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# Chapter 9

## Environmental Education and Its Effects on Environmental Sustainability

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### ABSTRACT

*Environmental education (EE) for sustainable development remains a valuable subject of contemporary society, which is characterized with environmental issues such as climate change, pollution, loss of biodiversity, and resource degradation. The delivery of EE is based on the North American Association for environmental education values of knowledge, dispositions, competencies, and responsible behavior towards the environment. EE is a transformative tool to learners since it prepares learners with skills, attitudes, knowledge, and values to resolve environmental problems. It promotes environmental activism and action-oriented resolution of environmental issues. The full benefits of EE are challenged by limited human capacity, questionable professionalism, limited resources, and poor transformation of knowledge to practice. These challenges however can be alleviated through community engagement in formulating EE programs, multidisciplinary engagements, and research on EE delivery and quality.*

### INTRODUCTION

Initiatives focusing on the need for environmental protection began two centuries ago with the motive of rescuing endangered species. However, the growing indicators of environmental degradation including global warming, climate variation and change, ozone layer thinning, soil and water pollution have imposed the need for environmental protection and diversified education initiatives focused on this subject (Boca

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& Saracli, 2019). It is from these predispositions that the awareness of the importance to act responsibly towards nature at individual and collective level has grown among humankind. Consequently, mutual collaborations at all administrative levels to protect nature are emerging in the field of environmental education (EE). According to Thomas (2005), EE is the acquisition of knowledge aimed at behavioural and action modification by students and is skewed to wise use of environmental resources at individual and group level. Similarly, Grosseck et al. (2019) pointed out that recent research tendencies focused on understanding EE promote sustainable development (SD). A research by Choudhary et al. (2019) also indicated that EE is an opportunity to acquire skills, attitudes and knowledge essential in ecological improvement. The Rio de Janeiro earth summit that promulgated the Agenda 21 emphasized the role of education in environmental sustainability (Boeve-de Pauw et al., 2015). Other efforts towards EE for SD include the Johannesburg world summit of 2002 that declared 2005 to 2014 as the period, which this initiative was to be implemented and the campaigns by UNESCO aimed at reshaping curriculum to inculcate EE (Grosseck et al., 2019).

Although the initiatives aimed at promoting EE are existent, the actions to address environmental issues and participate in actual initiatives is low among students. Boca and Saracli (2019) highlighted this issue observing that there is a rift between the lack of involvement in practical environmental protection despite the rich ecological knowledge among communities. This tendency could be a flaw of existing curriculums whose attention does not specify methods aimed at practical civic and moral education towards environmental sustainability. Therefore, EE aimed at SD does not only disseminate knowledge on environmental issues but also enriches the value associated with the ecology to instil problem-solving skills and change the attitudes and perceptions of ecosystems for the better (Liu & Guo, 2018). Authors such as Maurer and Bogner (2019) assessed the role of EE and SD and highlighted their inter-relatedness and overlap. Environmental education, “resonates with the model which refers to the environment in a holistic, human-oriented approach as interacting biophysical (organisms and life support systems), social (people living together), economic (livelihood, money and services) and political (power, policy and decisions) dimensions” (Goldman et al., 2013, p. 517). These are some of the tenets of SD, which can be interrelated with EE. The purpose of this book chapter will be to highlight the chronological development of EE; discuss its delivery determinants and challenges involved in its dissemination with the aim of providing a way forward. Additionally, it will discuss the effects of EE in relation to learner outcomes using named case studies of Botswana and Colombia. The case studies were chosen because EE in these two countries is compulsory unlike other developing countries where it is voluntary or offered on ad hoc basis. The methodology applied in the chapter is an examination of existent literature on the topic.

### **The History of EE**

EE is traceable from the early educational reformers from Europe such as Humboldt, Goethe, Pestalozzi, Rousseau and Comenius prior to its definition and integration of this concept to mainstream education (Rosaleen, 2012). In the 1970s, an international working meeting on environmental education was held in the USA and came up with an EE definition (IUCN, 1970). In the meeting, EE was defined as a process of developing values and understanding concepts to cultivate attitudes and skills essential to appreciate the interrelationships among humans, their culture and biophysical features. Furthermore, EE was a tool useful in making decisions, coding behaviours and best practices on environmental quality issues. Following this development, the United Nations (UN) in a conference on human environment held at

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Stockholm recognized EE formally (UNESCO, 1972). The conference led to the conceptualisation of EE as Hollweg and others stated claiming that this concept served,

*“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 toward solutions of current problems and the prevention of new ones” (2011, p.2).*

This move triggered a number of related publications and most notable of these was the, “Silent Spring’ book by Carson that detailed the harmful effects of using pesticides such as Dichlorodiphenyl-trichloroethane (DDT) on the environment (Maurer & Bogner, 2019). The book’s claims were used to enforce a global ban for the pesticide use years later after environmentalists lobbied against DDT use. Later in the 20<sup>th</sup> century, the global population’s awareness on environmental issues increased due to the prevalence of ozone layer declines, air pollution and acid rain. These trends were in line with EE efforts of inculcating commitment and motivation to eradicate environmental protection (UNESCO-UNEP, 1978; UN, 1992). The Tbilisi declaration and the Belgrade charter further reinforced these efforts (UN, 1992). A broader viewpoint of EE emanated in the 1990s at the Rio conference through the Agenda 21 aimed at a global action plan towards sustainable development, SD (UN, 1992). These initiatives resulted to the concept of environmental SD, which focuses on ecological development and is one of the three components of SD including social and economic development (Reilly, 2008).

There is consensus from the education history that EE promotes eco-friendly lifestyles among growing children and learners apart from acquisition of knowledge on their natural bio-physical environment (Kaiser et al., 2008; Boeve-de et al., 2015; Choudhary et al., 2019). In the 1960s, physical systems and species were used in EE (Maurer & Bogner, 2019). In the 1970s, EE advanced to practical models to incorporate urban studies, outdoor adventures while the 1980s saw the application of diversified knowledge dissemination and acquisition approaches including inquiry and discovery learning, case-based, project-based, problem-based and just in-time teaching (Palmer, 1998; Prince & Felder, 2006). In the 1990s, EE was recognized globally and its integration in affective, psychomotoric and cognitive learning aspects was formalized as De Kock et al. (2004) observed. The diversified learning and teaching approaches do not automatically translate to success especially if learners’ behaviour, attitudes and knowledge on the environment is limited (Rickinson, 2001). Grosseck et al. (2019) supported this ideology suggesting that apart from factual knowledge, action-related knowledge is essential for effective EE. The focus of this chapter is to assess the factors that influence EE, the challenges encountered during the process and the resultant effects of disseminating the concept based on literature.

### **The Need for Environmental Education**

Previously, the needs of man considering the scarce population of humankind were limited and had no interference on nature. However, in the contemporary society, population rise of humankind has constrained man’s needs and consequently affected the environment negatively to the extent of threatening the sustainability of land and water (natural) resources. Indiscriminate and unplanned use of the resources by humans has led to their scarcity. This situation is further exacerbated by modernization, deforestation, pollution and rapid industrialization. Therefore the need to devise strategies aimed at introducing and enhancing EE among people to save existent natural resources and the entire earth is indispensable (Choudhary et al., 2019). Introducing EE in schools increases awareness on the surroundings among

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young learners, which assists them to understand and acquire knowledge prerequisite in developing appropriate skills and attitudes necessary in solving the environmental challenges they encounter daily through responsible acting and scientific thinking (Edsand & Broich, 2020). Although through EE, pro-environmental behaviour cannot be acquired, emotional involvement and pro-environmental consciousness can be enhanced (Kollmuss & Agyeman, 2010).

## **The Domain of Environmental Education**

EE is underpinned on a framework that was initiated by the North American association for environmental education (NAAEE) (Hollweg et al., 2011). The framework describes environmental literate individuals as those who make wise decisions on environmental issues and are willing to take action that will influence the welfare of individual, group and world's environment positively during their civic life. Therefore, environmental literate persons should possess a number of characteristics according to Sharma (2016). These include 1) having a high standard of conduct to apply understanding and knowledge when making decisions regarding varied environmental contexts, 2) cognitive abilities and skills, 3) affective and cognitive dispositions and 4) knowledge and understanding of various environmental issues, problems and concepts. A summary of the framework and its sub-domains is provided in Table 1 and discussed in the following sub-titles.

*Table 1. Components and sub-components of the EE domain according to Hollweg et al. (2011)*

<b>Domain Components</b>	<b>Sub-components</b>
Knowledge What do you know?	<ul style="list-style-type: none"> <li>❖ Ecological and physical systems</li> <li>❖ Political, cultural and social systems</li> <li>❖ Environmental issues</li> <li>❖ Action strategies and citizen participation</li> <li>❖ Many solutions to environmental problems</li> </ul>
Dispositions How do you respond to environmental problems?	<ul style="list-style-type: none"> <li>❖ Concerns and attitudes to the environment</li> <li>❖ Sensitivity</li> <li>❖ Personal responsibility assumption</li> <li>❖ Concerns and attitudes to the environment</li> <li>❖ Self-efficacy</li> <li>❖ Intent and motivation to take action</li> </ul>
Competencies What skills and abilities do you possess? When and how do you apply them?	<ul style="list-style-type: none"> <li>❖ Identify environmental problems</li> <li>❖ Question about environmental problems under different environmental conditions</li> <li>❖ Analyse environmental problems</li> <li>❖ Use primary and secondary sources to investigate the science and social aspects of environmental problems</li> <li>❖ Assess and make judgements on environmental problems considering the socio-political systems</li> <li>❖ Use evidence and knowledge-based facts to propose solutions to the problems</li> <li>❖ Monitor and evaluate plans to solve environmental problems at various levels and scales</li> </ul>
Responsible behaviour towards the environment	Participate in habitual and deliberate behaviours at individual and group level to solve current environmental problems sustainably and prevent re-emergence of new ones.

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### **Knowledge**

Literacy on physical and ecological systems; environmental issues; socio-cultural and political processes; citizen involvement and action planning and a variety of solutions to environmental problems constitute the five types of knowledge. Researchers on EE as early as 1960s and 70s identified these sub-domains of knowledge (Disinger, 1983; Hart, 1981; Harvey, 1977). Documents prepared by NAAEE (2004) and UNESCO (1978) included these as some of the objectives of EE explicitly. Knowledge on physical and ecological systems focuses on earth sciences, atmospheric, oceanic and geological systems relevant to environmental literacy. These systems are interdependent and link the environment to humans as earth system and ecosystems' main variables (Coyle, 2005). According to Berkowitz et al. (2005), the area of knowledge also evaluates the role of humans as protective agents and their associated activities as influencers of these systems using evidence-based research. Knowledge on socio-cultural and political processes such as legal, economic, transportation, kinship and agricultural systems as well as their spatial and temporal variations in development is another domain of knowledge (Rickinson, 2001). The area considers practices and beliefs encountered during civic participation and problem solving of environmental issues. Citizen involvement in various environmental issues is key to collaborative solution seeking through effective political action and communication strategies. Several technical, scientific, educational and regulatory efforts are and have been underway to address various environmental problems and form part of EE. The knowledge on environmental issues that arise from human conflicts and biophysical changes of the natural world are key in environmental literacy.

### **Dispositions**

Dispositions are negative or positive determinants of behaviours towards the environment. These behavioural determinants influence the willingness of EE students to recognize and adapt to various values while resolving environmental problems (Sharma, 2016). The motivation to participate and act during problem resolution forms part of the predispositions. According to Dada et al. (2017), affective dispositions focus on the sensitivity, attitudes, locus-of-control, worldview, values and personal responsibility of learners regarding environmental issues. Dispositions influence competency on environmental issues and are influenced by levels of environmental knowledge (Igbokwe, 2016).

### **Competencies**

Competencies are a group of abilities and skills that are required and expressed for a specific environmental issue. They enhance the capacity of learners to identify, analyse, investigate, question and evaluate environmental problems to make a personal judgement regarding them and informed by critical thinking and evidence-based research (Hollweg et al., 2011). EE therefore advances competences that enhance the aptitude to deal with real life environmental problems (Roczen et al., 2014). Pro-environmental competencies are cultural beliefs, environmental perceptions, personal motives and skill that promote ecological matters. Through these abilities, learners can assume responsibility in addressing environmental matters for the betterment of communities (Sharma, 2016).

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### **Responsible Behaviour to the Environment**

This is an expression of competencies, disposition and knowledge regarding environmental issues. By being responsible, EE learners actively participate in solving issues related to the environment. Hsu (2004) observed this predisposition among college students of Taiwan whose environmental responsibility, perceived knowledge on such issues, intention to act and skills towards resolving environmental problems was enhanced following EE.

### **Influence of School Education in Inculcating Environmental Literacy**

In the science curriculum, social scientific themes and topics are essential in equipping learners with skills to become responsible citizens, manage society sustainably as well as participate in social life (Wan & Bi, 2019). This aspect has been proven by a number of empirical studies on the effects of environmental education and schools. Bradley et al (1999) assessed the relationship between EE and environmental attitudes of high school learners of Texas, USA. The study reported a positive correlation between higher scores in EE and enhanced environmental attitudes among students. In Mexico, an empirical study using qualitative data correlated EE to ecological knowledge positively among middle school learners (Ruiz-Mallen et al., 2009). In New Haven, Connecticut, third and fifth grade students showed enhanced environmental awareness after an open space EE program was initiated according to Fisman (2005). Elementary school student-teachers of Turkey showed improved attitude towards the four dimensions of EE (knowledge of environmental challenges individual responsibility to the environment, general attitudes towards environmental solution and problems) following enhanced awareness on the concept (Ozden, 2008).

Despite these positive reports on the correlation of EE and environmental awareness, a number of studies did not establish any relationship between the two aspects. A study by DeChano (2006) investigating EE and environmental knowledge among high schoolers of USA, Switzerland, England and Chile did not find any significant relationship between EE and resultant environmental attitudes. In Israel, there was no significant correlation between EE and environmental behaviour (Negev et al., 2008). However, the impact of EE programs examined by Israeli out-of-school environmental associations established an enhanced sensitivity to human-environment interrelationships with limited cognitive domain on environmental issues (Goldman et al., 2013).

Schools have been evaluated for their role in promoting environmental awareness and attitudes. A study by Coertjens et al. (2010) in Flanders region of Belgium is a case example. The study concluded that, “schools in which science is taught in a more hands-on manner are associated with higher student environmental awareness whilst environmental learning activities are associated with more pro-environmental attitudes amongst students” (Coertjens et al., 2010, p. 497). Environmental responsibility towards a sustainable environment was enhanced according to Lin and Shi (2014) in a study correlating school and individual-related environmental literacy determinants in USA and Canada. The authors emphasized that a deeper sense of responsibility to the environment is inculcated following EE at school. Schools cultivate creative problem solving skills among learners through EE, which prepares them for the current environmental challenges they face in their daily life. Huang et al. (2019) as well as Karpudewan and Roth (2018) confirmed this supposition among primary learners since EE improved and advanced their reasoning capacity and ability to make evidence-based decisions on various environmental issues.

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Most studies evaluating the effects of school EE and environmental literacy are conducted in developed countries as observed by Edsand and Broich (2019). There are limited empirical studies investigating this aspect in developing countries and emerging economies. A case example is a study by Kim and Hamdan Alghamdi (2019), which examined the science education reforms among secondary school girls of Saudi Arabia that have incorporated EE. The authors concluded that EE has the capacity to reform education such that the metacognitive learning orientation, knowledge and attitude of the girls in science education and practice is improved. Similarly, extra-curricular environmental learning in primary schools of Cote d'Ivoire enhanced environmental awareness and attitude towards environmental issues among learners according to Borchers et al. (2014). An Indonesian study established a positive correlation between EE and student knowledge but not their resultant environmental awareness and attitudes (Haryono et al., 2014). Children from rural Madagascar who had prior exposure EE showed enhanced knowledge and positive attitudes on the matter compared to those who did not (Rakotomamonjy et al., 2015). In this chapter, the gap between this aspect in developed and developing nations will be evaluated by exploring the challenges encountered during EE delivery.

These discussed empirical studies show the existent of a conflict between EE as a tool to enhance knowledge and attitudes on the environment as well as the resultant behaviour to this subject. A number of documentations support the ideology that EE raises awareness and concerns on environmental matters but these do not necessarily translate to behaviour change (Bamberg & Moser, 2007; Zsoka et al., 2013). Other researchers have supposed that values and attitudes are drivers for action though their effectiveness to altering behaviour is questionable (Marjaine et al., 2011). There is however consensus that pro-environmental attitudes and EE are interrelated and strengthen each other by motivating information-seeking on environmental problems. Among learners at young and adult age, EE was a crucial stimulant to awareness of environmental probes in Germany and Finland (Asunta, 2004) as well as in Canada (Michalos et al., 2009). In addition to internal factors of environmental literacy defined by its domain components (Table 1), external factors such as traditions, pressures and norms transmitted by the social environment also influence pro-environmental behaviours and actions (Zsoka et al., 2013). These divergent dispositions of EE and its resultant impact present a challenge in its implementation as discussed in the following subsection.

## **CHALLENGES OF EE DELIVERY**

### **Lack of Professionalism**

A number of challenges emerge during the delivery of EE. One of the commonest bottleneck is professionalism flaws that are either implicit or explicit. It is argued that EE programs should be well delivered and conceived, that experts working in them should specialize in pedagogy and that programming and professional development of the program should be improved using evidence-based research (Marcinkowski, 2009). Although the milestones realised in developing EE since the 1990s have enhanced professional programming and development, the growth is not yet optimal. For a long time, EE has been criticized as being advocacy oriented and presenting messages laced with emotionalism, despair, misinformation and hype as Marcinkowski (2009) highlighted. These criticisms raise the uncertainty of EE particularly in the United States. An Independent Commission on Environmental Education (ICEE, 1997) criticized EE as weak in economics and science as well as controversial since it did not adequately equip learners



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with skills to understand the trade-offs when dealing with contentious environmental problems. The criticism questioned the credibility of ill-prepared EE providers, the use of superficial and inaccurate materials, the program's advocacy practices and limited programs. In justification of this view, Salmon (2000) claimed that the ICEE report was an unbiased viewpoint on its guides and materials but did not assess the broadside of EE. The lack of professionalism in delivering EE resulted to collaboration among groups of experts such as the NAAEE, Environmental Education and Training Partnership (EETAP) and US Environmental Protection Agency (EPA) to develop a set of guidelines for such programs (NAAEE, 2004). These guidelines are not reconciled up-to-date and remain contentious among EE experts (Zsoka, 2013). In Nigeria for instance, EE is still associated with activism by non-governmental and international organizations and its implementation in mainstream educational sector remains non-objective despite its good intentions (Erhabor & Don, 2016).

### **A Poor Interconnection of EE and SD**

A second challenge is the complex relationship between EE and education for sustainable development (ESD). The initial guidelines on EE included economics and sustainability as content areas. However, ESD scope is intricate since it is coupled with its complex interrelationships with technological, economic, social and environmental demands and issues. Additionally, the involvement of multidisciplinary experts in addressing education for sustainability has made it difficult to agree on a way forward in reconciling these concepts. The recognition of a document titled, "Environmental education for sustainable societies and global responsibility" by the NAAEE resulted to an emphasis on sustainability within the UN (UNESCO) rather than EE (Marcinkowski, 2009). It is from this imbalance that it has been difficult to interrelate EE and ESD. Case studies of Denmark and Sweden by Breiting and Wickenberg (2010) pointed the difficulty in integration EE methodologies to the three dimensions of SD especially during pedagogical training. Some authors argue that ESD has its roots from EE (Disinger, 1983) while others claim that the two serve in a similar capacity (Sato, 2006). Although EE has a longer history compared to ESD that emerged with the wave of SD, the latter has a broader outlook encompassing social, economic and technological goals while EE is limited to environmental issues (Marcinkowski, 2009). As such, the challenges that emerge in linking the two aspects can be summarised into three. These include: 1) to what level does EE follow the ESD concepts and seek to address issues related to basic literacy, healthcare and poverty and 2) to what level do proponents of the two concepts believe that ESD is superior compared to EE. Lastly, 3) to what extent do supporters of ESD agree that its focus is broad and addresses issues of biodiversity, environmental quality and natural resource better than EE. These issues remain contentious and are major hindrance to optimal delivery of EE programs.

### **The Climate Change Challenge**

A third challenge in the delivery of EE is the climate change issue. The national evaluation of professional needs in environmental literacy recommended that climate change is an essential content area. However, climate change concepts have exceptional pedagogical and methodological challenges to EE learners as Marcinkowski (2009) highlighted. Climate change on one hand is the predominant environmental crisis that needs societal attention and education following the increased loss of biodiversity, ozone depletion, population growth, pollution and resource depletion. On the other hand, EE serves to streamline behavioural patterns and lifestyles through training and educational programmes to overcome

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the aforementioned environmental challenges. The extent to which EE is applicable in climate change adaptation and mitigation is therefore the challenge. For instance, East African countries of Kenya, Uganda and Tanzania have registered progress in inducing EE in the region but the challenge of harsh weather conditions exacerbated by climate change have reversed the gains (Johnson-Pynn & Johnson, 2005). This supposition is because of the multifaceted, large scale and interrelated nature of climate change, which poses the most potent environmental threat of interest in EE compared to the existent ones. Therefore, three issues can be deduced from this challenge

1. To which level are environmentalists willing to cooperate with EE experts towards common goals for climate change adaptation and mitigation?
2. To which level are EE experts ready to engage collectively or individually with other experts that have a common goal of addressing climate change and its resultant effects?
3. To what extent are governing and policy formulating agencies who have an appreciation of EE willing to incorporate it during decision-making on responses to climate change?

To address these issues, cooperation of EE experts and climate change advocates in multiple disciplines is essential coupled with knowledge sharing and participative decision-making (Darnton, 2008; Marcinkowski, 2009).

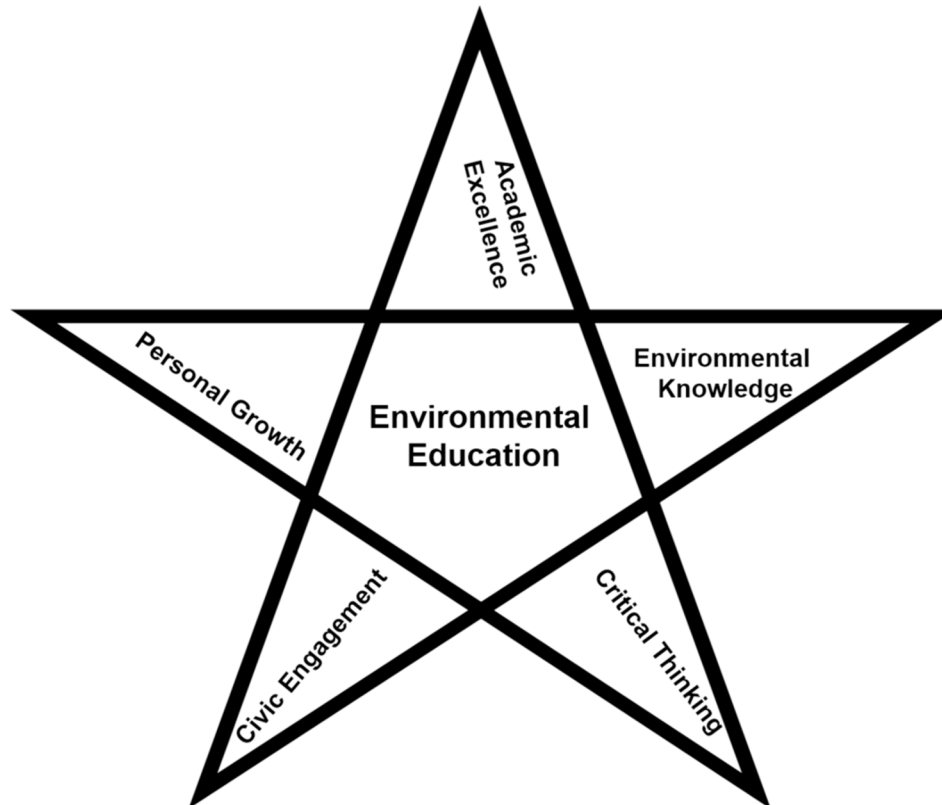
### **The Effects of EE on Environmental Sustainability**

Stanford University experts (2013) have documented the impacts of EE in relation to environmental sustainability extensively in a review. Apart from enhanced awareness of the environment, a number of positive effects resulted from EE. These are as summarized in Figure 1. The positive effects including improving academic excellence enhanced critical thinking and reasoning skills, life building skills and personal growth. Additionally, learners were shown to be better civic engagers with good environmental behaviours. Ardoin et al. (2018) in a review study provided evidence that alluded to EE learning as a transformative learning opportunity to promote environmental sustainability. Similarly, Stern et al. (2014) demonstrated that EE learning instils confidence, skills, behaviour, motivation and better academic performance among learners towards sustainable environmental practice. Stern et al. (2011) observed that EE enhances interest and passion to resolve environmental issues, which is the mainstay of environmental sustainability. Learners with EE skills were more likely to engage in community clean-ups, waste recycling and water reuse activities compared to those without (Harness & Drossman, 2011).

Apart from equipping learners with knowledge to deal with environmental issues, EE learners can synthesize complex information through decision-making and critical thinking to produce long-life problem solvers and active community participants (Ernst & Monroe, 2004). Additionally, it offers motivation and personal responsibility to address current environmental issues such as water management (Stern et al., 2011) pollution and climate change (Jennings et al., 2005). The following section discusses the effects of EE on environmental sustainability using named case studies.

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*Figure 1. Effects of environmental education to learners in relationship to environmental sustainability.  
Source: the authors*



## **CASE STUDIES**

### **Effects of EE in Botswana**

The Botswana government made EE compulsory in secondary schools in 1994 following the revision of the country's policy of education (Botswana Government, 1994). The move was in response to fighting environmental degradation that has worsened and is under pressure because of improved economic development and growth of the country's population (Silo, 2015). From this initiative, EE has enabled transmission of skills, knowledge and values among the youth, which has resulted to a protective attitude in their use of environmental resources. According to Kanene (2016), EE has enhanced personal responsibility and commitment to conservation practices as motivated action to enable ethics and values of environmental sustainability. An empirical study by Sundar (2010) in Botswana showed that through EE, learners have better awareness of their environment in addition to positive values and attitudes that are requisite in ESD. Mogensen and Schnack (2010) explained the role of EE in Botswana as,

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*“the action competence approach points to democratic, participatory and action-oriented teaching–learning that can help students develop their ability, motivation and desire to play an active role in finding democratic solutions to problems and issues connected to sustainable development that may even consist of the aforementioned tendencies, ideas and agendas” (p. 62).*

Their sentiments are also shared by Kanene (2016) who reported improved perceptions of environmental issues and a positive attitude towards their solutions after the introduction of EE in secondary schools of Botswana. The use of civic clubs to promote EE in Botswana has also been shown to promote environmental stewardship by transforming attitudes and knowledge towards resolving environmental issues (Ajiboye & Silo, 2008).

Although these effects have been realized and are supported by policies, integration of EE in the mainstream education system has faced its challenges in Botswana. According to Velepini (2016), integration of EE failed to engage community who are key stakeholders and have valuable contribution. Consequently, the acceptance of EE learners by and in involvement of community environmental issues remains a contentious issue characterized by tension, as both parties perceive each other as less knowledgeable. A case study by Velepini et al. (2017) in secondary schools of Okavango Delta region of Botswana raised similar issues citing that indigenous knowledge through community participation was not incorporated in EE and if this can be done to what extent and of what relevance would it be. The authors also cited limited education resources such as the lack of transport means to cover outdoor learning activities stipulated in the EE curriculum and the translation of skills learnt to hands on practice. Educators particularly teachers who deliver EE curriculum are insufficiently equipped and the use of English language for communication of environmental issues was also a limiting factor in optimizing the effectiveness of EE in rural Botswana as noted by Velepini et al. (2017). Despite these challenges in greening the curriculum, Botswana has made great strides in EE adoption compared to other developing countries of sub-Saharan Africa (Kanene, 2016; Velepini et al., 2017).

### **Effects of EE in Colombia**

Compulsory education for children aged between 5 and 15 years was introduced in Colombia in 1991. This move was aimed at; 1) expanding public service provision, 2) raising the enrolment figures in secondary schools and 3) expanding learning capacities in schools (Edsand & Broich, 2020). The efforts resulted to increased enrolment in schools by 20% in a period of two decades though wide discrepancies in the quality of education occurred in private and public schools as well as rural and urban areas (Faguet & Sanchez, 2014). A number of national efforts have supported the incorporation of EE in the education system of Colombia. An example is the recognition of EE as a tool to protect the environment and gain knowledge on its related issues by the Colombian national constitution since the early 1990s (Sauvé et al., 2005). A collaboration by the ministries of education and environment have outlined the goals and funding alternatives to facilitate EE delivery. Regionally initiatives such as the school environmental projects (PRAE), the inter-institutional technical committees of EE (CIDEA) and citizen projects for EE (PROCEDA) enable the delivery of EE at municipality level (Faguet & Sanchez, 2014).

Through these initiatives, a number of impacts have been realized among learners. According to Faguet and Sanchez (2014), EE has enhanced awareness on environmental problems among learners, instilled responsible environmental behaviour towards SD including the use of renewable energy and application of EE knowledge to resolve environmental issues. Another study by Youkhana et al. (2018)

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highlighted that EE cultivates the creation of environmental activists who enforce ESD ideologies through community participation and action-oriented problem-solving skills. Jefferson et al. (2016) observed that EE resulted to positive attitudes and perceptions of the environment towards SD and hence the motivation to use ecosystems and protect them sustainably. These achievements have been realized despite the challenges of questionable quality of EE in the country, spatial inequities in EE delivery, the non-involvement of community members in streamlining the curriculum and transformation of acquired knowledge to practice. These problems are attributable to the sluggish development of EE in the country and its undervalued impact towards ESD as Youkhana et al. (2018) noted.

## **CONCLUSION**

This book chapter explores the history, challenges of delivery and impacts of EE towards SD. It is evident that EE is necessary in contemporary society that faces a myriad of environmental issues including pollution, land degradation, climate change and biodiversity loss, which are worsened by the growth of population and increased economic practices. EE plays a role in promoting awareness, knowledge, positive values and attitudes towards the environmental and environmental issues. Ultimately, the novelty in this chapter revolves around how the EE concept is a powerhouse to SD since it equips learners to be action-oriented and responsible environmentalists. These positive effects have been proven in a number of empirical studies and in case studies of Botswana and Colombia in the chapter. Issues of limited human capacity, questionable professionalism, limited resources and poor transformation of knowledge to practice hinder optimal benefits of EE. To alleviate these issues, the need for more support of EE programs through extensive research, funding and involvement of many disciplines is essential to reconcile contentious issues. Additionally, the involvement of community among other stakeholders during integration of EE programs is requisite to enhance the acceptance of learners while practicing environmental activism and projects within the society. Therefore, the book chapter emphasizes the need to raise awareness on EE and implement it as part of the mainstream education just as is the case in Botswana and Colombia. This will enhance its application in resolving SD related problems and in specific, those associated with environmental conservation.

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