belgrade Charter was the first milestone of EE, providing an international framework for EE to rapidly proliferate in many cities. Essentially, EE aims to:

“develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively towards solutions of current problems and the prevention of new ones” (UNESCO, 1976, p. 2).

Research Study and Objectives

While EE is often interpreted differently and contextually adapted, the unanimous practice for public education is to incorporate EE in school disciplines. Of interest is how the geography discipline has long been promoted as the platform for

introducing EE (Ministry of Education, 2019). This paper is concerned with how EE is incorporated into the Singapore's Lower Secondary Geography (LSG) curriculum. Within this context, this paper understands EE to be a study of the environment that aims to promote positive environmental behavioural changes and actions of students through the use of effective pedagogy, together with the teaching and learning of the right kinds of content (Thomas, 2015). The question then is what does the geography curriculum offer to students or what is the form of environmental knowledge (EK) that can empower them to act for the environment.

There are two reasons for this study to examine the LSG curriculum. Firstly, as a compulsory subject for students in the Singapore's public schools, it potentially affects a vast number of youths in their formative development of the appropriate environmental knowledge, attitudes, and behaviours. Secondly, while EE is believed to be present in the LSG curriculum, the gap between environmental awareness and actions among youths warrants our attention (Chang, 2014; Ramirez, 2017). Hence, an analysis of the LSG curriculum will prove significant in understanding what exactly the curriculum offers. Although it is acknowledged that solely analysing the cognitive aspect of EE might not contribute to a holistic study, it is indisputable that the right kinds of EK discussed is a key factor in developing students' positive attitudes and behaviours towards the environment (Chang, 2016).

EE research in Singapore has gained traction with the rising acknowledgement of the contribution of geography education to EE, particularly with the support of evidence from empirical studies. However, heeding calls for a stronger integration of EE into the geography discipline both globally and locally, this paper contends the

need to clarify what are the key EK dimensions critical for a closer integration EE and geography education.

This paper is organised into six parts, beginning with the introduction. Section two, the literature review, is dedicated to reviewing a few models that expound on the relevant dimensions of EK. With insights from the review, a four EK-dimension framework is then created for subsequent analysis of the LSG syllabus. Section three describes the qualitative analysis of the LSG curriculum before the findings and interpretation, and the discussion are presented in Sections four and five respectively. Section six concludes this study and provides some recommendations for a stronger integration of EE into the LSG curriculum.

Literature Review

Environmental Education in Geography Education

The interdisciplinary nature of geography has been widely acknowledged to be an ideal platform for the delivery of EE (International Geographical Union, 1992; Tilbury, 1997). Geography studies the interactions between human and natural/physical systems, which can be understood through geographical concepts like 'sustainable development' and 'urbanisation'. Similarly, integral to EE is the concept of 'human-environment relationship' (Tilbury, 1997). It is hence an unsurprising trend for formal school geography of many countries to embrace EE and ideas of sustainability (Cutter-Mackenzie, 2010). Chang (2015) articulates the same belief that "the geography classroom is the best place" (p. 3) to provide the lens for unpacking this complex concept such that students can develop an interest and an ability to act as stewards of the Earth. A good example is

shown in the secondary school geography education of Switzerland, which has made major shifts towards a more eco-centric view of the Earth with the deliberate incorporation of EE (Reinfried, 2004). Closer home, progressive efforts to increase the prominence of EE in the geography curriculum has been noted (Goh, Chuan, Tan, Chang, & Ooi, 2009), particularly in the Lower Secondary Geography (LSG) curriculum (Chang, 2014). Unlike the past syllabuses which were conceptual or systematically framed, the issue-based framework found in the 2014 syllabus enhances the potential for secondary geography education in Singapore to promote EE.

While EE's aim is internationally established, its interpretation within a school setting is less defined or consistent. For instance, in an empirical study by Ho and Seow (2017) comparing three Singaporean geography teachers and three Filipino teachers teaching social studies (which contains the discipline of geography) on their perceived role as climate change educators, it was found that differing beliefs of teachers led to distinct differences in pedagogical choices. The Singaporean teachers tended to "adhere closely to the official geography curriculum that focused on presenting scientific information about the causes and consequences of climate change in what they felt was a largely "objective" manner" (p. 250). The Filipino teachers, on the other hand, channelled their time towards maximising the subject's interdisciplinary nature by highlighting the complexities of environmental issues and "developing a sense of civic agency" (p. 247) among their students, which meant engaging them less with scientific information on environmental issues. These teachers' perception of EE as an advocacy tool is consistent with the literature (Fien, 1993; Huckle, 1983; Morgan, 2012) as they chose to actively promote pro-

environmental attitudes and behaviours among students (Lee, 1993; Ho & Seow, 2017). Conversely, teachers who believed that they ought to be neutral when conveying the curriculum tend to avoid discussing their opinions and focus on facts provision (Baildon & Sim, 2009; Ho & Seow, 2017; Stenhouse, 1975).

Environmental Education Research in Geography Education in Singapore

While there is rising attention given to EE and geography education in Singapore, research in this field appears narrowly scoped when compared to the progress in global EE discourse in at least two ways. Firstly, much of the research is concentrated on climate change education or CCE (e.g., Chang, 2013; Chang & Pascua, 2016; 2017; Goh et al., 2009; Ho & Seow, 2017; Seow & Ho, 2014; 2016) which is a specific topic under EE. Secondly, when research does examine EK in the school setting, they largely seek to understand how much students know about an environmental topic. Tan, Kay, Lee and Goh's (1998) study is one of the few early research studies that collected first-hand data on the knowledge levels of secondary students and concluded that more emphasis should be made to increase students' level of factual EK. Chang, Tan, Tan, Liaow and Kwek (2017) express the persistent gap between environmental awareness and action among students as a significant problem, detailing how secondary geography students' environmental conceptualisations are "found to be erroneous, inaccurate and incomplete" (p. 1). The common assumption made by these works appears to converge towards the idea that knowledge should lead to action, which begs the question of what knowledge should students have before they can act for the environment. The study by Ho and Seow (2017) is perhaps one of the few local studies that brought the discussion a step

further by differentiating two essential types of knowledge needed for an effective CCE. Beyond the scientific knowledge, they emphasise the promotion of civic knowledge as a critical contributor in achieving the goal of EE. It is clear from this literature review that a potential research area would be to uncover the kinds of EK that should be imparted to students in the geography curriculum.

Different Dimensions of Environmental Knowledge

In order to understand the EK dimensions needed to achieve the goals of EE and of geography education, the works by Kaiser and Fuhrer (2003) and Jensen (2002) are found to be helpful in providing insights for the purpose of this study.

According to Kaiser and Fuhrer (2003), there are three forms of EK that are significant to instilling positive environmental attitudes and behaviours among students. The first is known as declarative knowledge. This knowledge helps an individual understand how environmental processes work. Frick, Kaiser and Wilson (2004) specify that declarative knowledge contains both the scientific knowledge on how ecosystems operate (referred to as geography-environment system knowledge) and the knowledge on the effects of human actions on the environment (referred to as human-environment system knowledge). The former includes examples such as the understanding of how clouds are formed and where the groundwater originates. The latter would look at how, for instance, deforestation by people brings about negative impacts to the environment. The second is procedural knowledge, which refers to the knowledge on the range of behavioural alternatives and how to execute them, like how soil erosion can be prevented (Frick et al., 2004). Effectiveness

knowledge is the third dimension and often found missing in EE analysis, but which Kaiser and Fuhrer (2003) believe would encourage translation of knowledge into action. For instance, a question related to this knowledge, “Which recycled material saves more energy in comparison to producing it?” (Díaz-Sieffer, Neaman, Salgado, Celis-Diez, & Otto, 2015, p. 15512) would demand higher-order thinking skill from students as they consider the relative effectiveness of different environmental strategies when intending to act. This provides opportunities for teachers to creatively stimulate students’ imagination by setting a context that enables students to apply this knowledge. However, differentiating between procedural and effectiveness knowledge can be difficult. In Liefländer, Bogner, Kibbe and Kaiser’s (2015) work, “Which method is effective for saving water?” (p. 3) was used as an example of procedural knowledge. Going by the definition explained earlier by Kaiser and Fuhrer (2003), this question would require some evaluation, which should have been classified as effectiveness knowledge. To ensure clarity, this paper chooses to define procedural knowledge solely as the knowledge on the range of behavioural alternatives, and effectiveness knowledge as the knowledge on the relative effectiveness of the alternative strategies.

With regards to the nature of EK taught in school curricula, Jensen (2002) believes that it “is not in essence action-oriented” (p. 329). This sentiment is supported by Fien (2003), who argued that youths are insufficiently educated on the possible alternatives to address environmentally harmful practices. Hence, Jensen proposes an ‘action-oriented’ knowledge model containing four different knowledge dimensions, namely, effects, causes, change strategies, and alternatives and visions that could guide teaching and

learning towards the goal of enhancing students' competency to act and effect change. This model would directly address the link between EE and the formal geography education.

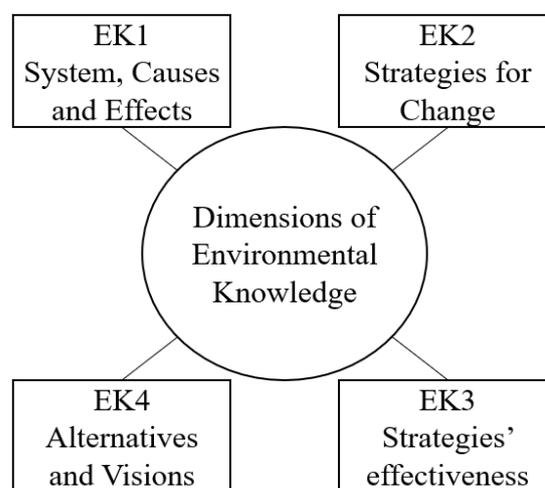
The first knowledge dimension relates to the knowledge about the effects of environmental problems, that is, the awareness of the existence and extent of the issues. However, this knowledge is technical and can lead to an unintended effect of 'action paralysis' among students if not coupled with the understanding of the causes and solutions of the problems (Jensen, 2002; Thielking & Moore, 2001). The second dimension involves the knowledge about the root causes of environmental problems. This requires a holistic examination of an issue, for instance, by looking at the cultural, economic, and political background behind an intensification of an agricultural production in a certain place (Jensen, 2002). The third dimension, the knowledge on strategies for change, is central to an action-oriented form of EE for it provides the knowledge about how one can contribute to the changing environmental conditions at various scales. This form of knowledge also helps for instance, to develop problem-solving and collaborative skills among students. The fourth knowledge dimension spurs students to develop their own alternatives and visions of environmental conditions, which Jensen believes would enhance students' willingness and ability to act.

Theoretical Framework for Analysing Environmental Knowledge

This study proposes a framework that contains four EK dimensions thought to be significant in addressing environmental issues (see Figure 1). It is constructed by classifying common knowledge dimensions in terms of their characteristics

and definitions from the review of the researchers' work in the literature review (see Table 1). For simpler reference, this section will refer to Kaiser and Fuhrer's (2003) and Jensen's (2002) work as research A and research B, respectively. The four knowledge dimensions will also be referred to as EK1 to EK4.

Figure 1: The Proposed Environmental Knowledge Framework



Firstly, EK1, the knowledge on *system, causes and effects* includes the declarative knowledge from research A and the knowledge about effects and root causes from research B. These abovementioned forms of knowledge provide the necessary basic geographical knowledge but is deemed insufficient to promote action among students (Raselimo, Irwin, & Wilmot, 2013). One might doubt EK1's classification given that declarative knowledge from research A has no explicit inclusion of knowledge about causes of environmental problems, which is however featured in research B. It must be clarified that thorough considerations have been made when combining the knowledge forms from both researchers. On further research, it was found that knowledge on causes of environmental problems is at times classified under declarative knowledge. For instance, while Díaz-Siefer

et al's (2015) made references to research A's EK dimension model, "What is the major cause of pollution of groundwater with nitrates?" (p. 15514) was given as an example of declarative knowledge. By categorising EK1 as the knowledge on system, causes and effects, it is believed to reflect a more holistic and encompassing knowledge dimension. Next, EK2, the knowledge on *strategies for change* takes on the knowledge dimension as termed by Jensen as it overlaps with the procedural knowledge from research B. Lastly, no combined grouping for the effectiveness knowledge from research A and the knowledge about alternatives and visions from research B was made since no

commonalities were observed. However, both knowledge dimensions are crucial. Effectiveness knowledge would provide the needed evaluation skills and is considered the most important knowledge among the other dimensions according to Kaiser and Fuhrer (2003). Knowledge about alternatives and visions is believed to galvanise environmental actions as students learn to formulate their own opinions and consider alternative environmental ideals in their society (Fien, 2003; Jensen, 2004). Thus, two separate categories were created – EK3 following research A's knowledge about *strategies' effectiveness* and EK4, as cued by research B, as knowledge about *alternatives and vision*.

Table 1: The Proposed Environmental Knowledge Dimensions Synthesised from Different Models

Kaiser & Fuhrer, 2003	Jensen, 2002	Proposed knowledge dimensions
Declarative knowledge • Human-environment system knowledge and geography-environment system knowledge*	Knowledge about effects (What kind of problem is it?)	EK1 Knowledge about system, causes and effects
	Knowledge about root causes (Why do we have the problems we have?)	
Procedural knowledge	Knowledge about strategies for change (How do we change things?)	EK2 Knowledge about strategies for change
Effectiveness knowledge		EK3 Knowledge about strategies' effectiveness
	Knowledge about alternatives and visions (Where do we want to go?)	EK4 Knowledge about alternatives and visions

* Declarative knowledge is further classified into 2 sub-categories of knowledge by Frick et al. 2004.

Methodology

This study involves a systematic qualitative analysis of the LSG curriculum through the examination of the 2014 LSG syllabus document (CPDD, 2014a), made available online by the Singapore' Ministry of Education (MOE). Document analysis provides valuable insights to the official

discourse on the importance of EE in geography education (Cohen, Manion & Morrison, 2013). Teachers are also supported with a document that guides them in teaching and learning (TLG) of the geography syllabus (CPDD, 2014b). The TLG is subsequently analysed to overcome limitations of a subjective analysis of the LSG syllabus document. This is done by

examining the number of periods recommended for each of the guiding questions or GQs before extending the analysis to understand the curriculum's emphasis on each knowledge dimension.

The issue-based framework contains six geographical issues contextually relevant to Singapore (see CPDD, 2014b, p. 18). Each issue is guided by a set of GQs, statements from the syllabus, specifically, the knowledge learning outcomes from the six issues are identified. Knowledge learning outcomes are guidelines for teachers to deliver the relevant core content. It is to be noted that concession is made to consider learning outcomes on 'value and attitudes' for EK4. The selected statements are compiled and presented in Table 2 to represent the findings for this study as they reflect the nature of EK in the LSG.

It is acknowledged that the positionality of the author may present challenges to the credibility of the study's results. This is because the analysis is subjectively made by this author who is a geography teacher in training and a future MOE employee. However, she has constantly reminded herself to avoid assertion of her own beliefs about EE and the geography curriculum, and instead to bring in insights from her relevant knowledge and experiences learning about geography and EE when interpreting the LSG curriculum.

Findings and Interpretation

It has been found that while the LSG curriculum reflects positive strides towards the incorporation of EK where there is an emphasis of EK1 and EK2, the focus on EK3 and EK4 is less strong. The next few paragraphs will elaborate on these findings.

From Table 2, EK1 is found to correspond to the first three GQs of the syllabus. Hearteningly, the syllabus

attempts to extend students' knowledge beyond the facts of environmental issues, whereby students are expected to learn about "Which part(s) of the world is/are affected by the issue?" as part of the EK1's system knowledge. The curriculum encourages the application of geographical skills such as map reading and data organisation as students examine the severity of the issue across different places. Such skills application can help to illuminate the concept of 'interconnectedness', which is relevant to EE. For one, students are able to extend their understanding of relationship of places to that of the relationship between the human and the environment, and secondly, the emphasis of place provides a sense of learning relevancy for students (Baerwald, 2010; Roberts, 2011).

In the analysis of EK1, it is also observed that the knowledge of effects corresponds to GQ3, "How does the issue affect human society and natural environments?" It is expected that there would be opportunities for students to examine impacts of the issues on both the human and natural settings. Yet, the supposedly holistic coverage of impacts is inconsistently reflected across the six issues. From Table 2, only issues 1 and 5 explicitly highlight both human (social and economic) and environmental impacts. Issue 2 solely focuses on the former while issues 3, 4 and 6 indirectly mention the latter. For instance, issue 4 expounds on two direct social consequences of housing shortage – "homelessness" and "proliferation of slums and squatter settlements" (see CPDD, 2014a, p. 25). "Environmental pollution" is then explained as one of the indirect consequences under the latter. The tendency to highlight challenges of urban societies with negligible mention of how the environment is impacted by human activities might not be effective in bringing across the idea that the impacts on human

and natural environments are often interconnected. Such inconsistencies could unintentionally promote a sense of

environmental determinism (Almeida & Vasconcelos, 2013; Huckle, 2002) among students.

Table 2: Analysis of Syllabus Statements According to the Proposed Knowledge Dimension Framework

Proposed knowledge dimension framework		Issue-based framework from the TLG (GQs)	Selected statements from Secondary 1 syllabus			Selected statements from Secondary 2 syllabus		
			Issue 1: Tropical rainforest Topic: Deforestation	Issue 2: Water resource management Topic: Water shortage	Issue 3: Energy resource management Topic: Energy crisis	Issue 4: Housing Topic: Housing shortage	Issue 5: Transport Topic: Traffic congestion	Issue 6: Natural hazards Topic: Floods
1. Knowledge about system, causes and effects	i. System	1. What is the issue?	Define deforestation.	Define water shortage.	Describe the features of an energy crisis.	Define housing shortage.	Define traffic congestion	Describe the types of floods.
	ii. Causes	2. Which part(s) of the world is/are affected by the issue?	Describe the distribution of tropical rainforests and its deforestation.	Identify countries and regions which are facing water shortage.	Describe the pattern of energy consumption in the world.	Identify the location of cities experiencing housing shortage.	Describe the distribution of traffic congestion in the city.	Describe the location of cities prone to floods.
		2. Why is the issue located there?	Explain the causes of deforestation.	Explain the causes of water shortage.	Explain why energy consumption has risen in recent decades.	Explain the reasons for housing shortage.	Explain the causes of traffic congestion in the city.	Explain the causes of floods.
iii. Effects	3. How does the issue affect human society and natural environments?	Describe the impact of deforestation on people and the environment.	Describe the impact of water shortage on people.	Explain how an energy crisis could impact society.	Describe the consequences of housing shortage.	Describe the impact of traffic congestion on people and the environment.	Describe the socio-economic impact of floods.	
2. Knowledge about strategies for change	Strategies for change	4. How should it be managed?	Describe and explain the measures taken to manage deforestation in the Amazon and conserve the rainforest in Singapore.	Describe and explain the measures taken to manage avoid water shortage in Singapore.	Describe and explain the measures to reduce energy consumption in Singapore and the world. Explain the strategies of adapting to declining fossil fuels reserves.	Describe and explain the strategies used by Singapore and other cities to manage housing shortage.	Describe and explain the strategies used by Singapore and other cities to manage traffic congestion.	Describe and explain the strategies used in Singapore and other cities to mitigate the impacts of floods.
3. Knowledge about strategies' effectiveness	Evaluating strategies for change		Describe the benefits and challenges of measures taken to manage deforestation in the Amazon and conserve the rainforest in Singapore.	Describe the advantages and disadvantages of various measures to avoid water shortage in Singapore.	Describe the benefits and challenges of advantages and disadvantages of the different strategies of adapting to declining fossil fuels reserves.	Explain the challenges faced by Singapore and other cities to manage housing shortage.	Describe the benefits and challenges faced by planners in managing transport issues.	Describe the benefits and challenges of various strategies used to mitigate the impact of floods.
4. Knowledge about alternatives and visions	Alternatives and visions		Respect the different perspectives people have about rainforests. *	-	Respect the views and opinions of others that may not be in agreement with one's own. *	-	-	Respect the views and opinions of others that may not be in agreement with one's own. *

* Obtained from values and attitudes lesson outcomes of each issue

While the proposed EK framework distinguishes between EK2 and EK3, the syllabus classifies them under the same GQ, “How should it (the issue) be managed?”. The two learning outcomes in GQ4 are organised such that students first learn to “Describe and explain the measures ...” (referring to EK2) and subsequently “Describe the benefits and challenges...” or “Describe the advantages and disadvantages...” (referring to EK3). However, as recommended by the EK framework, EK2 and EK3 should be given comparable amount of attention and rigour, which is not evident from the LSG syllabus. The author’s personal insights from her secondary geography education reveals the tendency for teachers to list the pros and cons of various strategies for change as part of GQ4’s learning outcome. This differs from the purpose of EK3 according to Kaiser and Fuhrer (2003), whereby the application of evaluation skills in assessing the relative effectiveness of different environmental strategies should have been the focus. This could be due to how the learning outcomes are phrased. For instance, the command word “describe” used in the second learning outcome does not suggest the need to make use of evaluation skills. As such, GQ4 that combines EK2 and EK3 might not prove effective to empower students to act for the environment. The provision of a range of environmental strategies from EK2 lacks a strong follow-up to critically engage students to examine which environmental strategies that are best suited for a local context as required for an effective delivery of EK3. There is no apparent inclusion of EK4 as examined from the knowledge learning outcomes in the syllabus for the purpose of this study. However, through a thorough analysis of the various statements from the issue-based framework, an allowance was made to include statements from the ‘values and attitudes’ learning outcomes. It is important to note that values and attitudes are not

considered ‘teachable knowledge’ but can be developed and instilled among students when the right kinds of knowledge are delivered by teachers (Chang & Pascua, 2016). As identified in Table 2, the learning outcomes of issues 3 and 6 are phrased generically such as “Respect(ing) the views and opinions of others that may not be in agreement with one’s own” while issue 1 specifies it as “Respect(ing) the different perspectives people have about rainforests.” Through teacher guidance, students can draw on how individuals and groups from other societies view and resolve environmental issues and subsequently create their own ideas and visions of how the environment situation in their respective localities should be like. As such, issues 1, 3 and 6 potentially promote some form of moral responsibility among students as environmental stewards as they are prompted to conduct perspective taking. On the other hand, issues 2, 4 and 5 might appear to promote a narrower perspective as the respective ‘values and attitudes’ learning outcomes prompt students to appreciate how urban problems are overcome and how humans can better utilise natural resources (see CPDD, 2014b, pp. 36-50). Hence, these issues’ statements of learning outcomes are not included in the framework, which only seeks to select relevant statements aligned to EK4. The inconsistency of the nature of EK4 across the issues is a similar problem highlighted previously in the analysis for EK1. Overall, there is no explicit inculcation of the development of alternative visions among students and the TLG lacks the relevant pedagogical recommendations. Students at most are exposed to the knowledge of alternative strategies for change (EK3). The presence of EK4 is subjected to students’ understandings and/or teachers’ beliefs about the importance of developing students’ ability to envision alternative futures of their environmental context.

The above findings reveal two points about the LSG syllabus, between and within the knowledge dimensions. Firstly, there is a diminishing emphasis from EK1 to EK4, with a strong focus on EK1 and EK2 and an under-emphasis of EK3 and EK4. Secondly, the same EKs exist with differential quality across the issues. Specifically, inconsistencies are found in EK1 and the 'values and attitudes' learning outcomes for EK1 and EK4 respectively across the six issues. To overcome some of the possible subjective analysis above, the TLG is analysed. While each issue is equally allocated 10 periods (each period lasting 35-40 minutes, see CPDD, 2014b, pp. 15-16), different GQs are allocated different number of periods for the different issues (see CPDD, 2014b, p 239-244). As established in Table 2, GQ1 to GQ3 corresponds to EK1, which would hence be allocated 6-7 periods whereas EK2 and EK3 (covered as GQ4), supposedly the knowledge dimensions that would more significantly affect environmental behaviours, are to be covered in 3-4 periods. As EK4 is not taught as a form of knowledge per se in the curriculum, no recommended periods are given. Clearly, this analysis supports the earlier findings above, whereby the bulk of teaching and learning is focused on EK1, which might unfortunately suggest the diminished emphasis and importance of EK2 to EK4. Hence, this paper believes that there is a lower than expected integration of the cognitive aspect of EE into the LSG curriculum.

Discussion

Possible Reasons for Findings

The disproportionate emphasis of EK1 and to some extent EK2 over EK3 and EK4 has yet been empirically studied. However, the findings can be thought to be related to the "institutionalisation of dominant beliefs

about knowledge, teaching and learning" (McIntyre, 1985, p. 79, cited in Stevenson, 2007, p. 151). The syllabus reflects the social context of a nation – it is created by a group of government officials with certain beliefs and attitudes towards the concept of the environment and the purpose of education.

The Singapore education system remains one that is performance and results oriented. This is evident from the assessment objectives laid out in the TLG document whereby two out of the three assessment objectives place heavy emphasis on students' "factual knowledge" attainment (see CPDD, 2014b, p. 190), which essentially means that EK1 would carry the heaviest weighting in assessment. In fact, such narrow content coverage is not unique to Singapore and is thought to align with the idea of education for the purpose of examination (Raselimo et al., 2013). There appears to be a perceived conceptual difference between objective and subjective knowledge, analogous to Esland's (1971) argument that the former is considerably more straightforward and measurable than the latter, which is "problematic and essentially personal in nature, being socially constructed from the learner's active participation in the production and verification of meaning" (as cited in Stevenson, 2007, p. 149). EK3 and EK4 would fall under the latter for they require for instance, the evaluative skills and one's personal imagination and envisioning of alternative environmental strategies that do not have a definite criterion for assessment.

Implications on Teaching and Learning

A curriculum skewed towards EK1 might affect how EE is integrated into teaching and learning within the geography education. For one, it could potentially shape how geography teachers, the bridge

between the curriculum and students, form their beliefs and practices of what and how EE should be delivered. More importantly, this underscores the issue of the recurring cycle for why EK is not holistically developed in the curriculum and the action-paralysis found among students.

Indeed, it has been observed that geography teachers tended to perceive environmental processes as the core content knowledge (Morgan, 2012). Ho and Seow's (2017) study concluded that the syllabus document has a strong influence on teachers' professional identity and pedagogical decisions. Similar findings were reported in Cotton's (2006) study of three teachers whom, because of their beliefs in displaying neutrality, avoided framing their lessons aligned with EE, which they felt is socially critical. While the improvised 2014 LSG syllabus introduces the issue-based framework as a guideline for teachers to engage students to think critically about the issues, it remains an uphill task for teachers without the relevant resources and support from the system, to deviate much from the curriculum. They will also be less likely to make the conscious effort to tap on EE as a platform to develop students who can be critical yet active contributors to the local environmental scene. It is hence unsurprising that teachers may choose to stick to the 'easier' route by following closely to guidelines stipulated in the LSG syllabus and TLG document and fail to realise the full potential and benefits of a holistic EK curriculum.

In turn, students may fall short of participating in the improvement of environmental problems existing in their societies. In fact, the dominance of scientific knowledge and facts might do more harm than good as students are overwhelmed with the knowledge and awareness of the seriousness and extent of

environmental issues from both the media and the school, but find themselves unprepared and ill-equipped to address them. The limited knowledge of alternatives and visions can lead to students being despondent "of a future that they do not quite understand" (Chang & Pascua, 2016, p. 18) and effectively foster a sense of powerlessness and negative environmental outlook among students.

Suggestions for Future Actions

To overcome the pessimism that many Singaporean youths experience towards the environment (Tan, 2013), prompt and decisive changes must be made to the geography curriculum and support for teachers' empowerment in delivering EE need to be enhanced.

Given teachers' reliance on and the influence of the syllabus and the TLG document, changes to the recommended teaching periods for each GQ and hence, the EK dimensions, should be made in accordance to the proposed EK-dimension framework. This means that EK1 needs to be streamlined to focus on the necessary scientific knowledge needed to attain other EK dimensions. This can be supported by the development of relevant resources and pedagogical strategies in the teaching of EK2 and EK3. Slight modifications such as an inclusion of higher order command words to the learning outcome of EK3 could garner greater attention in teaching and learning of this knowledge dimension. As for EK4, explicit and consistent learning outcomes would be required. This can be expressed as statements that require students to formulate an environmental goal for the issue or topic, with which they can then apply the relevant EK that they have previously acquired as they work towards the said vision.

However, while the recommendations

call for a change in the LSG curriculum, they are unlikely to be realised if the education system remains one that is strongly oriented towards assessment and examination that largely bases itself on the convenience of objective measurements. Still, the author is optimistic that the LSG curriculum has great potential to accommodate changes, considering it is not part of the national examination. In addition, as Chang (2014) critically points out that despite inclusion of EE in the curriculum, the translation of the curriculum into practice might not be as straightforward due to teacher subjectivity. This points to the need to enhance teacher training more holistically. Cognitively, professional training programmes should assist teachers in enhancing the depth and breadth of their knowledge content on current environmental issues according to the knowledge framework. On the pedagogical aspect, teachers should be provided the space to critically examine their perceptions on the purpose of EE and be made aware of the array of pedagogical strategies and resources that they can employ. In this way, teachers would too feel empowered and equipped to engage EE in a more holistic way, thereby facilitating the translation of the curriculum and policy at practitioner level.

Conclusion

In this study, a four-dimension EK framework has been proposed to assess the cognitive nature of the LSG curriculum. A disproportionate emphasis of EK is identified, with the focus skewed towards EK1 and EK2. The under-emphasis of EK3 and EK4 could interfere with the holistic learning of environmental issues that is needed to instigate the right kinds of environmental actions and behaviours expected of students. Such findings are believed to be attributed to the heavy stress on objective assessments present in the

larger educational context in Singapore. This influences the perceptions of teachers towards the EE within the geography discipline, and further affects students' competence as not just the discipline's learners, but as citizens and environmental stewards of their nation. It can be postulated that the failure to deliver an action-competence EE in the school curricula might result in the persistent gap between 'knowing' and 'doing' among youths in the environmental context of Singapore.

The scope of this study is limited to the analysis of the cognitive aspect of the Singapore's LSG curriculum, which may mask insights from the possible hidden curriculum that might surface during actual lesson implementations. By adapting the proposed framework presented in this study, future research can look to conducting empirical studies that examine how the LSG curriculum is appropriated and delivered by teachers in the classroom, and how they are received and internalised by students. This should bring more substantive conclusions on how geography education can develop a greater stake in promoting responsible environmental stewards. Another aspect of research that merits further investigation would be to consider the possible influences of assessments on the pedagogical choices of teachers in the teaching and learning of the different EK dimensions. This would allow for a more holistic evaluation of how effective the incorporation of EE is in the curricula.

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