SUSTAINABLE MOVEMENT:

DEVELOPING A MOBILE ENVIRONMENTAL EDUCATION CURRICULUM FOR RURAL SCHOOLS IN NAMIBIA

By: Emily Dunham, Benjamin Hawks, Chandlor Lyles, Amy Misera

WPI

EduVentures

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Sustainable Movement: Developing a Mobile Environmental Education Curriculum for Rural Schools in Namibia

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Submitted by:
Emily Dunham
Benjamin Hawks
Chandlor Lyles
Amy Misera

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Sponsoring Agency:	EduVentures Trust
Onsite Liaison:	Corris Kaapehi, EduVentures, Program Manager
Project Advisors:	Professor Holly K. Ault Professor Thomas B. Robertson

ABSTRACT

The national curriculum of Namibia includes environmental education in Grades 1-4 only, despite research that environmental education is more effective in secondary schools. The goal of this project was to assist the EduVentures Trust with the integration of environmental education into rural Namibian secondary schools through the development of interactive SMART technology lessons for the EduMobile project – a mobile classroom truck that travels to rural schools to educate learners about environmental topics. Our assessment of Namibia's flawed environmental education curriculum revealed that environmental education could be improved through the implementation of hands-on learning – the method preferred by Namibian learners.

ACKNOWLEDGEMENTS

The completion of our project would not have been possible without the guidance, insight, and participation of many individuals and organizations.

Most importantly, we would like to thank the EduVentures Trust for allowing us the opportunity to work with them and participate in the EduMobile project. Corris Kaapehi, Maria Johannes, Tauno Iipinge, and Sophia Nuuyni were immensely helpful throughout the project and it was a pleasure to work with them. We are grateful that they provided us the opportunity to learn more about the rural communities of Kavango and experience all that Namibia has to offer.

For their insight into the education system, environmental education, and environmental problems in Namibia, we would like to thank Stephanie Bradley, Victoria Endjala, Alex Kanyimba, Linna Nantinda, and Vilho Absalom Vilho for answering our questions and sharing their experiences. Our research would not have been possible without their help and we are very grateful for their participation.

We would like to thank the staff of Maria Mwengere Secondary School and Martin Ndumba Combined School for allowing the EduMobile program to come to their schools. A special thanks goes to the learners of both institutions. Their energy and enthusiasm while participating in the program was encouraging and the pride they have for their education was inspiring. We are thankful for the opportunity to meet and work with them.

Finally, thank you to our advisors, Professor Holly Ault and Professor Thomas Robertson, for their guidance, insight, and support throughout our project. Their assistance in research and writing helped make our project possible.

EXECUTIVE SUMMARY

Communities in the Kavango region of Namibia suffer daily from the effects of environmental problems such as excessive rainfall, which has limited residents' access to food, shelter, and healthcare and resulted in school closings, impassable roadways, and agricultural damage (Government of the Republic of Namibia, 2009; Niikondo, 2011). Education about these problems is limited because of inadequate environmental education in Namibia caused by ill-informed teachers, instruction in Grades 1-4 only, a lack of environmental solutions, and socioeconomic disparities within communities (Campbell, 2009; Ministry of Basic Education, 2008; Pande, 2001). Many organizations have sought to address the flaws in environmental education, but successful implementation in Namibian schools has been limited. The EduVentures Trust in Windhoek, Namibia developed "EduMobile" – an initiative designed to bring experiential learning-based environmental education activities to rural Namibian schools via a mobile classroom truck. To support this initiative, EduVentures required lesson plans and activities for use on the EduMobile truck. Through the determination of critical environmental problems in Kavango and the assessment of Namibia's environmental education curriculum, this project sought to assist EduVentures in promoting knowledge of critical environmental problems in rural Namibian communities through the development of SMART technology lesson plans.

METHODOLOGY

To accomplish our project goal, we established four research objectives:

1. *Identify the critical environmental problems in Kavango.*
2. *Evaluate how the current environmental education curriculum in Namibia addresses the critical environmental problems.*
3. *Develop lesson plans and engaging hands-on activities focusing on critical environmental topics for use in rural Kavango classrooms via the SMART Exchange website.*
4. *Test the lessons in rural schools.*

To collect information regarding the critical environmental problems in Kavango, we reviewed Namibian government reports, referenced local Kavango news articles, and interviewed Namibian environmental experts. The collection of this information highlighted the most important topics for learners in Kavango to learn about. We evaluated the inclusion of critical environmental problems in the Namibian secondary school curriculum through the assessment of Namibian curriculum textbooks and communication with environmental education experts. Communication with these experts, along with literature review, also provided insight into the best practices in environmental education. This information enabled

us to develop biodiversity, climate change, heritage, and sustainability lesson plans for use in the EduMobile program. These lessons were tested during the EduMobile visits at two Kavango secondary schools. We observed their implementation and collected data regarding learners' impressions of the program via classroom surveys.

Through our observation of the EduMobile program, during the testing of our lessons, we identified what worked well and where it could be improved. Using this evidence, we collected significant information about environmental education in Namibia and the EduMobile program.

FINDINGS

Our findings fell into three categories: the environmental problems in Kavango, complicated rural conservation, and the EduMobile program.

ENVIRONMENTAL PROBLEMS IN KAVANGO

1. **Learners in the Kavango region should be educated about five significant environmental problems – deforestation, climate change, human-wildlife conflict, pollution, and land degradation – because these problems greatly impact the lives of Kavango community members.** Analysis of Namibian government reports, review of local Kavango news articles, and communication with Namibian environmental experts identified deforestation, climate change, human-wildlife conflict, pollution, and land degradation as the most apparent environmental problems affecting Kavango communities.

COMPLICATED RURAL CONSERVATION

2. **Conservation of natural resources in rural Namibian communities is challenging because the benefits are inadequately communicated to rural communities and communities lack sufficient income.** Learners participating in the EduMobile program said that explaining environmental conservation to their parents and community is challenging because these individuals depend on natural resources to sustain their livelihoods.

3. **Many Kavango residents are unaware of the damage they are causing to their environment through their timber usage.** As the largest producer of wood carvings in Namibia, Kavango community members use an unsustainable amount of wood annually. Studies of the Kavango wood industry revealed that many community members are improperly educated on the values of this resource.

ENVIRONMENTAL EDUCATION IN NAMIBIA

4. **Focusing rural environmental education on local problems is an effective way to engage Namibian learners because it improves their comprehension of environmental problems and ability to connect the information to their everyday lives.** Namibia is a vast country with many diverse environmental problems. Namibian environmental education experts agree that focusing environmental education on local problems facilitates learners' ability to connect to the material and identify what they can do to address environmental problems in their communities.

5. **Environmental education in the Namibian school system could be improved by consistent implementation, a more extensive inclusion of important environmental topics, and wider accessibility.** Communication with environmental education experts and students at the Polytechnic of Namibia highlighted the inadequacy of Namibia's environmental education system because of poor implementation nationwide and the prevalence of environmental education centers inaccessible to many schools. A review of the Namibian secondary school curriculum identified the lack of inclusion of critical environmental problems as a serious problem.

6. **Although many Namibian learners and educators prefer hands-on learning because it engages them, its implementation in the Namibian school system has been limited because of poor teacher training and financial limitations.** Namibian education experts, teachers, Polytechnic of Namibia students, and EduMobile program participants identified hands-on, interactive learning as the preferred method for Namibian learners. Poor teacher training on interactive methods and the financial restraints of Namibian schools prevent this method from being adequately implemented.

IMPLEMENTATION OF THE THE EDUMOBILE PROGRAM

7. **The existing EduVentures lessons were ineffective because of their length, excessive text, and lack of interactive activities. The new lessons are easily comprehensible and effectively educate the learners.** The length, text density, and limited activities in the previous EduMobile presentations lessened EduVentures' ability to effectively educate Namibian learners. Learners demonstrated exceptional understanding of the material presented in the new SMART board lessons through correct responses to content-based survey questions.

8. **Learners learn better using the SMART Board because it uses helps them to learn through pictures and interactivity rather than note-taking.** EduMobile program participants indicated that using the SMART Board positively affected their learning by making the

material fun, increasing their understanding, and communicating material better than a traditional chalkboard.

9. **The SMART lessons' effectiveness decreases after the first hour because learners stop paying attention and enjoying the material.** Classroom observations during the EduMobile lessons showed that as the lesson progressed, many learners lost interest in the material and stopped paying attention. Following the hour mark, the number of learners paying attention steadily decreased. It appears that long lessons bored the learners and caused them to not pay attention, rendering the lessons ineffective.

10. **Learners enjoy the EduMobile program because it teaches them new things in a fun, interactive way.** All thirty-five participants in the EduMobile program said that they enjoyed the program and had a lot of fun. Many indicated that they enjoyed the program because they learned new information and saw things they had never seen before.

11. **Instruction on environmental topics in Namibian schools would be supported by learners and teachers because it increases learners' environmental skillset and inspires them to protect the environment.** Students from the Polytechnic of Namibia, EduMobile program participants, and Namibian educators indicated that the inclusion of more environmental education in Namibian schools would be welcomed and would significantly benefit Namibian learners.

While this study was not without its flaws, the literature review, interviews with experts, and program observations we completed enabled us to develop credible findings regarding the environmental problems in Kavango, complicated rural conservation, environmental education in Namibia, and the EduMobile program.

RECOMMENDATIONS FOR THE EDUVENTURES TRUST

Based on our findings, we have identified several key actions that the EduVentures Trust could take to improve their implementation of rural, secondary-school environmental education through the EduMobile program.

1. **We recommend that the EduVentures Trust makes their Biodiversity, Climate Change, Heritage, and Sustainability lessons specific to the region they are visiting.** By providing learners with examples of environmental problems that directly affect their lives, EduVentures will improve the efficacy of their education by providing learners with information they can relate to.

2. **We recommend that the EduVentures Trust instructs learners on the benefits of environmental conservation.** By educating learners on the benefits of environmental

conservation, EduVentures will provide learners with the tools they need to bring conservation into their communities, enhancing the lasting impact of the EduMobile project.

3. **We recommend that the EduVentures Trust invites learners to use the SMART Board more often to enhance the EduMobile experience.** Participants in the EduMobile program responded positively to the usage of the SMART Board. By providing learners with more opportunities to use the board, EduVentures will harness the enthusiasm they have for the technology and translate into eagerness to learn environmental topics.

4. **We recommend that the EduVentures Trust limits the amount of time devoted to lessons by breaking them up throughout the day.** By breaking up the lesson throughout the day and limiting the amount of time for lessons to smaller periods, EduVentures will better engage the learners and increase the effectiveness of the program.

5. **We recommend that the EduVentures Trust provides supplementary materials for schools to use year-round.** By developing supplementary materials for schools to use throughout the year, EduVentures could provide environmental education to more learners across Namibia, even outside of the EduMobile program.

6. **We recommend that the EduVentures Trust completes an extensive survey of learners across the country regarding their experiences with environmental education.** For EduVentures to have the most significant impact on environmental education in Namibia, they must understand the critical areas their program should address. A survey of learners nationwide would provide key insight into how EduVentures can improve Namibian environmental education.

The implementation of these recommendations could improve EduVentures' impact and the overall educational experience of learners participating in the EduMobile program. We hope that our research will help EduVentures improve environmental education in Namibia and enable the EduMobile program to better engage learners and inform communities on environmental problems.

AUTHORSHIP

EMILY DUNHAM

Emily served as the primary author for the report, writing several major sections and revising sections written by other team members. She also transcribed all interviews and organized data. Emily completed observations during school visits and developed the Biodiversity lesson plan for the EduVentures Trust.

BENJAMIN HAWKS

Benjamin served as a major editor for the report by checking for errors during the report reviews. He also evaluated Namibian textbooks and wrote several sections of the report, contributing significantly to the introduction, methodology, and conclusion chapters. Benjamin completed observations during school visits and developed the Sustainability lesson plan for the EduVentures Trust.

CHANDLOR LYLES

Chandlor served as the primary interviewer for all in-person interviews and facilitated communication with interviewees. She also wrote several sections of the report, contributing significantly to the introduction, background, and methodology chapters. Chandlor completed observations during school visits and developed the Heritage lesson plan for the EduVentures Trust.

AMY MISERA

Amy provided extensive technical support in developing the SMART lessons and multimedia components for reports and presentations. She also evaluated Namibian textbooks and wrote several sections of the report, contributing significantly to the background, methodology, findings, and conclusion chapters. Amy also completed observations during the school visits and developed the Climate Change lesson plan for the EduVentures Trust.

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LIST OF ACRONYMS

CCF – Cheetah Conservation Fund

EPA – Environmental Protection Agency

GRTC – Gobabeb Research & Training Centre

IWB – Interactive White Board

ME – Ministry of Education

MET – Ministry of Environment and Tourism

NaDEET – Namib Desert Environmental Education Trust

NARREC – Namibia Animal Rehabilitation Research & Education Centre

NEEC – Namutoni Environmental Education Center

NEEN – Namibia Environmental Education Network

NNF – Namibia Nature Foundation

NWRA – National Water Resource Authority

TEAL – Technology-Enabled Active Learning

UNESCO – United Nations Educational, Scientific and Cultural Organization

UNICEF – United Nations International Children's Emergency Fund

WPI – Worcester Polytechnic Institute

CHAPTER 1 – INTRODUCTION

Global deforestation and habitat destruction have increased significantly in recent years (Saylan & Blumstein, 2011). In Africa, forests are being destroyed at twice the global average (Doyle, 2008). Namibian forest destruction occurs at four times the rate of all other middle-income countries combined (World Bank, 2009) and at ten times the global average (World Bank, 2012). Residents of the Kavango region in northeastern Namibia suffer daily from the effects of environmental problems. In the last decade, excessive rainfall has caused severe flooding, resulting in school closings, impassable roadways, limited access to healthcare, and agricultural damage (Government of the Republic of Namibia, 2009; Niikondo, 2011). The destruction of Kavango trees reduced the earth's ability to remove greenhouse gasses from the atmosphere, contributing to global warming (Scheer & Moss, 2012). The excessive rainfall in Kavango is believed to be an effect of global climate change (Government of the Republic of Namibia, 2009).

To alleviate environmental problems such as deforestation and climate change, individuals must make a commitment to live sustainably, but many individuals are unaware of how to do so because of a lack of education about environmental problems (Potgieter, 2011). According to the U.S. Environmental Protection Agency, environmental education is a process that encourages individuals to explore environmental issues and improve the environment through problem-solving actions (EPA, 2012). Around the world, environmental education faces four main barriers: ill-informed teachers, limited learner exposure, a lack of environmental solutions, and socioeconomic disparities within communities (Campbell, 2009; Ministry of Basic Education, 2008; Pande, 2001). Focusing environmental education on local problems increases learners' comprehension of environmental topics and makes education relevant. Developing relevant environmental education in rural communities like those in Kavango is particularly challenging because environmental problems like climate change often seem abstract to rural learners (Pande, 2001; Tarr, 1997) and rural communities are often hesitant to participate in conservation because flawed efforts in the past have punished and evicted native people (Bollig, 1998; Odendaal, 2007). These challenges, in addition to other barriers such as inadequate funding, contribute to the critical flaws in Kavango's environmental education (Loubser, 1997).

Environmental organizations around the world have sought to repair flawed environmental education. India sought to address the overexploitation of natural resources through the addition of environmental education to the national curriculum (Sarabhai, 2002). Yemen introduced environmental education into its curriculum through "Water Education" – a program to educate learners about how and why to conserve water (Alwan, 2013). In Namibia, the Namib Desert Environmental Education Trust (NaDEET) uses interactive, experiential learning techniques to increase learners' understanding of local environmental problems (NaDEET, n.d.).

Chapter 1 – Introduction

While programs such as NaDEET have been successful, environmental education in Namibia still faces two main challenges. First, current programs fail to adequately integrate environmental education into the national curriculum. NaDEET's programs have limited reach, as they only happen at the NaDEET Centre (NaDEET, n.d.). This limitation prevents rural schools from participating and only provides environmental education to schools that can afford to travel to the center. In Namibian public schools, environmental education is only included in the curriculum for Grades 1-4 (Ministry of Basic Education, 2008), despite research showing that environmental education is more effective in secondary school (Goussia-Rizou & Abeliotis, 2004). Second, many Namibian schools cannot provide sufficient education because of a lack of resources (Ministry of Basic Education, 2008). Implementation of financially-feasible environmental education into the school curriculum outside of Grades 1-4, preferably in secondary school, would produce more effective environmental education in Namibia.

Inspired by the efforts of other environmental education programs, organizations such as the EduVentures Trust, an environmental education company affiliated with the National Museum of Namibia in Windhoek, have designed their own environmental education programs. To bring experiential learning-based environmental education to rural Namibian learners, the EduVentures Trust has developed "EduMobile" –a mobile classroom truck. To support this initiative, EduVentures required lesson plans and activities.

This project was designed to assist EduVentures in promoting knowledge of critical environmental problems in rural Namibian communities through the development of interactive SMART technology lesson plans. The main objectives were to:

1. Identify the critical environmental problems in Kavango.
2. Evaluate how the current environmental education curriculum in Namibia addresses the critical environmental problems.
3. Develop lesson plans and engaging hands-on activities focusing on critical environmental topics for use in rural Kavango classrooms via the SMART Exchange website.
4. Test the lessons in rural schools.

Through the implementation of this phase of the EduMobile project, we hope environmental education will become more prevalent in Namibia's curriculum and that learners are better informed about how to protect their environment now and in the future.

CHAPTER 2 – BACKGROUND

In this chapter, we will illustrate how experiential learning techniques can help alleviate problems faced by environmental education initiatives in rural communities. We will examine four subjects:

1. Environmental problems in Kavango
2. The history of flawed conservation efforts in Africa
3. The challenges and best practices in environmental education
4. The advantages of experiential learning in environmental education.

2.1 ENVIRONMENTAL THREATS IN KAVANGO

Kavango East and Kavango West are located in northeastern Namibia. See Figure 2.1. These regions are known for their subtropical climate, rivers, woodlands, and grassy plains – an environment that differs greatly from the arid climate that characterizes 90% of Namibia (Etosha National Park, 2015; Tadross & Johnston, 2012).

FIGURE 2.1: MAP OF THE 14 REGIONS IN NAMIBIA

Adapted from (Commons, 2007)

This unique environment creates several environmental problems for Kavango communities:

Water Shortage. Communities in Kavango depend primarily upon water resources to support their crop cultivation – a large part of their economy. In Kavango East and Kavango

West, these resources come almost exclusively from the Okavango River (Figure 2.2). With 80% of the region's population living within 5 kilometers (3 miles) of the river bank, the Okavango River supports the highest population of rural people in Namibia (Tarr, 1997). The Okavango River is one of the largest in southern Africa, spanning over 1000 kilometers (621 miles). As a perennial river, the Okavango and its resources support the livelihoods of river basin community members year-round. Uses of the river include domestic utilities, mining, subsistence farming, and large-scale farming. The basin communities depend heavily on farming, resulting in more than 50% of the annual Okavango usage coming from crop irrigation (IWRM, 2010).

Conservationists expect the pressure on the river's resources to rise in the future because of an increase in economic needs in the basin communities (Pinheiro et al., 2003). Conservative use of the Okavango River and its resources is critical for the social, economic, and environmental sustainability of the basin in the future (Conservation Magazine, 2003).

FIGURE 2.2: THE OKAVANGO RIVER

Excessive Rainfall. Recent excessive rainfall has resulted in severe flooding in Kavango. Because local populations live so close to the river, this flooding poses a serious threat for Kavango communities. In 2009, flooding left 2,000 people displaced and with limited access to food, water, and shelter (Government of the Republic of Namibia, 2009). Due to the flooding, communities experienced impassable roadways, stranded livestock, and limited access to healthcare and sanitation facilities. This catastrophic flooding affected almost 90% of the region's population (Government of the Republic of Namibia, 2009), resulting in school closings, disruption of business, and agricultural damage (Niikondo, 2011). The Namibian Government blames climate change for this excessive rainfall (2009).

Deforestation. Forests in Kavango are disappearing rapidly as a result of agricultural expansion, forest product harvesting, and forest fires. Kavango communities are home to a large wood carving industry that many experts cite as one of the largest contributors to deforestation in the region (Travel News Namibia, 2012). This deforestation causes increased

groundwater, contributing to flooding in the region. Namibian Government also believes deforestation contributes to the effects of climate change in the region (2009).

The environment in Kavango experiences many challenges and has many unique features that require conservation. Community vigilance and careful conservation are important to preserve Kavango's resources.

2.2 FLAWED CONSERVATION IN AFRICA AND A NEW APPROACH

In Africa, outside conservation organizations have tried to address environmental threats that they know little about. To protect and conserve the environment, these organizations sometimes cause more damage, harming the local people and even the environment.

Outside conservationists often fail to consider the opinions and needs of local communities. In Tanganyika, the Masai experienced serious problems with conservationists. In 1940, international conservationists widely supported the decision to make the Serengeti – the ancestral land of the Masai – a national park (MacKenzie, 1989). In 1959, British colonial government evicted the Masai from the Serengeti, claiming that they were over-grazing protected land (Poole, 2006). By evicting them for "conservation," the government undermined the Masai's livelihood (MacKenzie, 1989). This event illustrated the problem of governments in Africa focusing on animals and land rather than people.

Several regions of Namibia have experienced similar problems. For decades, external authorities have inaccurately claimed that the grazing cattle of the Himba tribe in the Kunene region caused the desertification of Namibian land (Bollig, 1998). When the Namibian government made plans to build a hydroelectric dam on the Kunene River to promote water conservation, it disregarded the Himba (Appiah & Gates, 2010). This dam would have flooded the Himba grazing lands (Hanes, 2008) and caused serious damage to their lifestyle (Bauer, 2001). The government chose to ignore those possibilities for the sake of conservation.

During the foundation of Etosha National Park in the 1950s, the native Hai//om people were evicted for the sake of conservation. While preserving the park's wildlife aimed to help Namibia overall, it left over 9,000 people homeless (Odendaal, 2007). Past misguided conservation efforts evicting native people have made many local community members hesitant to participate in conservation.

As community members have a great knowledge of their local environment, they can often contribute to environmental protection more effectively than external organizations (Tarr, 1997). Through collaboration with local communities, conservations achieved major environmental goals, such as the reduction of poaching in Namibia (Joyce, 2011). Namibia has one of the most successful communal-conservancy programs in the world, with 59 new conservancies registered from 2000-2010 alone. Communal-conservancy programs aim to

engage rural communities by allowing them to profit from wildlife conservation. In turn, the programs have led to a regrowth in national wildlife populations and more sustainable natural resource consumption (Louis & Denker, 2012).

Many Namibian conservancies give community members control over wildlife maintenance and tourism. In a *National Geographic* interview, Vengapi Tijvinda, a fifty-year-old Namibian woman, described her experiences with the flawed conservation efforts of the past. Tjivinda explained that through working with local conservancies, she was able to return to her former farming lifestyle and enjoy her life again (Lange, 2004). The appointment of community game guards has also promoted the active participation of rural community members and contributed to a significant decrease in Namibia's wildlife poaching (Tarr, 1997). Cooperation between community members and conservationists can allow for a balance of both parties' needs, promoting local culture and environmental conservation.

Working with individuals familiar with the environment and its challenges can be more effective than conservation efforts imposed arbitrarily by foreign powers. Informing local people about the problems their environment faces allows them to take protection of the environment into their own hands, which will be more likely to represent their environmental needs.

2.3 COMMON OBSTACLES TO ENVIRONMENTAL EDUCATION

Providing individuals with the tools to take control of their environment is one of the best ways to empower communities. Environmental education can be an important aspect of developing individual awareness of the threats their community faces and how these threats impact their lives, but it is insufficiently implemented worldwide. Four critical barriers contribute to the failure of environmental education:

Teacher Unfamiliarity with Environmental Subjects. Many teachers are unfamiliar with important environmental topics. Table 2.1 depicts the responses of educators in three international communities in a survey regarding their familiarity with climate change, deforestation, and environmental pollution – key global problems identified at the 2007 United Nations Climate Change Conference. These results show that fewer than half of the teachers surveyed were familiar with the problems identified as most important at the conference. Their unfamiliarity indicates a distinct gap between what is considered "important" and what is being relayed to learners by teachers (Campbell et al., 2009). Without a basic understanding of these subjects, educators are unable to draw connections between larger global issues and the problems faced by their local communities. When educators are unable to pass this information on, the community is not educated on the most important topics.

TABLE 2.1: EDUCATORS' FAMILIARITY WITH TOPICS OF CLIMATE CHANGE, DEFORESTATION, AND ENVIRONMENTAL POLLUTION
(Campbell et al., 2009)

Country	*Yes-Teacher was familiar*	*No-Teacher was not familiar*
U.S. Teachers (N = 54)	33 (61.1%)	21 (38.9%)
Bolivian Teachers (N = 63)	23 (36.5%)	40 (63.5%)
Turkish Teachers (N = 54)	16 (29.6%)	38 (70.4%)
Total Teachers (N=171)	72 (42.1%)	99 (57.9%)

Ineffective Learner Exposure to Environmental Topics. Namibian learners do not receive environmental education at the correct age to benefit from it. The National Curriculum for Basic Education developed by the Ministry of Education identifies the goal of Namibia's environmental education curriculum as providing learners with the scientific skills and knowledge necessary to maintain a well-sustained environment. While this goal has been established, Namibia only includes environmental education as part of its curriculum for Grades 1-4 (Ministry of Basic Education, 2008). Learners are receiving a minimal level of environmental education, and it exists at an age where they are unlikely to retain much of what they learn. Research shows that environmental education in secondary schools is more effective than environmental education in primary schools because learners are better able to retain information and act on it when they are older (Goussia-Rizou & Abeliotis, 2004). Implementing environmental education in the secondary school curriculum will provide learners with the skills necessary to protect the environment when they are more capable of taking action.

Not Providing Solutions. Environmental education in rural communities often faces challenges because the problems presented lack solutions and seem abstract to learners (Tarr, 1997). For example, to a learner living in a rural community like those in Kavango, where the village forest is used to support the extensive wood carving industry, deforestation can be incomprehensible. While deforestation may be a significant problem in the community, the learner may be unmotivated to address the problem if they are not given a means to fix it, since their community relies on that resource (Pande, 2001). Providing solutions to environmental problems in the environmental education curriculum would allow learners to comprehend what they are learning and would provide them with methods to apply what they learn in their communities.

Socioeconomic Disparities. In many regions, formal environmental education programs take place exclusively in expensive private schools. As a result, only those who are affluent are able to receive environmental education (Campbell, 2009). In rural communities, environmental education typically is not integrated into the school curriculum because of economic challenges. For example, the South African township of Philippi struggles with environmental education accessibility. As the largest producer of Cape Town's vegetables, Philippi's environment requires special attention and care (City of Cape Town, 2007), yet learners in Philippi do not have access to environmental education because of the community's high level of poverty (SAEP, 2013). Poverty-stricken communities such as Philippi are often unable to receive structured environmental education, causing a significant awareness gap between the upper and lower classes (Campbell, 2009).This gap contributes negatively toward the overall goal of environmental education, as it prevents a large portion of the community from receiving the knowledge and tools necessary to make informed decisions.

Namibia's environmental education also faces problems caused by socioeconomic differences. Two out of five Namibians live on less than $1.25 USD (14.59 NAD) per day (United Nations, 2010). Poor communities in Namibia struggle to provide school-age children access to quality education (UNESCO, 2014). Schools in low-income communities experience poor conditions and lack the facilities and resources that are available to the wealthier schools (Ministry of Basic Education, 2008). With such a large low-income population in the country, many schools in Namibia struggle with limited facilities and resources. Due to these limited resources, a large portion of the Namibian population does not receive education on important environmental problems and cannot make informed decisions about their environmental actions (Loubser, 1997).

Environmental education encounters many problems worldwide, especially in Namibia. Changes to the current curriculum are essential to ensure the success of future environmental education programs.

2.4 BEST PRACTICES IN ENVIRONMENTAL EDUCATION

Studies of the successes and failures of past environmental education initiatives have led to a set of best practices for environmental education. The curriculum should:

Develop Environmental Awareness. Successful environmental education works to develop a population with an awareness of and concern about the environment and the threats it faces. Environmental education aims to provide individuals with the tools and skills necessary to solve the current environmental problems and prevent the development of new problems (UNESCO, 1976). International organizations agree that environmental education should focus on developing awareness of the effect of "social, economic, political, and ecological" practices on the environment, providing opportunities for residents to receive the skills and knowledge

they need to protect their local environment through conservative and sustainable actions (Campbell et al., 2009).

The Namib Desert Environmental Education Trust (NaDEET) has successfully increased environmental awareness through *It's Time To* and *The Bush Telegraph*. These magazines cover topics such as recycling, climate change, energy efficiency, light pollution, and animals. Over the past ten years, *The Bush Telegraph* readership increased significantly, starting with 500 subscribers in 2003 and growing to 18,000 in 2013 (NaDEET, 2014). These magazines have successfully reached a wide audience and increased the general environmental awareness of each reader – meeting one of the main goals of environmental education initiatives.

Receive Educator Support. The previous implementation of environmental education into the Namibian curriculum failed because teachers' did not support it. In 1991, a three-year pilot program called Enviroteach was introduced to the Namibian school system. Enviroteach developed environmental education resource materials with the goal of integrating these materials into the national education system. An evaluation during the third year of the program revealed that schools were not using all of the program materials (e.g. worksheets) and that the classroom activities were rarely completed. These shortfalls were attributed to the teachers' unwillingness to participate in the program because they were unfamiliar with the material they needed to teach and felt that the program was too time-consuming (Janse van Rensburg et al., 1995). For environmental education to succeed, teachers must be onboard with the material and be willing to participate.

In 2001, the Australian government introduced environmental education into the school curriculum from kindergarten through Grade 12. Unlike Enviroteach, this implementation was welcomed by educators and has achieved great success. The instruction of subjects such as "Human Society and Its Environment" has provided Australian learners with environmental knowledge and fostered their ability to act sustainably (Tilbury, 2006).

Apply to Learners' Lives. Environmental education is more effective when learners can personally connect to the lessons. For example, the effect of excessive rainfall on rural farmers' crops is less likely to interest urban learners because it does not relate to their lifestyle (Tsurusaki & Blakely, 2010).

The National Water Resource Authority (NWRA) of Yemen has used environmental education to facilitate learners' connections to local environmental problems. Since 2004, Yemen has suffered from a critical water shortage (Alazzany, 2014). To address this problem, the NWRA decided to increase learners' awareness of the problem through the implementation of "Water Education" in the national education system. By educating learners on local environmental problems, the NWRA fostered constructive conversation about the country's water deficiency and increased learner awareness of the problem. Learners have reported that they have a stronger consciousness of their water usage after receiving this education (Alwan, 2013). This program was successful because it used local problems to educate individuals and heighten their concern about the overall issue.

NaDEET has also experienced success with environmental education because their program welcomes learners from all regions and adapts the lessons to the relevant problems in the learners' regions (NaDEET, n.d.). NaDEET's success earned the organization recognition at the UNESCO World Conference on Education for Sustainable Development in Aichi-Nagoya, Japan – making NaDEET one of only twenty-five organizations recognized worldwide (UNESCO, 2014). By basing the educational materials on the information most relevant to the learners participating, NaDEET was able to gain more learner participation and more successfully develop learners' interest in the subject.

Be Interactive and Engaging. Studies show that interactive projects increase learners' retention rate and concentration (Duffin, 2005). For learners to benefit from environmental education, it must allow them to actively participate in the learning process. Another critical flaw in the Enviroteach program was its dependency on worksheets. This passive method of education hinders learners' ability to engage with the material and retain information (Janse van Rensburg et al., 1995).

Unlike Enviroteach, NaDEET approaches environmental education with hands-on learning programs for a range of age groups. NaDEET closes the gap between teaching about the environment and practicing sustainability through hands-on, experiential learning, providing participants with the unique experience of learning how to live sustainably rather than just hearing about it. To increase environmental awareness and sustainability skills in Namibia's educational community, the program utilizes active learner participation through hands-on activities such as dune walks, solar cooking, and biodiversity scavenger hunts (NaDEET, n.d.).

NaDEET has successfully engaged a growing number of program participants over the past eight years, as shown in Figure 2.3. The increasing number of returning groups illustrates NaDEET's success in engaging learners and establishing enjoyable environmental education.

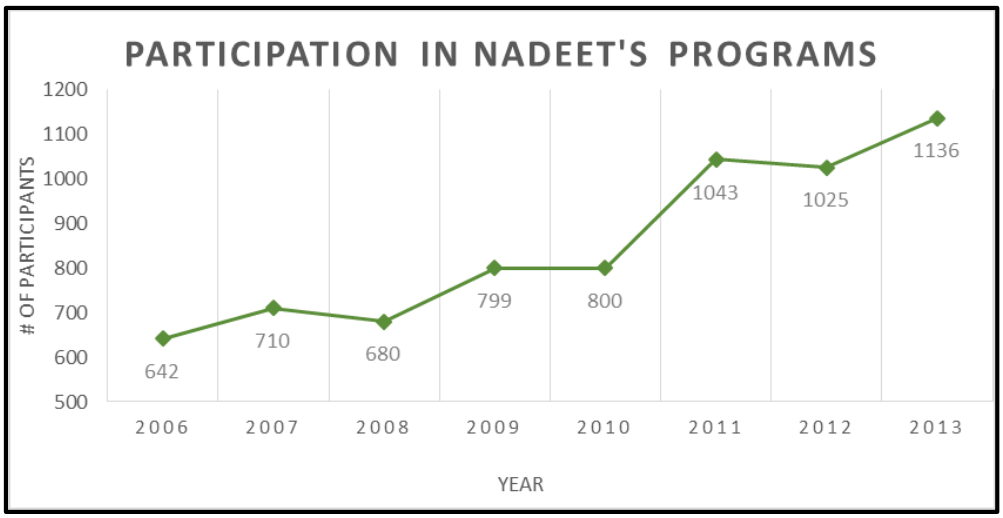

FIGURE 2. 3: LEARNER PARTICIPATION IN NADEET'S ENVIRONMENTAL EDUCATION PROGRAMS 2006-2013 *(NaDEET, 2014)*

NaDEET's experiences have shown that the hands-on approach to environmental education is much more effective and far-reaching than passive lectures and worksheets. Learners respond more positively to hands-on learning and benefit much more from learning through interactive, experiential learning.

Adapt to Changing Times. Successful environmental education is able to adapt to the most relevant problems present in the community. In response to rapid population growth, India extended its national curriculum to establish environmental education as an essential part of the education system. This environmental education includes topics such as sustainable use of natural resources – something that is particularly relevant with India's growing population (Sarabhai, 2002). Developing environmental education that can adapt to changing circumstances and actively reflects the most relevant problems in the community is an important step in ensuring the curriculum will be implemented effectively.

Promote Critical Thinking. Environmental education should facilitate critical thinking on the "communal nature" of the world's resources and emphasize that they must be preserved for future generations to survive. Successful environmental education connects individuals to where they live to enforce their individual responsibility to preserve the environment. Beyond that, environmental education should teach individuals how to thrive while living sustainably. Environmental education must extend beyond recycling and passive sustainability to foster critical thinking on how to reduce the human "footprint" on the planet (Saylan & Blumstein, 2011).

Many factors contribute to the establishment of a successful environmental education curriculum. Drawing key lessons from past initiatives provides useful insight into how to create lasting, effective education.

2.5 THE BENEFITS OF USING EXPERIENTIAL LEARNING IN ENVIRONMENTAL EDUCATION

Experiential learning has the potential to solve many of the problems in environmental education programs. Although often viewed as a modern adaptation to education, experiential learning has been around for many years. In *Experience and Education* (1938), the American educator and philosopher, John Dewey, detailed the benefits of environmental experiences to learn about nature.

Experiential learning uses alternative education techniques such as hands-on activities, group discussion, projects, and field trips to increase learner engagement. According to David Kolb, an education theorist specializing in experiential learning, learners benefit more from education based in "doing" rather than "listening" (Kolb, 1984). Kolb developed what is now known as the Kolb Cycle (Figure 2.4) to describe the four stages of experiential learning.

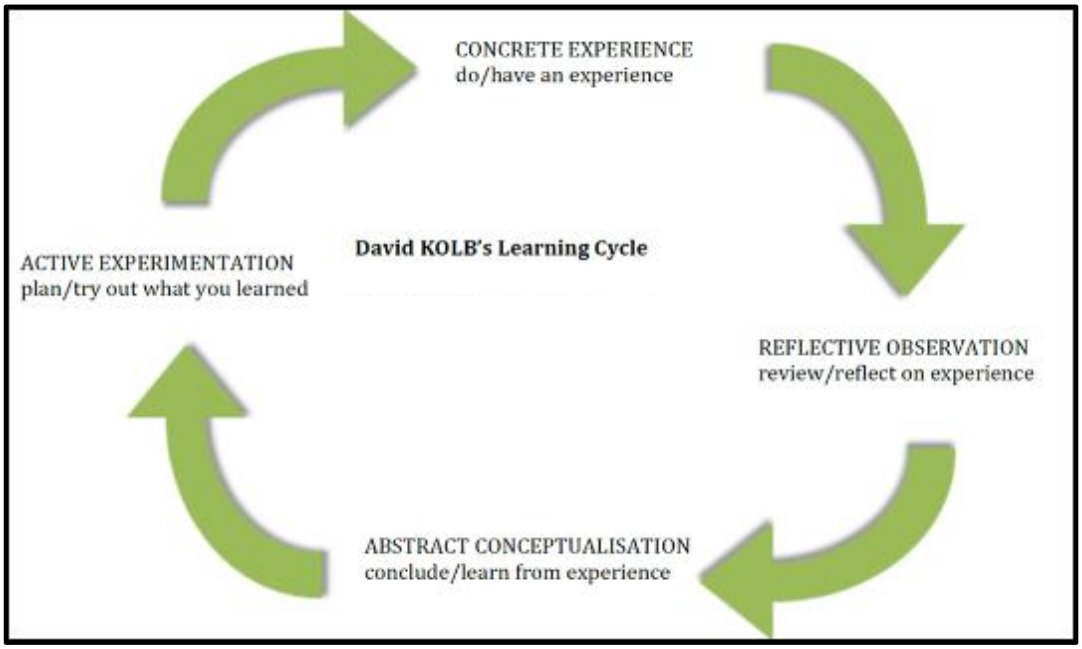

FIGURE 2.4: DAVID KOLB'S EXPERIENTIAL LEARNING CYCLE
(Kolb, 1984)

1. **Concrete Experience**. This stage includes partaking in a new experience or activity. An example is participating in an interactive classroom activity.
2. **Reflective Observation**. This stage consists of reflecting on the new experience. An example is having a class discussion after completing the activity.
3. **Abstract Conceptualization**. In this stage, the learner tries to understand the lesson of the experience by analyzing the reflection. This is a translation of what the activity accomplished into what the activity taught the participants.
4. **Active Experimentation.** In the final stage, the lesson learned in the activity can be applied to real concepts. This is a connection to the outside world, and it is one of the most important steps in experiential education.

Research shows that using experiential learning techniques in environmental education has four main benefits:

Increased Interest in Nature. John Dewey believed that experiential learning within nature promoted a greater respect for the natural world within learners (Saylan & Blumstein, 2011). Experiential learning allows learners to connect to nature and better understand the relevance of environmental problems. Effective environmental education programs present information and ideas in a way that is relevant to learners (NAAEE, 1996). Teaching lessons on the ocean and marine life to a learner who has never seen the ocean will be much harder than teaching a learner who has lived near the beach. Developing lessons that learners can relate to promotes a sense of responsibility to encourage conservation and sustainability within their community.

Participatory Learning. Experiential learning enhances lessons by allowing learners to participate in activities such as touring parks, collecting plants and bugs, or keeping a daily log on a specific location or plant. This participatory method of education engages learners by allowing them to have a role in their own education (Brace, 1982).

Participatory learning is particularly effective in rural communities. Due to their isolation, rural communities are often more independent and hold a stronger connection to their local region than individuals who live in an urban environment. Providing individuals in rural communities the opportunity to learn through activities in their own surroundings allows them to learn better and connect what they learn to their everyday life, helping them to enjoy environmental education more (Pretty, 1995).

Flexibility. Experiential learning provides more flexibility in learning style, making it more adaptable to school facilities, curriculums, and different learners. This adaptability makes experiential learning an attractive option for many educators, as it can be used in almost any setting with any material.

Like NaDEET, India's Center for Environmental Education's nature education park, Sundarvan, applies experiential learning methods to environmental education. Sundarvan seeks to develop a new appreciation for plants and animals in children and adults through a number of onsite educational programs using exposure to small animals, nature trips, and training camps. This program has been effective at immersing individuals in the environment and participants have reported increased interest in their local environment (Sarabhai, 2000). Though primarily based in an urban setting, this initiative illustrates the benefit of experiential environmental education in a developing country, where protecting the environment is particularly important.

In Sri Lanka, a program called "Farmer Field School" has used experiential learning techniques to educate rural farmers through weekly meetings where 15-20 farmers meet to sample organisms that potentially carry malaria and propose possible solutions to stop the spread of the disease. By working directly with the farmers to help them find their own financially-feasible solutions, Farmer Field School improved the relationship of farmers with the environment and successfully empowered rural community members with the tools and experience necessary to devise economic solutions to local problems (Berg & Knols, 2006).

Technological Integration. Many researchers have explored the implementation of technology as an extension of experiential learning, and their studies found a positive connection between the use of technology and the effectiveness of course material (Lowerison et al., 2006). A Taiwanese study focused on the use of Technology-Enabled Active Learning (TEAL) in a high school physics class found that technology greatly improved the learners' learning experience. Prior to the study, learners complained that being asked to record notes from the blackboard was "boring" and caused them not to learn anything. Following the implementation of TEAL, learners reported that the classes were "fun" because of the demonstrations and hands-on activities (Shieh et al., 2011). In addition to being more enjoyable

for learners, research shows that using technology in the classroom also enhances academic performance (Dori et al., 2007). Researcher Richard Hake found in his study of high school learners and university students that individuals retained twice as much information when taught with interactive, technology-based methods compared to traditional lecture methods (1998).

Various kinds of technology can be used in the classroom, but Interactive White Boards (IWB) are a common example used for experiential learning. The leading producer of IWB is SMART Technologies. SMART Board technology consists of a touchscreen white board, a projector, and software. The SMART Board has many capabilities including games, virtual lesson plans, and other interactive activities. The SMART Board has been found to promote learner engagement and interaction (Lee & Boyle, 2003). The interactive aspect of the SMART Board makes it a useful addition to an experiential learning-based curriculum, as it enhances learner involvement and academic performance.

2.6 MAJOR STAKEHOLDERS IN THE IMPLEMENTATION OF ENVIRONMENTAL EDUCATION

Stakeholders represent groups of people who will be impacted by an environmental education project. The implementation of environmental education could improve the actions and attitudes of local learners, teachers, and community members by encouraging sustainability and empowering them with the tools to make well-informed decisions. But individuals who have apprehension about the implementation of environmental education can threaten its success. Understanding the possible threats to our project allowed us to construct a program that can overcome these challenges and meet the needs of the Namibian education community. Three groups have a stake in environmental education in Kavango:

Learners. The implementation of environmental education into the Namibian curriculum can bring environmental change to the country through more motivated learners. Research shows that environmental education creates enthusiastic, self-directed learners who develop into real-world problem solvers, but it is important to include innovative learning techniques to keep learners engaged and interested (NEEF, 2015). Learners are unlikely to respond to flawed, overused methods of teaching, particularly in science-related fields (Ritchie & Tomas, 2013). A key aspect of our project was making environmental education relevant and interesting to learners to make them want to participate.

Teachers. A successful environmental education program will have positive and negative implications for Namibian teachers. Research shows that environmental education fosters the development of teachers who can strongly connect academics to the natural world (NEEF, 2015). Experience-based education may also take some pressure off of teachers when they present environmental topics, as learners will engage with the material more willingly.

Teachers may have some apprehension about moving from lecture-based education to hands-on learning, especially when it includes technology. Classroom technology can be threatening for educators, because it requires them to understand not only the material, but also have the technological capability to understand how technology can effectively present the material (Koehler & Mishra, 2008; Okojie, 2011). If they lack experience in these areas, they may appear unknowledgeable in front of their learners. Appearing unknowledgeable may lessen their authority in the classroom, which would not be well-received by many teachers. Many teachers also feel that technology distracts learners (Shieh, 2011). As such, they may be hesitant to adopt these teaching styles if they feel they may hinder their ability to teach effectively. Teachers with more traditional views are less likely to welcome technology in the classroom (Becker & Riel, 2000; Sang et al., 2010).

Local Communities. Namibian communities could be heavily impacted by environmental education because an informed population will ideally produce more environmentally conscious individuals. Informed community members often promote environmental improvement in the community, as well as stricter guidelines for protecting the local environment (Tarr, 1997). These improvements and guidelines can have both positive and negative effects. Environmental improvement would benefit the community through resource and landscape preservation, but the stricter environmental guidelines could put added stress on the everyday lives of community members. These individuals may not be willing to adapt their habits to these lifestyle changes and may not be supportive of environmental education. In addition, many community members have likely experienced the flawed conservation efforts that took place in the past. Due to that negative experience, they may be unwilling to participate in conservation for fear of what may happen to them or their homes. As such, it is possible that they may try to stop the implementation of environmental education by outsiders, since it holds many similarities to the conservation efforts of the past that abused their rights. Considering the individuals who have a stake in our project was a key step in identifying the challenges our project could face.

2.7 SUMMARY

This chapter highlighted four major obstacles to environmental education: teacher unfamiliarity with environmental subjects, ineffective learner exposure to environmental topics, not providing solutions, and socioeconomic disparities. The implementation of a new, experiential learning-based initiative would enable environmental education to overcome many of these obstacles.

CHAPTER 3 – METHODOLOGY

This project was designed to assist EduVentures in promoting knowledge of critical environmental problems in rural Namibian communities through the development of interactive SMART technology lesson plans. We developed four interactive lessons using SMART technology – a touch-screen whiteboard system that allows teachers to connect to interactive online lesson plans from the SMART Exchange website. This technology enhances the experiential learning aspect of environmental education in rural Namibian schools. To accomplish this goal, we completed the following objectives:

1. Identify the critical environmental problems in the Kavango region.
2. Evaluate how the current environmental education curriculum in Namibia addresses the critical environmental problems.
3. Develop lesson plans and engaging hands-on activities focusing on critical environmental topics for use in rural Kavango classrooms via the SMART Exchange website.
4. Test the lessons in rural schools.

In this chapter, we discuss the steps that we took to accomplish these objectives and develop the most effective lessons.

3.1 IDENTIFY THE IMPORTANT ENVIRONMENTAL PROBLEMS IN THE KAVANGO REGION

Knowledge Sought. The primary focus of our project was developing environmental education in the Kavango region, pictured in Figure 3.1. Collecting information on critical environmental problems in the area allowed us to ensure that the educational materials we developed addressed the regional environmental problems. For environmental education to be meaningful, it must be relevant to the individuals it aims to educate.

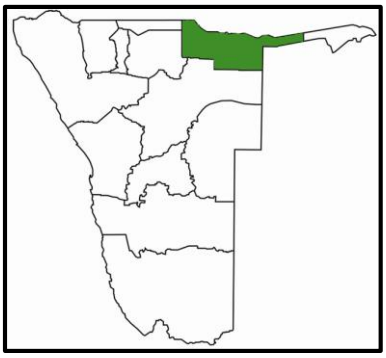

FIGURE 3.1: TARGET REGION FOR SUSTAINABLE MOVEMENT PROJECT
Adapted from (Commons, 2012)

Chapter 3 – Methodology

Method. We collected data about Kavango's environmental problems from the environmental reports of organizations such as UNICEF and the Ministry of Environment and Tourism, local Kavango news articles, Namibian publications at the Windhoek Public Library, and interviews with environmental experts. The experts we interviewed included a NaDEET representative, a Cheetah Conservation Fund (CCF) representative, a representative from the Ministry of Environment and Tourism, and a member of the Namibia Environmental Education Network (NEEN). The questions and protocol for these interviews can be found in Appendix B.

Justification of Method. Analysis of the government reports and contact with local experts allowed us to produce a comprehensive list outlining the environmental threats faced by these regions, the causes and consequences of these threats, and why the learners in this area must be educated on the problem.

Communicating with experts provided us with a better understanding of what communities perceive as the most important environmental problems and how we could educate learners on these problems in order to make the environmental education curriculum as effective as possible. This detailed identification process can be used to establish relevant lesson plans for other regions in the country for future projects.

Analysis Method. To determine what information learners most crucially need, we considered which problems most significantly affect the everyday lives of community members. Several environmental problems result in displacement, lack of food or water, and other limitations on the community's livelihood.

Limitations and Obstacles. Kavango is a complex region that faces a variety of environmental threats. It was outside the scope of our project to detail every environmental threat the region ever faces, since that information can change from year to year. A significant obstacle in this stage of our project was deciding which environmental problems are ongoing and have the most severe consequences for communities in Kavango. Ideally, learners would be educated about every threat their region faces, but for our project, we focused on the most critical environmental threats.

Finding Kavango-specific information was also a challenge. Due to the rural nature of the Kavango region, very little reporting of environmental factors occurs annually. Much of the available information identifies Namibia as a whole, despite the fact that environmental problems vary substantially across the country. The lack of information for Kavango made our assessment of critical environmental problems in the region challenging.

3.2 EVALUATE THE EXISTING ENVIRONMENTAL EDUCATION CURRICULUM IN NAMIBIA

Knowledge Sought. Understanding the current state of environmental education in Namibia required research on the presence of environmental education in the curriculum, the

topics covered, the level of detail of environmental lessons, and the teaching methods used. This information allowed us to identify the strengths and weaknesses of and gaps in the current curriculum to tailor our material to the needs of the Namibian education system. We focused primarily on secondary schools, as that was our target audience.

Method. We researched past environmental education initiatives in Namibia to identify their successes and failures, consulted EduVentures to gain their perspective on what improvements Namibian environmental education needs, interviewed local experts on environmental education and the Namibian education system, and reviewed Namibian secondary school curriculum textbooks.

The experts we interviewed included a NaDEET representative, a CCF representative, a Namibia Environmental Education Network (NEEN) member, and a lecturer from the University of Namibia. Communication with these Namibian experts helped us to understand the specific challenges faced by environmental education in Namibia. These interviews included questions regarding the presence of environmental education in Namibia, which methods are considered most effective with learners, and whether they would have any concerns about the implementation of environmental education. We also interviewed students from the Polytechnic of Namibia to understand their experiences with environmental education, since they are close to the age of our target audience and have experienced Namibia's environmental education curriculum firsthand. The questions and protocol for these interviews are located in Appendix B.

We reviewed fourteen Namibian textbooks for grades eight through twelve obtained from the EduVentures Trust, the Windhoek Public Library, the Polytechnic of Namibia library, and the University of Namibia Library. We evaluated whether critical environmental problems and the EduVentures module topics of Biodiversity, Climate Change, Sustainability, and Heritage are covered in the text and to what extent they are covered. These textbooks mostly covered Life Science and Physical Science, but a few books covered Biology, Geography, and History. The completed textbook evaluations can be found in Appendix K.

Justification of Method. Evaluating the environmental education curriculum in Namibia allowed us to identify flaws in the curriculum and determine how our project could improve the overall environmental education experience for Kavango students.

Researching past environmental education initiatives allowed us to identify the successes and failures of past projects to avoid making the same mistakes. Communication with EduVentures helped us identify the goals of our project by understanding the motivation behind their efforts. Environmental education experts and facilitators, specifically the representatives from NaDEET and CCF, provided insight into what methods of education are most successful in Namibian classrooms and what the biggest flaws in Namibia's environmental education are. Interviewing Polytechnic Students allowed us to understand how the current environmental education curriculum is perceived by the students who participate in it.

Chapter 3 – Methodology

Evaluating Namibian curriculum textbooks illustrated the limitations in the curriculum and the inadequacy of the information currently included. This evaluation indicated what environmental topics Namibian learners are not being educated about, highlighting the areas our project needed to address.

Analysis Method. We compiled the textbook evaluations to determine the effectiveness of the educational material. We considered how recently the textbooks were published, which subjects most often cover environmental topics, which environmental problems were covered, and the depth of the material.

Using the information gained through interviews, we compiled responses to develop a comprehensive list of the best practices in Namibian environmental education, aspects of the current curriculum that need immediate attention, and possible concerns regarding a new environmental education curriculum. This information provided clear insight into the role our project would play in the curriculum and how we could best meet the needs of Namibian learners.

Limitations and Obstacles. While we completed an adequate overview of the environmental education curriculum in Namibia, it was impossible for us to analyze every single aspect of the curriculum. Our evaluation was substantially accurate because most schools in Namibia use the same textbooks, but we could not review every textbook since we did not have access to all of them. We also could not communicate with every educator in the country or even in Kavango, so we could not know what was being done in every classroom if teachers use their own supplemental material. The limitation on the scope of our project was an obstacle we faced, but by completing interviews in addition to the educational material evaluation, we were able to overcome it.

3.3 DEVELOP LESSON PLANS AND ENGAGING HANDS-ON ACTIVITIES FOR RURAL KAVANGO SCHOOLS

Knowledge Sought. EduVentures had pre-existing PowerPoint presentations about the Biodiversity, Climate Change, Sustainability, and Heritage modules that were used to educate learners in the past.These presentations were considered long and ineffective, contributing to the need for new lessons. We required an understanding of what information was included in these PowerPoint presentations to determine what information our lessons should include. We also needed to understand the general lesson structure to ensure the new lessons would fit into the EduMobile program. We sought to understand the SMART Exchange website and gain a better understanding of how SMART technology works. This was an important step in our project because we needed to not only understand how our lesson plans would function, but also that they would meet the compatibility requirements for the SMART Exchange website.

Compatibility with the SMART Exchange website was crucial in making the material we developed accessible to schools across Namibia.

Method. Based on suggestions from Namibian experts, we developed four SMART lesson plans and classroom activities for use in rural Namibian schools. We targeted our material toward secondary school learners and focused on four key subjects: Biodiversity, Climate Change, Sustainability, and Heritage. A review of the existing module PowerPoint presentations provided us with the information we needed to include and clarified the structure of the lessons. We used the information we gained regarding critical environmental problems and the status of environmental education in Namibia to address the needs of the educational community in the region. We also used information we collected about effective and engaging teaching techniques to make our lessons interactive for the participating learners. We created instructions for how to use the lessons to make them understandable for both EduVentures facilitators and educators who may be accessing the lesson plans across the country.

Within our lessons, we also developed interactive activities for learners. Some of these activities, such as fill-in-the-blank vocabulary and word searches, used the SMART Board. Other lesson activities, such as the "Draw Your Schoolyard Ecosystem" activity, did not use the board. Figure 3.2 shows an example of an interactive activity used on the SMART Board.

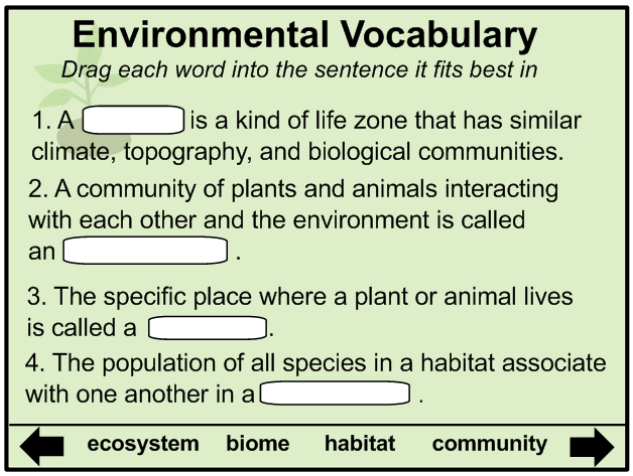

FIGURE 3.2: INTERACTIVE ACTIVITY FROM BIODIVERSITY LESSON

Justification of Method. We used the information we gained through research and communication with local experts to ensure that our lesson plans and activities effectively addressed the necessary topics. Making our lessons available through the SMART Exchange website allows school communities across the country to access them, even if EduMobile never visits their school. The lesson plan instructions will also assist other schools when using the lesson plans, as they explain how to use the program.

Analysis Method. After developing our lesson plans and activities, we tested them to ensure the lesson plans were comprehensible, since they would not be effective if they did not make sense. We also tested our activities with EduVentures staff to identify any flaws that would make them uninteresting or unsuccessful. Figure 3.3 shows a WPI team member testing a lesson in the EduVentures Office. After the lesson plans were made available on the SMART Exchange website, we tested them again to ensure that no functionality was lost in publishing them to the website.

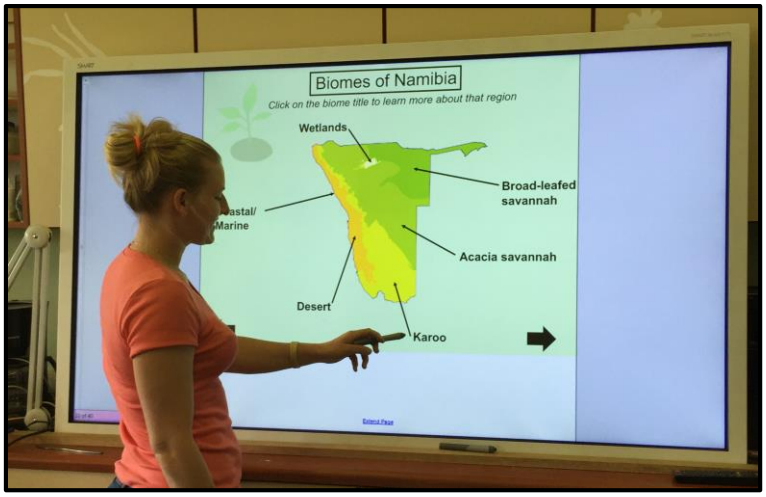

FIGURE 3.3: WPI TEAM MEMBER TESTING LESSON

Limitations and Obstacles. The EduMobile lessons are fully dependent on the SMART technology installed within the truck. In the event of technological unavailability or failure, the learners will not be able to use the lessons we developed. These circumstances would greatly hinder the learners' ability to learn from the EduMobile project. Hands-on program activities that do not use the board alleviate some of that hindrance, but relying on SMART technology was still a risk our project faced.

3.4 TEST LESSONS AT TWO RURAL SCHOOLS IN KAVANGO

Knowledge Sought. After the development of the lesson plans was completed, we brought them to rural schools in Kavango to determine their effectiveness and observe how learners react to them. We considered how many learners paid attention to the lesson, whether they appeared to be enjoying themselves, their participation in discussions and activities, and their level of confusion. We also gauged their comprehension of the material through content-based survey questions. We had to ensure that the lessons met the project goal of educating and engaging learners and identify what could be improved for future

projects. This information guided the completion of our project and will allow the EduMobile project to continue to develop in the future.

Method. Testing the lessons consisted of the EduVentures educators presenting the lesson while we completed classroom observations recording the learners' reactions to the lessons and administered learner surveys. Figure 3.4 shows EduMobile program manager, Corris Kaapehi, presenting a lesson on heritage.

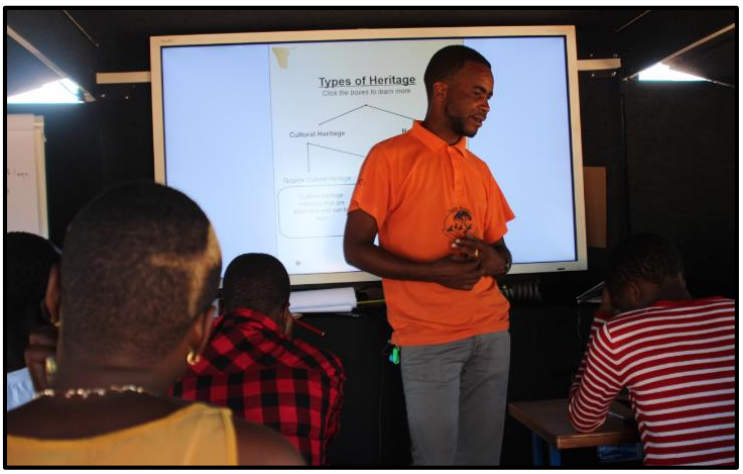

FIGURE 3.4: CORRIS KAAPEHI PRESENTING HERITAGE LESSON
Photo taken by Sophia Nuuyni, used with permission

The observations recorded whether the learners seemed to be engaged and enjoying the lesson – characteristics identified through body language, attentiveness, and interaction with other learners. Further information regarding the observation criteria is available in Appendix C.

Surveys were administered to learners immediately after the lesson, at the end of the day, and at the end of the week to record their impressions of the program. The lessons we developed were part of the week-long EduMobile program, which consisted of species collection in the schoolyard, field trips, and presentations. The end of the day and end of the week surveys compared the lessons to other aspects of the program to determine which activities the learners enjoyed most. The surveys covered topics including how enjoyable the lessons were, if they understood the material, and content-based questions. The survey questions are located in Appendix D.

Justification of Method. Testing the lessons and activities was an important part in the completion of our project because we needed to determine whether the material we developed was effective and will be applicable to schools EduMobile visits in the future. Classroom observations were an effective way of collecting this information because it allowed our team to gauge the learners' immediate reactions to the program. Surveys also allowed us to gain information on the learners' opinions that we may not have been able to understand solely through visual observation.

Analysis Method. We first compared the responses collected within each school. Based on survey responses, we determined which lessons and activities learners enjoyed most and which they enjoyed least. We also determined which lessons could be explained better based on the learners' responses. This information allowed us to determine which materials were most effective at engaging the learners, and which need further development. Following this analysis, we also compared the results from each school against each other to determine whether our results were consistent across each visit.

Limitations and Obstacles. Though our method of testing and evaluating the lessons was effective, the process had some limitations. We were able to visit only two schools, limiting our sample size. Visiting a larger pool of schools would have enabled us to collect more feedback to strengthen our lesson plans. In addition, while the surveys were a useful method of collecting learners' reflections on the EduMobile program, it is possible that they may not have been entirely honest. In addition, it can be challenging to collect information when individuals are not entirely forthcoming with their opinions. Obtaining information through classroom observations also had some limitations, as it was a subjective assessment. Developing criteria to evaluate the learners allowed us to complete more consistent evaluations. Our project also lacked the capability to measure long-term retention of the information presented, which would provide valuable insight into the effectiveness of the lessons. Though our collection method was effective, there were many obstacles preventing a thorough assessment of the program.

3.5 SUMMARY

The completion of the previously described objectives resulted in the development of a mobile environmental education curriculum for rural schools in Namibia. Through our research and interaction with local experts, educators, and learners we created comprehensive lesson plans and activities to meet the needs of the Namibian education system. We hope that this project made environmental education more accessible to learners in Kavango and that these learners now have the tools needed to preserve the future of their environment.

CHAPTER 4 – FINDINGS & ANALYSIS

This chapter presents information found through our literature review, evaluation of the Namibian secondary school curriculum, communication with local experts on environmental education and the Namibian education system, and observation of the EduMobile Program. We discuss four topics: the environmental problems in Kavango, the factors affecting conservation in Kavango, the inadequate environmental education system in Namibia, and the implementation of the EduMobile program using SMART Board technology.

4.1 ENVIRONMENTAL PROBLEMS IN KAVANGO

1. Learners in the Kavango region should be educated about five significant environmental problems – deforestation, climate change, human-wildlife conflict, pollution, and land degradation – because these problems greatly impact the lives of Kavango community members.

Deforestation. Returning to Namibia after almost thirty years in exile (Encyclopedia Britannica, 2015), Dr. Sam Nujoma, former president of the Republic of Namibia, was "shocked and sad to see the extent of environmental damage in [his] beautiful country." Severe forest destruction by South African soldiers made it difficult for him to recognize the Omusati village where he grew up. European settlers in the early twentieth century first began destroying Namibian forests, but the problem continues into the twenty-first century. Three things cause this deforestation: agricultural expansion, illegal wood cutting, and forest fires (Tarr, 1997).

In rural Namibia, 48% of households depend on agriculture as their main source of income (Dirkx et al., 2008). Agriculture contributes significantly to deforestation for two main reasons: clearing of land for fields and over utilization of forest resources for construction of homestead storage facilities (DRFN, 1995; Republic of Namibia, 2010). As a region heavily dependent upon agriculture as a livelihood, these factors greatly contribute to Kavango's deforestation (IWRM, 2010).

In Kavango, the illegal harvesting of wood products contributes significantly to deforestation. Kavango is one of the most heavily wooded regions in Namibia, but it is also the largest producer of wood-carvings. Under the Nature Conservation Ordinance, harvesting trees requires a permit, but many Kavango residents do not obtain permits when cutting down trees for their crafts (Tarr, 1997). Hardwoods are preferred for carving, but these trees are particularly difficult to replace (Cunningham & Choge, 2004). Because of Kavango communities' unsustainable usage, hardwood trees are becoming increasingly scarce (Pröpper et al., 2010).

Forest fires also contribute to deforestation, burning up to 15% of northeastern Namibia each year. In 2012, 8.4% of Namibian land was burned by wildfires. These fires release greenhouse gases and cause severe environmental damage (Hashange, 2013). These fires not

only destroy trees, but also degrade soil, making it difficult for new trees to grow (Mutorwa, 2008).

Deforestation education would benefit Kavango communities because their livelihood contributes to the problem. Community members have the ability to reduce deforestation, but they must receive education on how and why to do so. By educating community members on the need for protecting forest resources for the future and alternative resources that can be used, they will understand the importance of limiting their timber usage and how they can act sustainably without sacrificing their livelihood.

Climate Change. According to the Namibian Government, excessive rainfall in the Kavango region is an effect of climate change (2009). This excessive rainfall has led to severe flooding with a catastrophic impact on local communities. In 2009, flooding in the Kavango region left 2,000 people displaced with limited access to food, water, and shelter. The flooding severely damaged the livelihoods of almost 90% of the region's population (Government of the Republic of Namibia, 2009). Flooding in the Kavango region has dire consequences for many families. Higher water levels cause crocodiles to climb the river banks, often attacking children and killing livestock. Many businesses also close due to the flooding, causing the community to lose a significant amount of income (Africa News Service, 2012).

Pollution. Kavango communities experience serious problems with both land and water pollution. Water quality in the Okavango River has deteriorated in the last several decades due to pollution (Tarr, 1997). People washing clothes, vehicles, and other items in the river has largely contributed to this problem. Soap in the river decreases water quality and harms river wildlife (Africa News Service, 2012). Agricultural growth in the region also contributes to water pollution. A 2003 water quality study found that rapidly growing agriculture in Kavango may be contributing to water pollution through fertilizers, pesticides, and soil erosion (Trewby, 2003). In some areas, agriculture has been found to contribute to more than 50% of the water pollution (Kay et al., 2010). Sewage runoff into the river from expanding sewage plants is also a major concern for the future of the river (New Era, 2007). Water pollution is an important problem in the Kavango region because the population relies heavily on the river and its resources for water, food, and employment (Tarr, 1997).

More heavily populated areas of Kavango struggle with large amounts of land pollution. Many roadways, schoolyards, and public areas are littered with trash and other debris. Much of this pollution comes from community members not knowing where to put trash because of the government's refusal to collect certain items and the distance from smaller communities to waste sites (New Era, 2014). Figure 4.1 shows the litter dumping ground that has developed at a secondary school in Kavango.

Chapter 4 – Findings & Analysis

FIGURE 4.1: LITTER DUMPING SITE AT KAVANGO SECONDARY SCHOOL

Human-Wildlife Conflict. Communities in Kavango face serious problems as a result of wildlife in the region. In March 2015, a herd of elephants destroyed more than 100 fields in the Kavango West region (Nampa, 2015). Elephants kill people, destroy crops, and damage water and electricity infrastructure (Nakale, 2015). As elephant populations grow, the threat increases. Because elephants can eat over 270 kilograms (600 pounds) of food per day, a small herd can wipe out a farmer's entire annual crop in one night. Elephants disrupt community life and often severely injure people. When community members are harmed or killed, authorities are obligated to kill the elephants. Many local people also retaliate by killing the elephants (WWF, 2015).

Crocodiles also pose a threat for Kavango communities. Each year, several children are dragged into the river and killed by crocodiles (Nakale, 2015). Crocodiles also kill farmers' livestock. Over a five-year period, cattle made up 74% of all domestic animals killed by crocodiles. Crocodiles are a protected species in Namibia and can only be killed in defense of human life or livestock. Because of the significant conflict that occurs between people and crocodiles, crocodiles are killed quite frequently (Aust et al., 2009).

Efforts to control wildlife populations face many challenges. Containing elephants is difficult because they require a large area to roam (WWF, 2015). A regional councilor for Kavango West recently proposed an evening curfew to avoid human conflict with the elephants (Nampa, 2015). Crocodile-proof fences were implemented in Kavango, but have been unsuccessful due to damage caused by flooding and hippopotamuses in the region (Aust et al., 2009). Promoting crocodile conservation is difficult for the Ministry of Environment and Tourism because many local people have been killed by the crocodile population (Nakale, 2013).

Chapter 4 – Findings & Analysis

Human-wildlife conflict severely impacts the lives of Kavango community members. Learners in this region must understand both sides of the situation. It is difficult for many communities to understand why they should protect wildlife when it is so severely harming their livelihood. In Kavango, efforts to instruct local communities on the benefits of wildlife have been attempted through the communal conservancy at Bwabwata National Park. Bwabwata allows humans and wildlife to live together and presents opportunities to profit from the wildlife through community-run tourist campsites and meat from park-controlled trophy hunting. Communities in the area are able to grow crops and keep livestock. In the event crops are damaged or livestock is killed by wildlife, local residents are compensated by the Ministry of Environment and Tourism to prevent them from unnecessarily harming the animals (MET, 2011). Further community-based initiatives such as those at Bwabwata would improve community awareness of the complicated aspects of human-wildlife conflict.

Land degradation. Poor management of land leads to bush encroachment and the growth of invasive species (Republic of Namibia, 2010). In Namibia, approximately 300,000 square kilometers (190,000 square miles) of farmland are affected by bush encroachment. This infestation affects 43% of Namibia's farmland, leading to a 60% decline in livestock farming in the past forty years (Rhodes, 2013; Tarr 1997). Bush encroachment is the most devastating factor for sustainable livestock farming in rural Namibian communities like Kavango (Rhodes, 2013). This problem seriously affects the Kavango region because the economy of Kavango is heavily dependent upon agriculture (IWRM, 2010). Bush encroachment damages the land and makes it difficult for farmers to sustain their livelihoods, causing significant problems for Kavango communities.

The introduction of alien invasive plant species also damages the Kavango economy because it takes resources such as water and soil nutrients away from native plants. The invasive species' monopolization of these resources makes it difficult for other species to grow and damages local biodiversity, which can impact communities' access to food, medicine, and other necessities (Mullin, 2000). Figure 4.2 shows euphorbia tirucalli, an invasive plant species in Kavango. These trees threaten the water source of indigenous plants and pose major threats to local people, as the latex they produce can cause blindness, blisters, and even death (SA National Biodiversity Institute, 2007).

FIGURE 4. 2: INVASIVE PLANT SPECIES IN KAYENGONA VILLAGE IN KAVANGO

4.2 PROMOTING CONSERVATION IN RURAL KAVANGO COMMUNITIES

2. Conservation of natural resources in rural Namibian communities is challenging because the benefits are inadequately communicated to rural communities and communities lack sufficient income.

Promoting conservation in rural communities is a particularly challenging task because rural people depend on natural resources to survive. Approximately 70% of Namibians depend upon natural resources to sustain their livelihood (MAWF, 2010), but they often feel forced to exploit these resources to complement their limited income (Pröpper & Vollan, 2013). An EduMobile participant explained that they understand the importance of conservation, but have a difficult time explaining it to their parents and village members because these individuals do not "know the good it can do."

Wildlife conservation is a particularly challenging topic in rural Namiban communities because of the damages caused by local wildlife. Each year, residents of Kavango are killed by crocodiles, elephants, and hippopotamuses. Many farmers' livestock are killed and crops are destroyed by wildlife populations (Aust et al., 2009; Nakale, 2015). A conservationist at the Bwabwata National Park in Kavango explained that while members of communal-conservancies are compensated for damage or death caused by wildlife, non-members do not receive any benefits. While wildlife conservation in Namibia provides income for members of communal-conservancies from tourism, game sales, and trophy hunting, a large portion of Namibians do not receive this income. These communities view wildlife as a threat to their livelihood that must be controlled or eliminated (Tarr, 1997). Because the benefits of wildlife conservation seem nonexistent to rural community members, they are often unwilling to participate in conservation efforts.

To adequately implement conservation, the benefits of acting sustainably must be properly communicated to community members. The negative aspects of conservation appear to outweigh the positive aspects, making communities hesitant to participate in conservation efforts.

3. Many Kavango residents are unaware of the damage they are causing to their environment through their timber usage.

Local communities in the Kavango region are not purposely destroying their forest resources, but are instead unaware of the damage they are causing to their environment (Tarr, 1997). A study of the Kavango wood industry found that communities throughout the region lack the proper knowledge of the forest resources' ecological value (Pröpper & Vollan, 2013).

As the largest producer of wood carvings in Namibia, Kavango faces many challenges in its usage of wood resources. Small and large statues, masks, and other carvings produced by Kavango community members use an unsustainable amount of wood annually. The Kavango

wood carving industry puts significant strain on the resources available, but few communities are properly educated on the effects of this popular industry. During the off-season, wood carvers are forced to drop their prices significantly in order to sustain a living, resulting in expensive woods appearing "cheap." This contributes to the communities' lack of awareness about the wood's value because they are not making a profit proportional to the amount of time it takes to grow expensive woods (Conservation Magazine, 2003).

Freedom Litwayi, a third-year student at the Polytechnic of Namibia, said she feels communities in rural Namibia do not respect plants despite the fact they need plants to survive. She shared her opinion that many people in rural regions like Kavango are unaware of the environmental damage they cause when they are cutting down trees and destroying animals' homes. While the Kavango region faces many environmental problems, community members remain unaware of how they are contributing to these problems. Education on the present environmental problems would likely improve overall awareness and prevent many community members from contributing further to environmental damage.

4.3 ENVIRONMENTAL EDUCATION IN NAMIBIA

4. Focusing rural environmental education on local problems is an effective way to engage Namibian learners because it improves their comprehension of environmental problems and ability to connect the information to their everyday lives.

In developing environmental education for rural Namibian communities, it is important to center the education in the problems affecting these communities each day. Vilho Absalom Vilho, an environmental educator at the Namutoni Environmental Education Centre (NEEC), indicated that he focuses primarily on issues that are obviously happening in Namibia to make his environmental lessons relevant to learners. Victoria Endjala, an environmental educator at the Namib Desert Environmental Education Trust (NaDEET), finds using examples that relate to learners' home lives engages them in the material and helps them learn more. The purpose of this region-specific education is to help learners understand how the environmental problems around them have happened and what they can do to stop them. Many environmental problems, such as climate change, seem remote to learners. Learners need to understand the relevance of these environmental problems and how their actions can affect the bigger picture (Dale & Carlisle, 2008). Learners are more likely to act in favor of the environment if they have a direct connection to the material (Wells & Lekies, 2006). When local examples are used in classrooms, learners are more likely to interact with the material because they have a greater chance of encountering these examples in their everyday life (Dale & Carlisle, 2008).

Developing environmental education that learners can relate to is crucial in rural communities such as Kavango because these learners experience very specific problems. Problems from other regions may seem abstract and prevent them from actually learning from

the lesson. Centering environmental education in local problems can better influence people to make their community more environmentally friendly (Pitoska & Lazarides, 2013).

5. Environmental education in the Namibian school system could be improved by consistent implementation, a more extensive inclusion of important environmental topics, and wider accessibility.

In a survey of seven students at the Polytechnic of Namibia, only two indicated that they ever received environmental education after primary school. Three of the seven students indicated that they never received environmental education at all. Although environmental education exists in the national curriculum for primary school, it appears that many learners are not receiving environmental education and those who are receive inadequate education.

Sinomba Solver, a third-year student at the Polytechnic of Namibia, indicated that while he received environmental education, he felt that education on the benefits of environmental conservation does not exist. Solver explained that many people know they should keep the environment clean, but they do not know why. Vendelinus Shipopyeni, a first-year student at the Polytechnic of Namibia, agreed with Solver's point, emphasizing that the Namibian school system should be teaching learners the advantages of keeping the environment clean but it currently is not.

The limited environmental education that Namibian learners received also lacks proper explanation of important environmental topics. In a review of the Namibian secondary school curriculum textbooks, the inclusion of the environmental problems of pollution, deforestation, global warming, and flooding was evaluated for each textbook. The distribution of evaluated subjects is shown in Table 4.1.

TABLE 4.1: SUBJECT DISTRIBUTION OF EVALUATED TEXTBOOKS

Subject	Number of Books Reviewed
Life Science	7
Physical Science	3
History	2
Biology	1
Geography	1

Table 4.2 shows the results of the textbook evaluations. While the inclusion of pollution, deforestation, global warming, and flooding varied, many times the topics were interdependent. For example, *Go For Life Science – Grade 9* said, "Chopping down of large trees has led to serious problems worldwide (such as climate change)." The connection of topics such

as pollution and global warming or deforestation and climate change did occur in the books, but overall the coverage of pollution, deforestation, global warming, and flooding in the curriculum was limited.

TABLE 4.2: RESULTS FROM ASSESSMENT OF TEXTBOOKS' INCLUSION OF IMPORANT ENVIRONMENTAL TOPICS

Topic	Number of Texts	Level of Inclusion
Deforestation	3	Ranged from a single picture caption to 3 pages
Flooding	1	Single bullet point
Global Warming	5	Ranged from 3 pages to a 25 page section
Pollution	7	Ranged from a few paragraphs to 20+ page sections in some texts

The Namibian textbooks also included limited information relating to the EduVentures modules of biodiversity, climate change, sustainability, and heritage. Table 4.3 shows the results of the textbook evaluations. Although the information present for each module topic appeared to be extensive based on length, much of the information did not go into depth. These module topics do not appear in every textbook and are often barely mentioned when they do appear. In order for the information to be adequately included, it must be mentioned multiple times and explained more thoroughly.

TABLE 4.3: RESULTS FROM ASSESSMENT OF TEXTBOOKS' INCLUSION OF EDUVENTURES MODULE TOPICS

Module Topic	Number of Texts it Appeared in	Level of Inclusion
Biodiversity	5	Ranged from 1-18 pages
Climate Change	8	Ranged from 1 sentence to a full chapter
Heritage	2	50+ page sections
Sustainability	7	Ranged from 3 paragraphs to 3 pages

In addition to the inadequate environmental education received by Namibian learners, much of the available environmental education in Namibia is inaccessible to learners because it takes place at education centers rather than at schools. Several organizations such as NaDEET, Africat, and the Namibia Nature Foundation (NNF) contribute significantly to the environmental education that occurs in Namibia, but many of these organizations focus primarily on center-

based education rather than community outreach. Vilho Absalom Vilho said that there is a lack of accessible environmental education centers due to the remote nature of Namibian communities, with only ten major education centers existing across the country. The distance between the centers and schools makes travel very difficult for remote schools. Figure 4.3 shows the location of the major environmental education centers in Namibia. Vilho also identified lack of finances for transport as one of the most significant obstacles to environmental education in Namibia because many schools cannot afford to transport learners to the closest environmental education center. Transportation, along with education center entrance fees, presents a significant financial challenge that prevents many schools from participating in these programs. Linna Nantinda and Dr. Alex Kanyimba, a lecturer at the University of Namibia, also identified transport as a significant obstacle faced by Namibian environmental education. Developing environmental education that can be made present in schools rather than schools travelling to expensive, far-away education centers would overcome this obstacle and would more effectively reach Namibian learners.

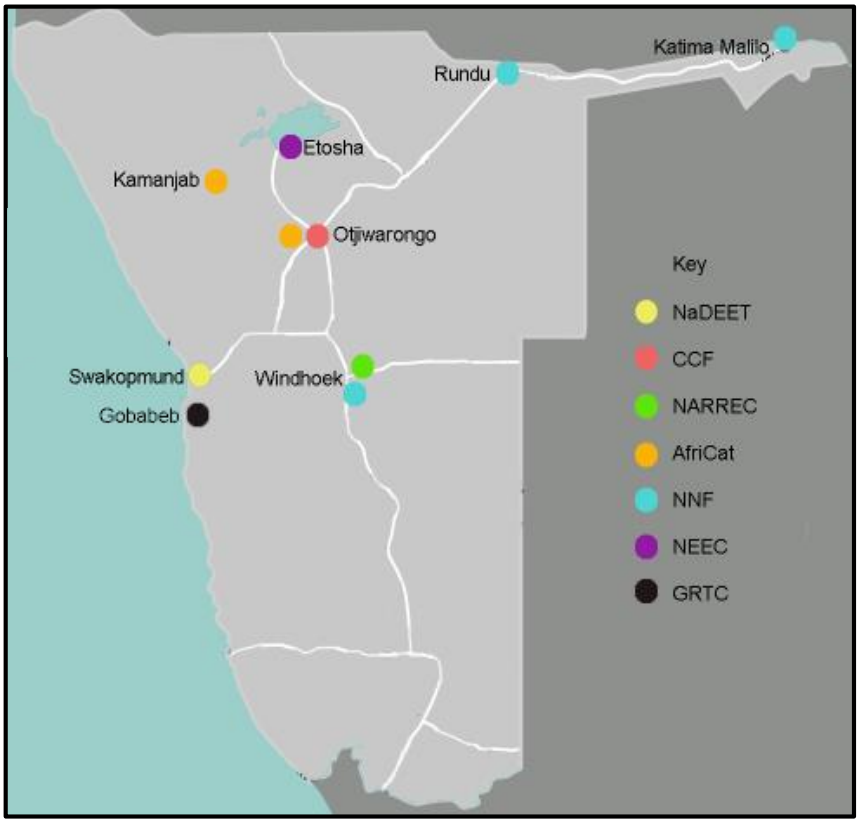

FIGURE 4.3: MAP OF ENVIRONMENTAL EDUCATION CENTERS IN NAMBIA

Environmental education in Namibia needs significant improvement in order to properly educate learners on the problems facing their communities and how they can address them. In regions such as Kavango, where environmental problems severely impact the lives of

community members, environmental education is crucial to ensure that further environmental damage does not occur. Making environmental education more accessible and inclusive of important environmental topics would significantly improve the state of environmental education in Namibia.

6. Although many Namibian learners and educators prefer hands-on learning because it engages them, its implementation in the Namibian school system has been limited because of poor teacher training and financial limitations.

Dr. Alex Kanyimba explained that Namibian education policy promotes interactive styles of teaching to challenge learners, ensure they understand the material taught, and allow them to practice active problem-solving. Kanyimba explained that in his experience, Namibian schools with higher pass rates tend to use interactive learning techniques outside of the classroom because it "enhances learners' understanding of social, economic, and environmental reality." Vilho Absalom Vilho finds experiential learning to be the most effective way to engage Namibian learners. "By doing hands on experiential learning where everyone is engaged," Vilho said, "learners are able to understand why certain issues are happening in their society and how to solve them." Stephanie Bradley, the education manager at the Cheetah Conservation Fund, cited interactive methods as the best method for Namibian learners.

Participants in the EduMobile program indicated they prefer hands-on learning. One learner said they did not like the Biodiversity lesson because "teaching only cannot open up a person's mind…practical is best." Another learner shared that collecting biodiversity was their favorite activity because it was "more fun" to be out in the field chasing and catching insects. Students interviewed at the Polytechnic of Namibia also identified activity-based learning as the method they prefer. Opo Ashiicuti, a third-year student, explained that he learns better through practical application of learning rather than theory because he can visualize the information. Freedom Litwayi and Sinomba Solver also indicated they learn better by learning something and then going on excursions to complete practical work so they don't forget what they learned.

For environmental education, Linna Nantinda identified learning outside of the classroom as the most effective way to implement interactive learning. It is believed that learners who learn about the environment through activities outside are more likely to care about the environment and act sustainably as adults (Wells & Lekies, 2006). Dr. Kanyimba also felt that using the local environment to teach environmental education is important and should be used if it can be executed properly. Victoria Endjala, an environmental educator at the Namib Desert Environmental Education Trust (NaDEET), finds hands-on activities where learners can learn through action best engages them in the environmental education programs.

Namibian learners and educators prefer hands-on learning because it actively engages learners in the material they are learning and increases their understanding of the information. Learners are better able to retain information when they learn and apply it through hands-on methods.

Despite the proven effectiveness of hands-on learning in the Namibian school system, its implementation is lacking. Both Nantinda and Kanyimba said that while the Namibian education system encourages the use of interactive teaching methods, many teachers use lectures instead, failing to properly engage the learners. Kanyimba identified poor training of teachers on interactive methods as one of the main reasons these methods have not been properly implemented. He also explained that while learning outside of the classroom is encouraged, financial and transportation limitations make this difficult in the Namibian school system.

Learners and educators support the implementation of hands-on learning in the Namibian school system, but it is currently not well-developed. The improvement of hands-on learning in Namibian schools would enable learners to learn more effectively and enjoy learning, especially in environmental education.

4.4 IMPLEMENTATION OF THE EDUMOBILE PROGRAM

7. The existing EduVentures lessons were ineffective because of their length, excessive text, and lack of interactive activities. The new lessons are easily comprehensible and effectively educate the learners.

The EduVentures staff indicated that the existing PowerPoint presentations for Biodiversity, Climate Change, Sustainability, and Heritage were too content-heavy and did not actively engage the learners. They stated that many learners would get distracted or not understand the information because of the long, information-dense lessons. We found that, on average, each presentation included forty-four slides with fifty-seven words per slide. These presentations each included only one or two activities in which the learner could participate and most of them were only questions and answers. The existing structure of the lessons did not promote learner participation and inefficiently communicated the material.

In testing the new SMART lessons, we found that learners comprehended the material well and retained the information. Of the 17 learners surveyed at Maria Mwengere Secondary School, only three indicated they did not understand part of the Biodiversity lesson and two did not understand part of the Climate Change lesson. At Martin Ndumba Combined School, only two learners responded they did not understand part of the Biodiversity lesson and every learner said they understood the entire Heritage lesson.

The post lesson surveys included five content-based questions from the lesson. The number of correct and incorrect responses to these questions are shown in Figure 4.4. Of the twenty questions asked with a total of 350 responses collected, learners answered correctly 80% of the time.

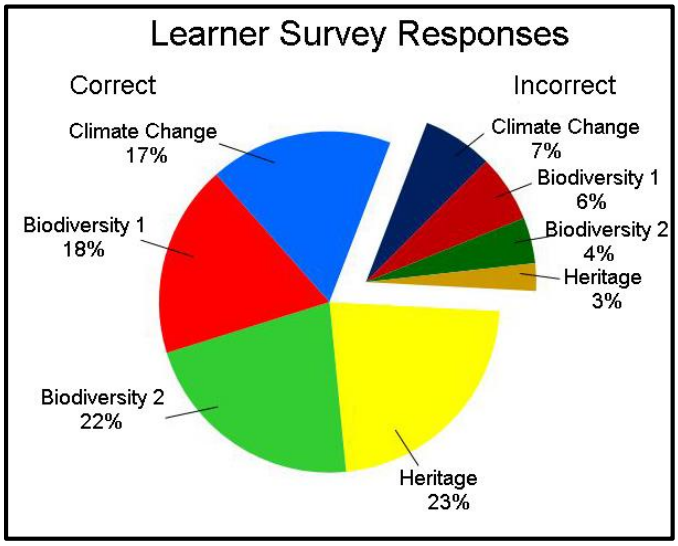

FIGURE 4.4 PIE CHART OF LEARNER SURVEY RESPONSES

8. Learners learn better using the SMART Board because it uses pictures and interactivity rather than note-taking.

All thirty-five EduMobile participants at Maria Mwengere Secondary School and Martin Ndumba Combined School indicated that using the SMART Board affected their learning positively. Survey responses from the learners indicated that the SMART Board helped them to "gain more skills" and improved their understanding of the material. During the Climate Change lesson, one learner shared that he "would very much like [a SMART Board] for his school because it is so easy to learn from and helps to understand." Several learners indicated that they found the SMART Board made learning about environmental topics more fun. Learners said they preferred learning through the SMART Board over a normal chalkboard and that it made learning easier. This finding supports the claims of other researchers who have advocated for Technology-Enabled Active Learning (TEAL) as a "fun," enjoyable method in classrooms.

9. The SMART lessons' effectiveness decreases after the first hour because learners stop paying attention and enjoying the material.

Classroom observations during the EduMobile lessons showed that as the lesson progressed, many learners lost interest in the material and stopped paying attention. Figure 4.5 shows the progression of the number of learners sitting up and listening throughout the lesson. The dotted line indicates the one-hour mark within the lesson. Following the hour mark, the number of learners paying attention steadily decreased. The Heritage lesson was shorter than the other lessons, but most of the lessons stretched for over two hours. It appears that sitting and learning from a lesson for such an extensive period of time bored the learners and caused them to not pay attention, rendering the lessons ineffective.

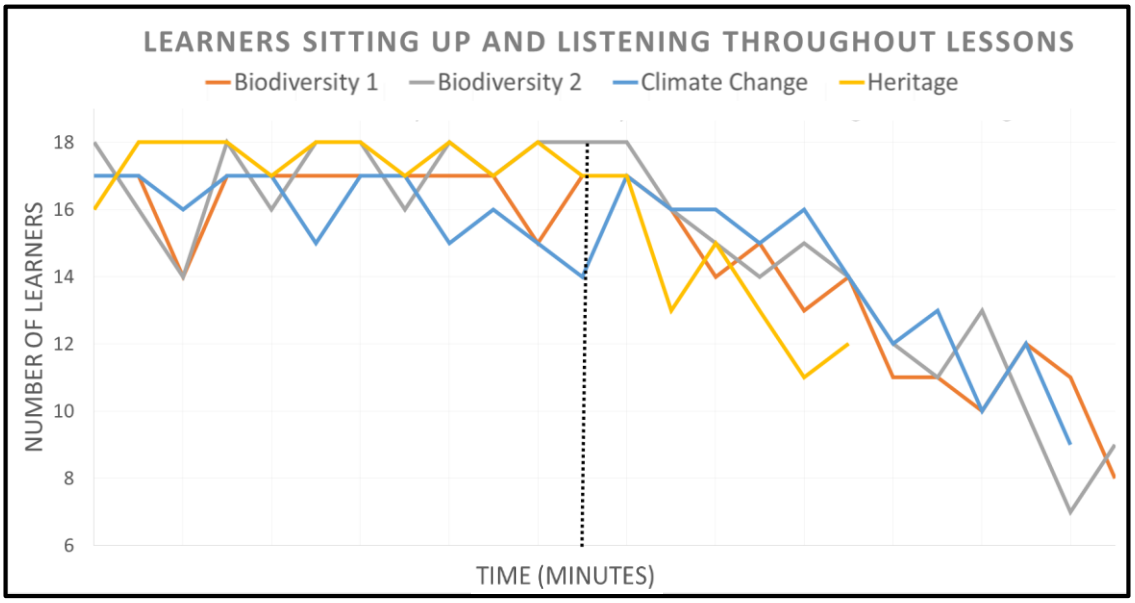

FIGURE 4.5: PROGRESSION OF LEARNERS PAYING ATTENTION THROUGHOUT LESSON

10. Learners enjoy the EduMobile program because it teaches them new things in a fun, interactive way.

The implementation of the EduMobile program was successful because it completed its goal of engaging rural Namibian learners and making them excited about environmental education. In the end of the week surveys, all thirty-five learners who participated in the EduMobile program in Kavango indicated that they "very much" enjoyed the EduMobile program and had fun. "This week was so fun," one learner said, "and I was excited about it." One learner said the program was "beyond fun" and that they had a "great time with everybody." Several learners shared that they did not want the program to end and wished it was "not supposed to be a week, but a month." Learners explained they enjoyed the week because they "learned a lot of things" and saw things they had not seen before.

11. Instruction on environmental topics in Namibian schools would be supported by learners and teachers because it increases learners' environmental skillset and inspires them to protect the environment.

EduMobile learner survey responses indicated that learners would very much enjoy learning about more environmental topics. Thirty-four out of thirty-five program participants said they would like to learn about more environmental topics. The learners explained that learning about the environment makes them "feel proud" and helps them to "gain more skills and knowledge." One learner said that they would be "looking forward to learning more topic[s] of this kind" because the topics are "educational and it's good for [their] environment." Participation in the EduMobile program made learners feel "motivated" and helped them to understand the right ways to protect the environment and act sustainably. Learners expressed

that they very much enjoyed gaining information through environmental lessons and would love to learn more.

Seven students at the Polytechnic of Namibia were surveyed about their experiences with environmental education. All of the students who indicated they had received environmental education previously said they enjoyed learning about environmental topics. Linna Nantinda, a member of the Namibia Environmental Education Network (NEEN) and a teacher at Hochland High School, finds her learners to be very engaged during environmental education lessons, especially field trips.

Four of the seven students surveyed at the Polytechnic of Namibia felt environmental education should be a compulsory subject in secondary school. Freedom Litwayi feels that all learners should be required to pass environmental education. Litwayi feels if everyone had to learn about the environment, more people would understand why they should care and would be more likely to act on it. Nantinda feels environmental education "helps people to do the right things [and] changes their attitudes."

The responses of EduMobile program participants, conversations with students having recently completed the Namibian secondary school curriculum, and the environmental education insight of Linna Nantinda indicate that Namibian learners and educators are open to environmental education and that learners enjoy learning about environmental topics. Further EduMobile visits and supplementary environmental education material would be welcomed into Namibian schools.

4.5 SUMMARY

Through research, interviews, and field testing with EduVentures, we have identified many key points in our analysis of environmental problems in Kavango, conservation in Kavango, environmental education in Namibia, and the EduMobile program. We have gained valuable insight into the role of environmental education in Kavango and the ways it can be implemented effectively. Our participation in the EduMobile program led to many discoveries regarding the successes of the program and where it can be improved.

CHAPTER 5 – CONCLUSION & RECOMMENDATIONS

This project has highlighted the complicated obstacles in rural Namibian environmental education. Literature review, interviews with Namibian experts on education and the environment, survey of students at the Polytechnic of Namibia, and communication with secondary school learners in the Kavango region highlighted the critical flaws in Namibia's rural environmental education. We determined the five critical environmental problems in Kavango, identified the complications of explaining conservation benefits in rural communities, found hands-on learning to be the preferred method in Namibia, and illustrated the Namibian environmental education system's need for consistent implementation, better explanation of environmental problems, and wider accessibility.

Developing the Biodiversity, Climate Change, Heritage, and Sustainability lessons illustrated the challenges of developing comprehensive, engaging, and interactive environmental education. Learning from the previous EduVentures presentations provided key insight into the criteria the new lessons had to meet. Field testing in the Kavango region highlighted the current strengths in the EduMobile program. We found that learners responded positively to the EduMobile program and that modifications to region-specific content, lesson timing, and hands-on opportunities would strengthen the program and more effectively educate program participants. Based on the information we were able to collect and the observations we made, we identified actions that could improve the EduVentures Trust's implementation of environmental education in rural secondary schools.

5.1 RECOMMENDATIONS FOR THE EDUVENTURES TRUST

1. **We recommend that the EduVentures Trust makes their Biodiversity, Climate Change, Heritage, and Sustainability lessons specific to the region they are visiting.**

   When environmental education is locally relevant, the material is more likely to interest learners and they will better retain the information presented to them. By providing learners with examples of environmental problems that directly affect their lives, they are able to identify how their actions affect the problem and can recognize possible solutions.

   We recommend that EduVentures makes the environmental problems presented in their lessons specific to the schools they are visiting. Namibia is a large country affected by many diverse problems. Learners in the north experience flooding while large portions of Namibia are in drought. Diversifying lessons based on the region being visited will enable EduVentures to deliver more effective environmental education and make a lasting impact on learners across the country.

   While making the lessons more general allows them to be applicable to any school, focusing at least a portion of the lessons on local problems could improve learners' comprehension of the problems facing their community. By better understanding local

problems, learners can more easily spread knowledge of these problems into their community. When sharing this knowledge, learners with information on local problems can provide specific examples of how individuals can mitigate the problems, making a more significant impact on communities.

2. **We recommend that the EduVentures Trust instructs learners on the benefits of environmental conservation.**

   A learner participating in the EduMobile program explained that while they understand the importance of conservation, they have difficulty explaining it to their parents because their parents do not understand "the good it can do." In rural regions like Kavango, conservation can be complicated because communities rely on natural resources to survive. In the case of wildlife conservation, many community members do not want to participate because of the damage wildlife causes to their livelihoods.

   We recommend that EduVentures explain the specific benefits of environmental conservation as part of their lessons. By educating learners on the benefits of environmental conservation, EduVentures will provide learners with the tools they need to bring conservation into their communities. Environmental education is useless if it is not applied and shared with the community. Helping learners to spread their knowledge and properly explain the benefits of conservation will promote change in the community and enhance the lasting impact of the EduMobile project.

3. **We recommend that the EduVentures Trust invites learners to use the SMART Board more often to enhance the EduMobile experience.**

   Participants in the EduMobile program responded positively to the usage of the SMART Board, explaining that it made learning "fun" and helped them understand the material more. Learners expressed the desire to have a SMART Board at their school. We recommend that EduVentures invites learners to use the board more often during lessons to harness this enthusiasm and increase the benefit of the program.

   While activities where learners could participate have been implemented into the lessons, learners were often asked to raise their hands to provide answers instead of coming to the board. Allowing learners to interact with the board may take more time, but will enhance their learning experience and may increase their retention of the information. Many of these learners are unfamiliar with technology such as the SMART Board and are eager to learn through this medium. The enthusiasm they have for the technology translates into eagerness to learn and engage with the environmental material.

4. **We recommend that the EduVentures Trust limits the amount of time devoted to lessons by breaking them up throughout the day.**

   Observations during the EduMobile lessons showed that the number of learners paying attention and enjoying the lessons steadily decreased after the first hour. It appeared that sitting at a desk for that period of time caused the learners to be bored, decreasing their ability to learn from the lesson. By breaking up the lesson throughout the day and limiting the amount of time for lessons to smaller periods, EduVentures will better engage the learners and increase the effectiveness of the program.

5. **We recommend that the EduVentures Trust provides supplementary materials for schools to use year-round.**

   Learners participating in the EduMobile program indicated that learning about environmental topics through the program gave them more skills and knowledge about how to protect the environment. Learners said that the lessons motivated them to protect the environment, and many learners indicated that they would like to learn more about similar topics. By developing supplementary materials for schools to use throughout the year, EduVentures could improve its lasting impact in the community. EduVentures can also share the lessons used during the program, as well as the lessons not used, for the school to use during the year. This would require the teachers to have, at a minimum, a projector and the SMART software beause the lessons can be used by clicking on the computer screen using a computer mouse. Access to the SMART software could be a challenge, but is still a viable option.

6. **We recommend that the EduVentures Trust completes an extensive survey of learners across the country regarding their experiences with environmental education.**

   For EduVentures to have the most significant impact on environmental education in Namibia, they must understand the critical areas their program should address. In surveying a small selection of students at the Polytechnic of Namibia, we gained useful information regarding the state of environmental education in Namibia. We identified potential areas of improvement and received valuable insight into how Namibian students feel the curriculum can be improved. By completing a more extensive survey of learners nationwide, EduVentures can better understand the current state of environmental education across the country from varying perspectives. A larger survey would provide more accurate results than our small sampling.

   By understanding the experiences of Namibian learners, EduVentures will gain insight into how they can meet the needs of the Namibian education system by recording first-hand perspectives of Namibian learners. Learners experience the environmental education curriculum first-hand and can provide the clearest depiction of the current state of environmental education in Namibia. Collaboration with members of the Namibia

Environmental Education Network would make this survey possible and would allow EduVentures to reach learners across the country.

The implementation of these recommendations could improve EduVentures' impact and the overall educational experience of learners participating in the EduMobile program. We hope that our research will help EduVentures improve environmental education in Namibia and enable the EduMobile program to better engage learners and inform communities on environmental problems.

5.2 CROSS-CULTURAL PROGRAM DESIGN

The role of technology in communities varies significantly across the world. Completing a project of this scale in a foreign country brings to light many of the cross-cultural implications of technology. Through the completion of this project, we have learned several key lessons about overseas, technological implementation:

Be mindful of your own bias toward technology. Base your decisions on the community's level of familiarity and need.

Because of our technological training, it was easy to want to help the community we were working with by implementing the best and most advanced technology available. However, we learned that to successfully complete an overseas project, we had to understand the community's level of familiarity with technology. Developing tools that would be beyond the ability of the target audience would be a waste of time, since the tools would not be used. We learned to take a step back and consider what the community needed rather than what we saw as the best solution. Often, the best solution in our eyes was not the best solution for our target audience. Understanding the role our project played in the lives of the community allowed us to step back from what we wanted to make choices that best met their needs.

Be sure to learn from your sponsor, because they have more experience than you in the host country.

Coming into the project, we had ideas of what we wanted to complete. However, we quickly learned the importance of listening to not only what the sponsor wanted, but what they have previously experienced. While it was important to be aware of the possible blind spots our sponsor could have, we learned that listening to their experiences was an important part of developing successful ideas. While at first we may have viewed something as a great solution, talking with our sponsor sometimes revealed that our idea was not within our ability or that the idea had been unsuccessfully implemented previously.

Understand and adapt to the technological limitations you will face in completing an international project.

The standard of technological resources can vary significantly from country to country. Internet availability may be limited and finding electricity outlets to charge devices can at times be challenging. We found early in our project that these obstacles hindered our ability to complete tasks. Anticipating these obstacles became an important part of completing our project.Technology plays a very unique role in different countries, and having constant access is often not a necessity for the people there. Expecting limited access to internet and electricity was an important part of completing a project abroad.

Conclusion: Completing an international project has many challenges that come along with it. The key to successful project completion is to not fight these challenges, but embrace them. While there may be obstacles and changes along the way, understanding the role a technology-based project plays in the target community highlights the fundamental purpose of the project: to meet the needs of the people. Expectation of and adaptation to these challenges can create a project experience that is immensely rewarding for the project team, making a lasting impression on both the community and the team members' lives, long after they return home.

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APPENDIX A: EDUVENTURES TRUST BACKGROUND

The EduVentures Trust is a nonprofit environmental education organization that was founded in Namibia in 2003 by a secondary school teacher and a scientist from the National Museum of Namibia. Originally funded exclusively through donations, EduVentures is now supported by and works with the National Museum of Namibia (EduVentures, 2007).The organization started with the goal of raising environmental awareness while helping to collect data on Namibian biodiversity. To accomplish this goal, EduVentures took learners on expeditions to remote areas of Namibia. On these expeditions, the learners helped collect data on species around the country. These expeditions not only gave the learners hands-on learning, but also taught them valuable skills in scientific methods (EduVentures, 2007).

Along with helping the learners, these projects were able to assist EduVentures in collecting important data on the biodiversity of Namibia. Their expeditions even included the discovery of a possible new species of insect in Fish River Valley (Travel News Namibia, 2006). Discoveries such as this one are both useful for the Namibian government and encouraging to the participating learners.

EduVentures' newest project, EduMobile, will help EduVentures bring experiential learning to rural schools in Namibia. This project consists of a truck that is equipped with materials to help give education to the learners in rural regions, as well as a classroom with SMART Boards. The materials onboard the truck include microscopes, magnifying glasses, and other scientific equipment (Solidaritätsdienst International e.V., 2011). The initial goal for the EduMobile project is for the truck to travel to five schools in the Windhoek area. The truck is intended to reach fifteen other schools throughout Namibia in the next five years (Solidaritätsdienst International e.V., 2011).

APPENDIX B: INTERVIEW QUESTIONS AND PROTOCOL

Interviews were transcribed, with permission.

Introduction: Hello, our names are Emily Dunham, Benjamin Hawks, Chandlor Lyles, and Amy Misera. We are a team of students from Worcester Polytechnic Institute in Massachusetts, USA. We are conducting research on environmental education in Namibia to assist the EduVentures Trust with developing a mobile environmental education curriculum that uses experiential learning. Due to your interests and experiences, we are looking to interview you about environmental education/the Namibian school system. Are you willing to participate in our research through an interview? *(Provide written consent if necessary.)* Would you like your responses to be kept anonymous? *(Discuss expectations of anonymity if applicable.)*

Various sets of questions were used based on the expertise of the interviewee.

ENVIRONMENTAL EXPERT INTERVIEWS

1. What environmental problems do you perceive as most important in northeastern Namibia?
2. What do you perceive to be the biggest obstacles for environmental education in Namibia?
3. How have you seen environmental education in Namibia change over the past few decades?
4. What (if any) actions have you taken to promote environmental awareness and education in your community?
5. What environmental education initiatives have you seen in your community?

Specifically for facilitators of environmental education programs:

6. How do you engage the learners?
7. How do you adapt your program to various age groups?
8. How do you make the issues you are presenting relevant to learners?
9. What teaching methods do you find most effective with learners?
10. Which topic areas within environmental education do you feel need immediate attention?

EDUCATOR INTERVIEWS

1. In what subject area(s) do you teach environmental education? (Science, history, language, health, art, etc.)
2. What grades do you teach?

3. Within your subject, what environmental topic areas do you cover? (Biodiversity, climate change, renewable energy, resource consumption, water resources, etc.)
4. What educational materials do you use? (Textbooks, magazines, websites, videos, etc.)
5. What method of education do you primarily use to teach environmental education? (Lectures, field trips, group projects, games, etc.)
6. How do learners react to this education? Are they engaged or disinterested?
7. What topics do you feel are best received by the learners?
8. What topics do you feel learners dislike?
9. How do you feel about the implementation of environmental education?
10. Would you have any concerns regarding the implementation of environmental education into the national curriculum for all grade levels?

EDUCATION EXPERT INTERVIEWS

1. What is the typical teaching style in Namibian classrooms? (Lectures, interactive activities, outside learning, etc.)
2. What teaching methods do educators typically find most successful with Namibian learners?
3. What is the best way to engage Namibian learners while staying within the bounds of the current education system?
4. What are the biggest challenges faced by the Namibian school system?

POLYTECHNIC STUDENT INTERVIEWS

1. What region of Namibia are you from?
2. What would you perceive as the most significant environmental threats in that region?
3. Did you ever receive any environmental education? If so, what topics are you familiar with? (Biodiversity, climate change, renewable energy, resource consumption, water resources, etc.)
4. How often did you learn about the environment and at what age?
5. How did you learn about the environment? (Parents, personal experience, school, etc.)
6. Did you enjoy learning about the environment? What parts of the education did you like and dislike?
7. How do you feel environmental education could be improved in the Namibian education system?
8. What teaching methods do you find most effective in Namibian classrooms?
9. How do you think environmental education can be made relevant to Namibian learners?

APPENDIX C: CLASSROOM OBSERVATION CRITERIA

This form was used for each classroom observation to assess the effectiveness of the lessons. We did not identify learners by name. For each of the behaviors, we listed the number of learners showing each behavior and indicated at what point in the lessons they showed this behavior. Observations were recorded approximately every 5 minutes.

Lesson Observation Form

Observer _____ Date _____ School _____ Lesson _____

		How many students are...?	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
At 5 minute mark	1	Sitting up and listening												
	2	Participating in side conversations												
	3	Maintaining eye contact												
	4	Expressing confusion/ frustration												
	5	Appear to be having fun												
During the 5 minutes	6	Asking insightful questions												
	7	Willingly responding to questions												
	8	Willingly participating in activities												
	9	Giving correct answers to questions												
	10	Working together on activities												
	11	Discussing answers/activities												
	12	Repeatedly asking clarifying questions												

Additional comments (Label: question #, letter ex: 2C)

		How many students are...?	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)
At 5 minute mark	1	Sitting up and listening												
	2	Participating in side conversations												
	3	Maintaining eye contact												
	4	Expressing confusion/ frustration												
	5	Appear to be having fun												
During the 5 minutes	6	Asking insightful questions												
	7	Willingly responding to questions												
	8	Willingly participating in activities												
	9	Giving correct answers to questions												
	10	Working together on activities												
	11	Discussing answers/activities												
	12	Repeatedly asking clarifying questions												

Additional comments (Label: question #, letter ex: 2C)

APPENDIX D: LEARNER SURVEY QUESTIONS

On Monday and Tuesday of each school visit, a survey was distributed to the learners immediately following the SMART lesson to gauge their understanding of the material and their opinions on the lesson. Another survey distributed at the end of the day collected learners' opinions on the entire day to understand which activities they liked best and how they feel what they learned can apply to their life. A survey was also distributed at the end of the week to gauge the learners' overall impressions of the program. These surveys were properly explained to the learners and they provided consent to participate in our research.

After Lesson Survey

What did you like about the biodiversity lesson?

_____

_____

Why did you like that?

_____

_____

What did you not like about the biodiversity lesson?

_____

_____

Why did you not like that?

_____

_____

Did you understand the lesson?

_____

_____

How would you explain biodiversity?

_____

_____

What are the three types of biodiversity?

_____ _____ _____

Give an example of species diversity.

_____

_____

What damages biodiversity?

_____

_____

How does biodiversity affect your life?

_____

_____

End of the Day Survey

Which activity was your favorite today? *Circle one*.

Biodiversity lesson | Setting traps to collect biodiversity | Identifying biodiversity

Why did you like that activity?

_____

_____

Which activities did you not like? *Circle any you did not like*.

Biodiversity lesson | Setting traps to collect biodiversity | Identifying biodiversity

Why did you not like that activity?

_____

_____

How did you use what you learned in the classroom truck this morning in the field today?

_____

_____

Appendix D

End of the Week Survey

During the lessons, did you get to use the SMART board?

_____

How did the SMART board affect your learning? Did it make it easier or more difficult?

_____

_____

Put the days in order of your favorite 1-5.
1 = your favorite day, 5 = less favorite day

_____ Biodiversity lesson and collecting specimens
_____ Climate change lesson and outdoor card game
_____ Exploring the River field trip and starting projects
_____ Creating an Environmental Club and working on project
_____ Presenting projects

How would you feel about leaning more environmental topics?

_____

_____

Did you have fun this week?

_____

_____

ALTERNATIVE QUESTIONS:

The questions asked varied upon the day's activities and the lessons taught. The questions pictured above are only a sampling. The additional questions asked are listed below.

After Lesson Survey

After the lessons, the learners were asked five content-based questions from the lesson and five questions related to the lesson experience. For each lesson, the content-based questions were:

Biodiversity: How would you explain biodiversity?
What are the three types of biodiversity?
Give an example of diversity.
What damages biodiversity?
How does biodiversity affect your life?

Appendix D

Climate Change: What is climate change?
Why would there be more methane in this region?
The Ozone Layer's main job is to…
Give an example of how you can lighten your carbon foot print.
How does climate change affect Kavango?

Heritage: What is heritage?
What is tangible and intangible heritage?
Give an example of tangible heritage.
What is natural heritage?
How did the heritage lesson apply to your life?

The five lesson-experience questions were:

What did you like about the _____ lesson?
Why did you like that?
What did you not like about the ____ lesson?
Why did you not like that?
Did you understand the lesson?

End of the Day Survey

The end of the day surveys consisted of the same questions each day, altered to reflect the activities completed that day. The questions were:

Which activity was your favorite today? Circle one. *(Included a list of that day's activities.)*
Why did you like that activity?
Which activities did you not like? Circle any you did not like. *(Included a list of that day's activities.)*
Why did you not like that activity?
How did you use what you learned in the classroom truck this morning in the field?

End of the Week Survey

Questions for the end of week survey were the same each week, with the only alteration being that week 1 had Climate Change activities and week 2 had Heritage activities. The field trip was also different each week.

APPENDIX E: INTERVIEW WITH LINNA NANTINDA

We were unable to conduct an in-person interview with Ms. Nantinda. The following interview was conducted via an email questionnaire.

Interviewee Name:	Linna Nantinda
Title:	Teacher at Hochland High School and member of the Namibia Environmental Education Network
Date:	March 31, 2015
Reason for Interviewing:	Ms. Nantinda has extensive knowledge on environmental education in Namibia and has experience teaching it to learners.

In what subject area(s) do you teach environmental education?
Life Science, Art and Language
What grades do you teach?
8-12
Within your subject, what environmental topic areas do you cover? (Biodiversity, climate change, renewable energy, resource consumption, water resources, etc.)
Climate Change, Resource Consumption, Biodiversity
What educational materials do you use? (Textbooks, magazines, websites, videos, etc.)
Textbooks, videos
What method of education do you primarily use to teach environmental education? (Lectures, field trips, group projects, games, etc.)
Field trips, lectures, group projects
How do learners react to this education? Are they engaged or disinterested?
Very much engaged
What topics do you feel are best received by the learners?
Climate Change Adaptation
What topics do you feel learners dislike?
None
How do you feel about the implementation of environmental education?
Environmental education helps people to do right things, changes their attitudes, etc.
Would you have any concerns regarding the implementation of environmental education into the national curriculum for all grade levels?

No
What is the typical teaching style in Namibian classrooms? (Lectures, interactive activities, outside learning, etc.)
Classroom teaching/lectures
What teaching methods do educators typically find most successful with Namibian learners?
Group work
What is the best way to engage Namibian learners while staying within the bounds of the current education system?
Invite them to join environmental clubs
What are the biggest challenges faced by the Namibian school system?
Transport
What environmental problems do you perceive as most important in northeastern Namibia?
Floods/deforestation
What do you perceive to be the biggest obstacles for environmental education in Namibia?
Stakeholders engagement. The Ministry of Education needs to work together with the Ministry of Environment and Tourism in order for environmental education in Namibia to succeed.
How have you seen environmental education in Namibia change over the past few decades?
Changing drastically. Teachers attend conferences on EE nationally, regionally, and internationally; Youth Conferences on EE, for example the Youth Environmental Summit (YES); Environmental Education Centers are build and run by well-trained environmental educators; the role of stakeholders like EduVentures, Ministry of Environment and Tourism, Ministry of Youth, Gobabeb Training Centre, UNESCO; people sharing their activities/experiences; Namibia Environmental Education Network (NEEN) is very active; etc.
What (if any) actions have you taken to promote environmental awareness and education in your community?
Gathering the youth/students and educating them on climate change adaptation – every house/school should have a garden, cleaning campaigns every Saturday
What environmental education initiatives have you seen in your community?
Planting of fruit trees, cleaning campaigns, recycling bins, gardens at some schools
How do you engage the learners in your environmental education programs?

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Appendix E

We are using a school workbook, “My Carbon Footprint,” and all areas of environmental education are well-covered in this booklet. I meet with the environmental club members every Wednesday to discuss topics in the workbook and other activities in EE. I organize trips to environmental education centers in Windhoek and beyond.
How do you adapt your program to various age groups?
Two groups, namely: Group 1 (Grade 8 & 9) and Group 2 (Grade 10-12). When it comes to the garden, each grade has its own plot for vegetables and each grade grows a certain type
How do you make the issues you are presenting relevant to learners?
In Namibia, we need to grow vegetables and plant fruit trees because we depend more on South Africa in this regard. Global warming and how to reduce it.
What teaching methods do you find most effective with learners?
Outdoor activities
Which topic areas within environmental education do you feel need immediate attention?
Sorting out the waste (recycling) or waste management, cleaning campaigns, water conservation

APPENDIX F: INTERVIEW WITH VILHO ABSALOM VILHO

We were unable to conduct an in-person interview with Mr. Vilho. The following interview was conducted via an email questionnaire.

Interviewee Name:	Vilho Absalom Vilho
Title:	Environmental Educator at the Namutoni Environmental Education Centre, Etosha National Park
Date:	April 2, 2015
Reason for Interviewing:	Mr. Vilho has extensive experience with environmental education in Namibia.

What environmental problems do you perceive as most important in Namibia?

Water wasting, littering (on land as well as in fresh water sources), energy wasting/energy inefficiency (mostly electricity), poaching

What do you perceive to be the biggest obstacles for environmental education in Namibia?

- Lack of awareness in the whole Ministry of Education structure that can influence different schools to be active in environmental education, which is in most cases conducted by NGOs
- Lack of resources e.g. finance and transport for some schools and communities that may show interest in environmental education, since most of the environmental education centers we have in the country conduct center-based education and not really outreach. Schools or communities will be forced to travel to wherever the education center is and this is only possible if they can afford the transport and fees charged at these centers.
- Lack of environmental education centers in the country, considering the distance we have in this country

How have you seen environmental education in Namibia change over the past few decades?

I have been involved in environmental education for the past four years now and before that, I had no idea about environmental education. For these four years, I have been in EE, I have realized that EE in Namibia has changed. It has grown rapidly and as a matter of fact it is still growing. There has been development of EE centers in the country, EE organizations that are bringing all Namibian environmental practioners together to share ideas and knowledge about EE in the country e.g. Namibia Environmental Education Network (NEEN).

What (if any) actions have you taken to promote environmental awareness and education in your community?

Leaving NaDEET (my former environmental education center) with the knowledge and skills I learned and joined the Namutoni Environmental Education Centre for the Ministry of Environment and Tourism is the biggest action I would say I have taken. With all the skills

learned at NaDEET, I'm able to implement education programmes at my new center for all the schools in the northern part of the country that cannot afford to travel to the south where NaDEET is.
What environmental education initiatives have you seen in your community?
The newly implemented waste management program in Etosha National Park, which I as the educator am helping to manage by incorporating it into our school programmes as well.
How do you engage learners in your own environmental education programs?
By doing hands-on, experiential activities where everyone is expected to contribute
How do you adapt your program to various age groups?
By having different activities for different phases (primary activities are designed to suite primary learners, which are slightly different to secondary activities).
How do you make the issues you are presenting relevant to learners?
My presentations mostly focus on issues that are happening and are obvious in this country. By doing hands-on, experiential learning where everyone is engaged, learners are able to understand why certain issues are happening in their society and how to solve them.
What teaching methods do you find most effective with learners?
Problem-solving method works best for me. In this way, learners are more active in finding questions and answers, for me as a teacher I only facilitate the lesson
Which topic areas within environmental education do you feel need immediate attention?
Waste management, biodiversity, water use, energy use

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APPENDIX G: INTERVIEW WITH ALEX KANYIMBA

We were unable to conduct an in-person interview with Mr. Vilho. The following interview was conducted via an email questionnaire.

Interviewee Name:	Dr. Alex Kanyimba
Title:	Lifelong Learning and Community Education Lecturer at the University of Namibia
Date:	March 26, 2015
Reason for Interviewing:	Dr. Kanyimba has particular expertise on the Namibian education system.

What is the typical teaching style in Namibian classrooms? (Lectures, interactive activities, outside learning, etc.)

Namibian education policy promoted interactive styles of teaching. One of the goals of "Towards Education for All," a booklet of the Ministry of Education published in 1933, is democracy. In classroom context, it means that learners need to express themselves in classrooms. The Pilot Curriculum Guide for Basic Education calls for a variety of techniques such as direct questioning, eliciting, explaining, demonstrating, challenging learners' ideas, checking for understanding, helping and supporting, providing for active practice and problem-solving, group work, etc.

Outside learning is encouraged but not adequately utilized because of financial limitations, transportation challenges, and logistical arrangements.

What teaching methods do educators typically find most successful with Namibian learners?

It is important to use interactive methods. However, variation is required. In cases where a topic is new and beyond learners' experience, teachers are advised to use lectures to bring content to learners' cognitive experience. Relating new content to learners' own environment is useful.

My experience shows that most Namibian schools with higher pass rates tend to use outside learning techniques because it enhances learners' understanding of social, economic, and environmental reality. However, this needs to be supplemented by projects which encourage persistent learners' contribution to solving social and environmental problems. Learners who engage in projects as part of learning tend to have a good understanding of social and environmental realities of their own and other geographical areas.

What is the best way to engage Namibian learners while staying within the bounds of the current education system?

Appendix G

The best way to engage Namibian learners will be to apply interactive activities because these are supported by Namibian policies. ICT, videos, and enviro-games are important and could get you learners' attention. ICT is particularly empathized in Namibia. Learning outside, using local environment is important. If you decided to use this technique, ensure that your leaners carry out real-life projects meant to solve the social and economic realities, albeit in a small way. It should not be like a big government project.
What are the biggest challenges faced by the Namibian school system?
There are many challenges but let's focus on methodological challenges. One of the biggest challenges is the use of learner-centered and interactive learning approaches. In fact, the Namibian education system encourages the use of interactive teaching methods, but recent research results shows that most teachers tend to use lectures, reducing learners to the role of note-taking. Second, research results show that large-scale, in-service teacher training on interactive methods in environmental education in scarce. They show that most Namibian teachers have not been recently trained on interactive methods of instruction pertaining to environmental education.

APPENDIX H: INTERVIEW WITH STEPHANIE BRADLEY

We were unable to conduct an in-person interview with Ms. Bradley. The following interview was conducted via an email questionnaire.

Interviewee Name:	Stephanie Bradley
Title:	Education Manager at the Cheetah Conservation Fund
Date:	April 28, 2015
Reason for Interviewing:	Ms. Bradley has experience running environmental education programs for Namibian learners.

What environmental problems do you perceive as most important in Namibia?
Human-wildlife conflict, water conservation, and general environmental awareness
What do you perceive to be the biggest obstacles for environmental education in Namibia?
Quality of life. If a person is hungry, then how can you expect them to take care of the earth? If we can work on quality of life alongside sustainable development, then you can go forward. Also, environmental education in the schools needs more support.
How have you seen environmental education in Namibia change over the past few decades?
I have only been in Namibia for the past year, but CCF *(Cheetah Conservation Fund)* has been doing environmental education in Namibia for the past 25 years. I have seen myself and from our records that kids are less connected to nature than they once were even a generation ago, much like the USA with a move to cities and urbanization.
What (if any) actions have you taken to promote environmental awareness and education in your community?
We have started environmental education teacher training workshops in our town of Otjiwarongo and have a teacher's resource guide full of environmental activities for kids. We visit schools all over Namibia offering free educational outreach programs. We concentrate on grades 5-7 and 10-12.
What environmental education initiatives have you see in your community?
Some recycling and more and more schools are starting after-school environmental clubs.
How do you engage learners in the Cheetah Conservation Fund's programs?
When learners visit our center, the animals do most of the work, like our cheetahs and livestock guarding dogs. Learners love seeing the animals up close. We also have a livestock guarding dog ambassador that the learners can meet and pet while we are giving them an informative talk about their role in helping to save the wild cheetah. We also try to immerse learners in nature while at our center and relate the cheetah to their own selves. While doing outreach programs, we try to get kids up on their feet and actively thinking and

answering questions. We also show some videos of cheetahs running and hunting which the learners really love.
How do you adapt your program to various age groups?
Our educators first establish a baseline – each group of learners can be different based on where they are from and the education they have received. Some may not be as good at understanding English or be introduced to conservation terms before. For very young groups of learners, Kindergarten – 2nd or 3rd grade, we are focusing on the physical, which they can see more than the theoretical. With grade 4 and up with increased difficulty in older grades, we are teaching about the physical but also having learners question the theoretical, such as how the environment will be affected without cheetahs.
How do you make the issues you are presenting relevant to learners?
We always look at how the cheetah is similar to humans – has the same basic needs, as well as, how cheetahs fit in the ecosystem. At CCF we are also addressing the issues of human-wildlife conflict and ways to minimize conflict.
How do learners react to your in-school programs?
Most are very enthusiastic about our visit and learning more about the cheetah and other predators in Namibia. They love the interactive parts of our programs and love to watch the video. With a lot of the schools we visit, they try to come to our center for a day visit or weekend program to follow up. Most schools unfortunately find that they cannot afford the transportation costs to visit our center, however cheap our programs are.
What teaching methods do you find most effective with learners?
Interactive and visual
Which topic areas within environmental education do you feel need immediate attention?
How a balanced ecosystem works and how to live and benefit from nature and wildlife.

APPENDIX I: INTERVIEW WITH VICTORIA ENDJALA

We were unable to conduct an in-person interview with Ms. Endjala. The following interview was conducted via an email questionnaire.

Interviewee Name:	Victoria Endjala
Title:	Environmental Educator – Outreach at the Namib Desert Environmental Education Trust
Date:	April 23, 2015
Reason for Interviewing:	Ms. Endjala has experience running environmental education programs for Namibian learners.

What environmental problems do you perceive as most important in Namibia?
Lack of environmental awareness and apathy in my opinion is a very important issue, an issue that needs more attention (however, as individuals, all environmental problems are just as important and need to be addresses). Some Namibians are aware however they are ignorant, others are just not aware of these issues. All Namibians need to be made aware of environmental issues so that they really understand what impacts they have on the environment.
What do you perceive to be the biggest obstacles for environmental education in Namibia?
Lack of passionate educators and lack of resources to implement what has been taught either in schools or at home
How have you seen environmental education in Namibia change over the past few decades?
I have only been an environmental educator for the past 2.5 years. I do not really have so much experience to compare to. However, there are more environmental education centers in Namibia, thus increasing access to environmental education. The Namibia Environmental Education Network has been a very active networking platform where a lot of educators can share information about environmental education.
What (if any) actions have you taken to promote environmental awareness and education in your community?
I work so far from home and in my own community I have not really implemented anything as I rarely go there. However, through my work I have been working with three rural communities in the Hardap region for the past year and a half to try to improve access to EE and also encourage them to live a sustainable lifestyle. I have done this through conducting theoretical and practical workshops, providing access to sustainable living technologies, etc. This is done together with the NaDEET Centre programmes.
What environmental education initiatives have you seen in your community?
A lot of the activities that our participants have learned through the years, they are implementing. Such as making recycled fire bricks to help with the firewood problem, solar cooking, implementing water-saving methods, and an increase in the use of fuel-efficient

stoves to mention but a few.
How do you engage learners in NaDEET's programs?
NaDEET's programmes for school learners are all learner-centered, hands-on, experiential learning and most of it is outdoor learning. A lot of our activities are practical and allow for learners to learn themselves while doing. Using real life examples while at the same time linking it to the school curriculum and their everyday home lives makes the connection between what they learn in theory in class and practical examples using the environment.
How do you make the issues you are presenting relevant to learners?
By taking issues relevant to their age group and talking about them but in environmental context. For example, in our secondary school programme we have an activity – shop till you drop – which demonstrates the inequality of wealth among people and to demonstrate the potentially negative role of consumerism on society and the environment. Using shopping (interest of young people) and different economic statuses.
How do you adapt your program to various age groups?
All NaDEET school programmes (primary and secondary) are linked to the formal education curriculum. Some activities are consistent throughout all age groups. We do not have a programme for lower primary, however in the cases where we get them, we use some of the activities from upper primary in the simplest form possible, developing activities for them in order to make sure that they understand the message given. The adults' programme uses their home living situations and develops a programme that suits their needs most, especially in a rural household title managing a household.
What teaching methods do you find most effective with learners?
Practical, learner-centered activities. Learners learn by doing with enough room to express their opinions and figuring out solutions to different problems.
Which topic areas within environmental education do you feel need immediate attention?
Climate change, which will include a lot of the other topics that lead to it. This way you will cover topics such as pollution, energy, water waste, biodiversity, and sustainable development as they all in one way or the other are involved/contribute to climate change.

APPENDIX J: INTERVIEWS WITH STUDENTS AT THE POLYTECHNIC OF NAMIBIA

These interviews were conducted at the Polytechnic of Namibia on April 9th, 2015. Chandlor Lyles conducted the interviews and asked all questions. Emily Dunham transcribed the interviews.

Interviewee Name:	Opo Ashiicuti
Year in School:	3rd Year

What region of Namibia are you from?
Oshikoto
What do you perceive as the most significant environmental threats in your region?
I think flooding.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
No, I never received it.
How often did you learn about the environment and at what age?
Maybe in primary school but I don't remember.
How did you learn about the environment? From your parents? School? Experience?
I didn't really learn about it.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
N/A
How do you feel environmental education could be improved in the Namibian education system?
Maybe making more courses in secondary school would help.
What teaching methods do you find most effective in Namibian classrooms?
Doing group work is good. Some classes we do the homework in class so we can learn from the teacher how to do it. Having group discussions helps to learn.
How do you think environmental education can be made relevant to Namibian learners?
Do more practice and not theory. Having more field work and field trips would be helpful because learners can visualize the information.

Appendix J

Interviewee Name:	Alidaie Haimbodi
Year in School:	1st Year

What region of Namibia are you from?
Omusati
What do you perceive as the most significant environmental threats in your region?
Deforestation probably.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
No.
How often did you learn about the environment and at what age?
Not at all.
How did you learn about the environment? From your parents? School? Experience?
I didn't.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
N/A
How do you feel environmental education could be improved in the Namibian education system?
People will stop cutting trees.
What teaching methods do you find most effective in Namibian classrooms?
Quizzes. I very much like taking quizzes.
How do you think environmental education can be made relevant to Namibian learners?
I'm not sure.

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Appendix J

Interviewee Name:	Lisa Katjimune
Year in School:	1st Year

What region of Namibia are you from?
Khomas
What do you perceive as the most significant environmental threats in your region?
Deforestation happens. There is also erosion, especially in the mountains.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
Yes, but it was back in high school and primary school.
How often did you learn about the environment and at what age?
In primary school, 3-4 times per week. In secondary school, twice per week. Here *(at the Polytechnic),* also twice per week.
How did you learn about the environment? From your parents? School? Experience?
I learned through school and personal experiences.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
Yes. I liked everything because it taught me how to take care of the environment and how to save water by not leaving the tap running and to take showers instead of baths.
How do you feel environmental education could be improved in the Namibian education system?
I think they should make it a compulsory subject instead of them choosing to participate. They can start kids learning starting from an early age and everyone will learn.
What teaching methods do you find most effective in Namibian classrooms?
Projectors work better than a normal board. Having role playing in class or stuff like that. I think it helps a lot.
How do you think environmental education can be made relevant to Namibian learners?
Most of them only take such things seriously if something bad happened. That's how they realize what they should and shouldn't do. They take things for granted. Make them care.

Appendix J

Interviewee Name:	Freedom Litwayi
Year in School:	3rd Year

What region of Namibia are you from?
Oshana
What do you perceive as the most significant environmental threats in your region?
Water pollution and land desertification are problems. The whole region is very rural.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
Yes
How often did you learn about the environment and at what age?
In primary school, I was told how to recycle and keep the environment clean in health & environment class. I only learned about the environment in primary school. We didn't get any in secondary school other than a once per year cleanup where you walked around picking stuff up for health purposes. I received more education here *(at the Polytechnic)* in the NEED lab where we learn to make things out of trash.
How did you learn about the environment? From your parents? School? Experience?
I learned from school and the radio had topics about the environment and how to keep it clean and respect plants' and animals' living spaces. There used to be a program where people would come on the radio and talk about programs for children.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
I guess so. I am a part of the environment club here. I learned that keeping the environment clean is part of our livelihood. Keeping the environment clean and recycling is the most important thing. You can make things from trash rather than throwing it out. South African women make school bags out of trash. I don't remember disliking anything.
How do you feel environmental education could be improved in the Namibian education system?
I think in Namibia in rural areas they don't respect plants but they provide oxygen and shade. People cut down trees and harm animals' homes. People aren't aware of environment. There should be programs in each and every school. Especially primary school as a foundation so you grow up with a base within you and know how the environment is important to you and how the resources matter. They must take this to the media to spread awareness. The environment is what we live on and it is important to protect it.

What teaching methods do you find most effective in Namibian classrooms?
Going in the field and getting more practical work by doing something helps. Getting to learn hands-on and seeing it and practicing it is better than just learning and you don't forget what you learn.
How do you think environmental education can be made relevant to Namibian learners?
Make it compulsory as a school subject and people will get more out of it and will learn about it and understand why they should care. You should have to pass it. We are different people from different backgrounds and have our own passions so some people like plants, animals, or other things. If you make it a school subject, people would get more engaged and learn.

Interviewee Name:	Vendelinus Shipopyeni
Year in School:	1st Year

What region of Namibia are you from?
Omusati
What do you perceive as the most significant environmental threats in your region?
Flooding mostly.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
No.
How often did you learn about the environment and at what age?
I didn't at all.
How did you learn about the environment? From your parents? School? Experience?
I didn't.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
N/A
How do you feel environmental education could be improved in the Namibian education system?
It can help, like with deforestation if you teach those people then they won't cut down trees.
What teaching methods do you find most effective in Namibian classrooms?

Quizzes.
How do you think environmental education can be made relevant to Namibian learners?
Teach them the advantages of keeping the environment clean.

Interviewee Name:	Likius Simeon
Year in School:	1st Year

What region of Namibia are you from?
Oshana
What do you perceive as the most significant environmental threats in your region?
Traffic congestion happens.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
No.
How often did you learn about the environment and at what age?
I didn't ever.
How did you learn about the environment? From your parents? School? Experience?
I never learned.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
N/A
How do you feel environmental education could be improved in the Namibian education system?
People will stop cutting trees.
What teaching methods do you find most effective in Namibian classrooms?
I'm not sure.
How do you think environmental education can be made relevant to Namibian learners?
Make it a subject in school and involve them even if they don't want to.

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Appendix J

Interviewee Name:	Sinomba Solver
Year in School:	3rd Year

What region of Namibia are you from?
Zambezi
What do you perceive as the most significant environmental threats in your region?
There is a lack of clean water and a lot of rubbish and littering in the towns.
Did you ever receive any environmental education? If so, what topics are you familiar with? Biodiversity Climate change Renewable energy Resource consumption Water resources
Yes. I remember we did a project in school on climate change.
How often did you learn about the environment and at what age?
Only in high school. I was actually in an environmental club at Dawid Bezuidenhout. I didn't learn in primary school that I remember.
How did you learn about the environment? From your parents? School? Experience?
At first you could say parents, but then in school.
Did you enjoy learning about the environment? What parts did you like? What parts did you dislike?
Of course I did. Like I said, I was in a club and once a week we would clean the school and pick up litter. That was enjoyable because we kept our surroundings clean. I didn't dislike much.
How do you feel environmental education could be improved in the Namibian education system?
It is neglected when you come to tertiary education. They feel like its other people's jobs. They should know to keep their surroundings clean.
What teaching methods do you find most effective in Namibian classrooms?
For me personally, I remember best when something is explained to me and then we go on an excursion to see it. I learn much better that way.
How do you think environmental education can be made relevant to Namibian learners?
I think they should be educated on the benefits of environmental preservation. Most people are aware of the environment and that they should keep it clean, but they should know why they should do it. I think there should be an environmental competition or something so people will see the problems and how important they are. They will learn that it will help health and diseases because of the environment and the conditions.

APPENDIX K: COMPLETED EDUCATIONAL MATERIAL EVALUATION FORMS

Title:	Life Science in Context – Grade 10
Author(s):	S du Plessis
Year Published:	2010
Subject:	Life Science

Evaluator:	Benjamin Hawks
Date:	March 31, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Biodiversity, Sustainability
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
10 pages about the diversity of organisms and why they are important to Namibian culture, 12 pages about the causes of global warming and the importance of the ozone layer
Is there any mention of environmental problems? List.
Global warming, ozone layer destruction
To what extent? (same criteria as above)
5 pages about the trend of global warming and greenhouse gases and how they affect Namibia specifically, 3 pages about the ozone layer and how harmful its destruction is to people
Additional space if needed.

Appendix K

Title:	Life Science for Namibia: Human and Healthy – Grade 10
Author(s):	Anna Louise Marais, John Pallett
Year Published:	2002
Subject:	Life Science

Evaluator:	Benjamin Hawks
Date:	March 31, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Climate Change
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
9-page chapter about the health of the environment
Is there any mention of environmental problems? List.
Pollution, toxic waste, global warming
To what extent? (same criteria as above)
5 paragraphs with pictures and diagrams explaining the effects of pollution and how people can reduce it, 1 section about toxic waste and how it affects human life, 1 section about global warming and greenhouse gases and ozone depletion
Additional space if needed.

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Appendix K

Title:	NSSC History: Namibia and Southern Africa Module 1 Part 2 Ordinary Level Grade 11-12
Author(s):	Reviser: Dr. Carol Kotze, Content Editor: E. Newmann
Year Published:	2007
Subject:	History

Evaluator:	Benjamin Hawks
Date:	March 31, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Heritage
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
80 pages discussing the early history of Namibian colonization, how South African occupation affected Namibia, and Namibia's independence
Is there any mention of environmental problems? List.
None.
To what extent? (same criteria as above)
N/A
Additional space if needed.

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Appendix K

Title:	Life Science for Namibia – Grade 10
Author(s):	Karen Nott, Derick Du Toit
Year Published:	1997
Subject:	Life Science

Evaluator:	Amy Misera
Date:	April 10, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Climate Change
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
Climate Change – chapter on global environmental problems
Is there any mention of environmental problems? List.
Pollution, deforestation, drought/flooding
To what extent? (same criteria as above)
Pollution – chapter covering different types of pollution Deforestation – 1 picture with a caption Drought/flooding – 1 bullet point
Additional space if needed. This book as "Test Yourself" pages

Appendix K

Title:	Physical Science for Namibia – Grade 10
Author(s):	Norman Curry, Klaus Linow, Henriette Speelman, Claudia Tjikuua
Year Published:	1994
Subject:	Physical Science

Evaluator:	Benjamin Hawks
Date:	April 10, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Sustainability, Climate Change
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
3 paragraphs on water pollution and its lasting effects in the water, 1 4-page section that discusses air pollution and its effects on the climate, 1 short paragraph on the Khoichab pan (a non-renewable water source in southwest Namibia that will eventually run out)
Is there any mention of environmental problems? List.
Water pollution, air pollution, global warming, clean energy
To what extent? (same criteria as above)
1 section with 3 paragraphs on the effects of non-biodegradable detergents on water and the importance of using biodegradable substances when possible, 4-page section on different air pollutants and how they affect the air and how CO_2 can cause global warming and CFCs cause ozone destruction, 4-page section on different kinds of clean energy like solar, wind, and hydroelectric power
Additional space if needed.

Appendix K

Title:	Namibian College of Open Learning: Physical Science Grade 12 Module 3 Units 6-7
Author(s):	Claudia Tjikuua
Year Published:	2002
Subject:	Physical Science

Evaluator:	Benjamin Hawks
Date:	April 10, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Climate Change
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
1 short section on the greenhouse effect from fossil fuels
Is there any mention of environmental problems? List.
Global warming
To what extent? (same criteria as above)
1 section that talks about how the release of carbon dioxide causes the greenhouse effect

Additional space if needed.

Appendix K

Title:	Namibian College of Open Learning: Physical Science Grade 12 Module 3 Units 1-5
Author(s):	Claudia Tjikuua
Year Published:	2002
Subject:	Physical Science

Evaluator:	Benjamin Hawks
Date:	April 10, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Climate Change, Sustainability
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
2-page section on air pollution's effects on the climate, 1-page section on water pollution's effect on available water
Is there any mention of environmental problems? List.
Air pollution, water pollution
To what extent? (same criteria as above)
1 section discussing the various types of air pollutants' effects on the air, 1 section discussing the lasting effects of water pollution
Additional space if needed.

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Appendix K

Title:	Go for Life Science – Grade 9
Author(s):	Hella Rust, Susan Lourens
Year Published:	2008
Subject:	Life Science

Evaluator:	Amy Misera
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Biodiversity, Sustainability, Climate Change
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
1 section mentions biodiversity and sustainability throughout the entire section, 1 quote about deforestation leading to climate change
Is there any mention of environmental problems? List.
Pollution
To what extent? (same criteria as above)
1 paragraph on each of the types of pollution

Additional space if needed.

"Chopping down of large trees has led to serious problems worldwide (such as climate change)."

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Appendix K

Title:	Life Science in Context
Author(s):	Publisher: Longman Namibia
Year Published:	2007
Subject:	Life Science

Evaluator:	Amy Misera
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Biodiversity
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
1 page discussing ecosystems
Is there any mention of environmental problems? List.
Pollution
To what extent? (same criteria as above)
7 pages with pictures and discussion of the different types of pollution
Additional space if needed.

Appendix K

Title:	Understanding History in Context – Grade 8
Author(s):	Revised by A du Preez
Year Published:	2007
Subject:	History

Evaluator:	Amy Misera
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Heritage
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
50 pages on early Namibian history
Is there any mention of environmental problems? List.
None.
To what extent? (same criteria as above)
N/A

Additional space if needed.

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Appendix K

Title:	Discovering Geography – Grade 10
Author(s):	Colin van Rensburg
Year Published:	2008
Subject:	Geography

Evaluator:	Amy Misera
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Climate Change, Sustainability
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
1 chapter on climatology, sustainability mentioned several times throughout chapters across the book
Is there any mention of environmental problems? List.
Crop destruction, fires, flooding, deforestation, pollution, global warming
To what extent? (same criteria as above)
1 paragraphs on crop destruction, 2 paragraphs on fires, 1 paragraph on flooding, 2 pages on deforestation, 6 pages on pollution, 2 pages on global warming
Additional space if needed. "The uncontrolled cutting down of trees, whether for firewood, building materials, wood carving or to clear land for farming, is a major cause of damage to the environment. Not only does it destroy ecosystems, it also increased the amount of carbon dioxide in the atmosphere."

Appendix K

Title:	Life Science in Context – Grade 8
Author(s):	S du Plessis
Year Published:	2007
Subject:	Life Science

Evaluator:	Benjamin Hawks
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Biodiversity, Sustainability
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
5 pages on classifications of life with examples of plants and animals, 7 pages on ecosystems and the connections between different types of life, 2 pages on the water cycle and why water conservation is important in Namibia, 13 pages on starting a school garden and implementing techniques like compost and crop rotation
Is there any mention of environmental problems? List.
None.
To what extent? (same criteria as above)
N/A

Additional space if needed.

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Appendix K

Title:	Go For Life Science – Grade 10
Author(s):	Hella Rust
Year Published:	2010
Subject:	Life Science

Evaluator:	Benjamin Hawks
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Biodiversity, Climate Change, Sustainability
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
18 pages about the different forms of life and their diversity with pictures explaining how the same species can be different depending on its environment (genetic diversity), 4 pages on climate change and the effects on climate change in Namibia, 2 pages about ways to prevent global warming by avoiding harm to the environment and using clean energy sources
Is there any mention of environmental problems? List.
Global warming, ozone layer depletion
To what extent? (same criteria as above)
4 pages on global warming and greenhouse gases, 4 pages on CFCs and their contribution to ozone depletion
Additional space if needed.

Appendix K

Title:	Biology for IGCSE
Author(s):	Mary Jones
Year Published:	2002
Subject:	Biology

Evaluator:	Benjamin Hawks
Date:	April 13, 2015

Namibia specific?	In the curriculum?
Yes No	Yes No

Can any of the four modules (Biodiversity, Climate Change, Sustainability, Heritage) be identified? List.
Biodiversity, Climate Change, Sustainability
To what extent? (Ex: sentence, paragraph(s), page(s), chapter(s). Are there pictures? Charts? Graphs?)
14 pages about the variety of life and their differences with pictures, 20 pages on how human actions affect the climate and the environment, 1 page on how people can conserve natural resources by reducing the amount they use and limiting pollution through recycling
Is there any mention of environmental problems? List.
Pollution, extinction, deforestation
To what extent? (same criteria as above)
7 pages about pollution and how the different types affect the environment, 3 pages about the extinction of plants and animals because of threats like deforestation and why it is important that these species are going extinct
Additional space if needed.

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APPENDIX L: PHOTO RELEASE FORM

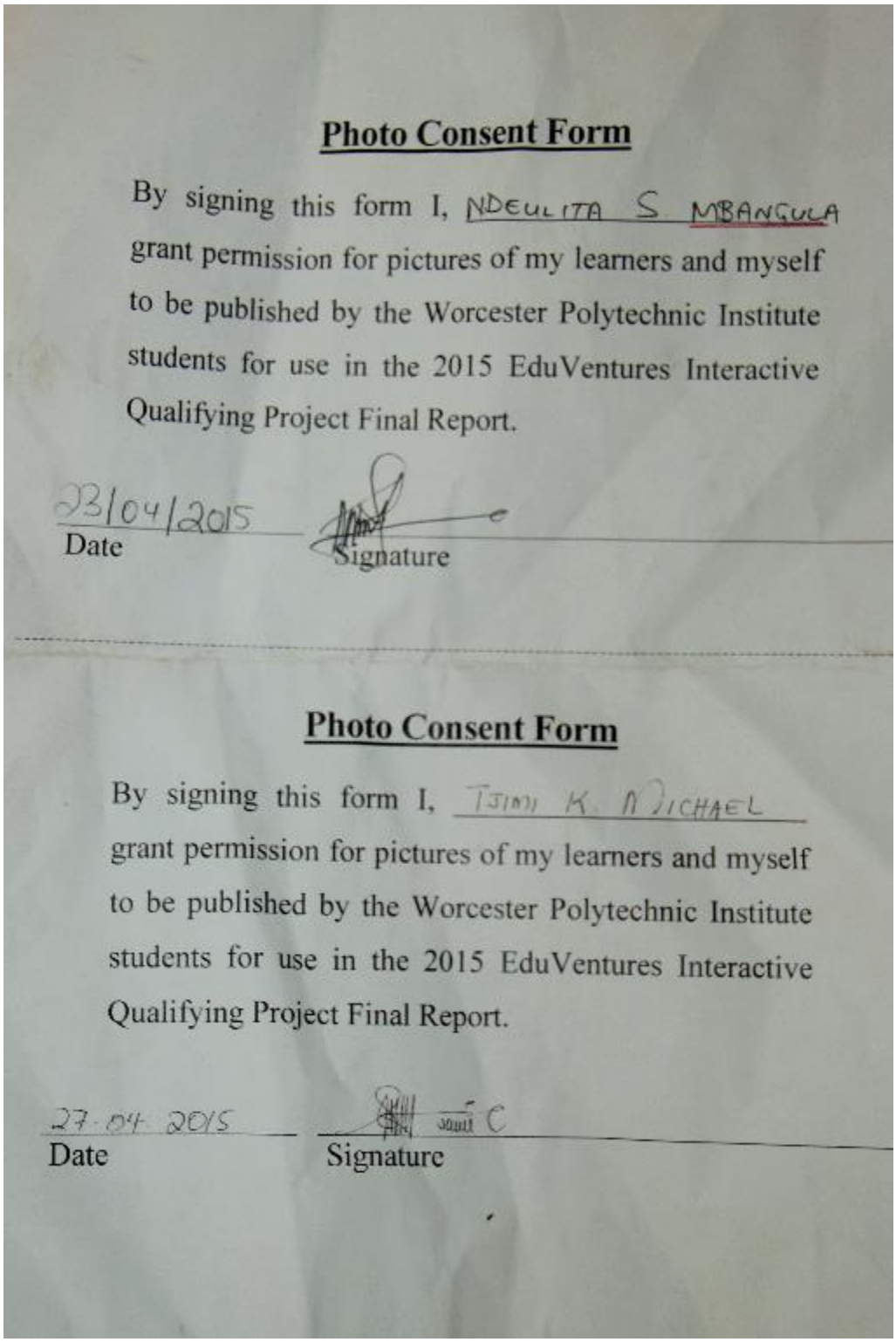

Photo Consent Form

By signing this form I, NDEULITA S MBANGULA grant permission for pictures of my learners and myself to be published by the Worcester Polytechnic Institute students for use in the 2015 EduVentures Interactive Qualifying Project Final Report.

23/04/2015
Date

Signature

Photo Consent Form

By signing this form I, TJIMI K. NDICHAEL grant permission for pictures of my learners and myself to be published by the Worcester Polytechnic Institute students for use in the 2015 EduVentures Interactive Qualifying Project Final Report.

27.04.2015
Date

Signature

APPENDIX M: RESULTS FROM LEARNER SURVEYS

All survey responses were transcribed exactly as written.

Biodiversity Survey

Week 1:

What did you like about the biodiversity lesson?	Why did you like that?
Why should we preserve biodiversity. The importance of biodiversity	Because it taught me how can I live a sustainable life
The value of biodiversity	Because it biodiversity that produce one food
I like the importance of it	Because I learn more about nature. I learn how we can look after our environment
The value of biodiversity	Because it tells us that it's the one that provide food is produce medicine and income
I liked about the importance of taking care of our environment. I liked the presentations on the activity	Learners payed a full attention and it was a good lesson
The importance of it	It teached me on how I can use the natural resources sustainably
Like how doe the living organism have been take care. Like on how to we are going to protect are biodiversity	To now how to protect our biodiversity. To learn more how to our biodiversity are speciefy
I liked the lesson about the preserving of different species	Because it taught me on how to differential the species according to their ecosystem
Plant, water	Plant give me oxygen to breath in. water is live, without water everything could be complicated
Water. Plants	Water → Because it gives us survivor when we drin it. Plants → It gives us medicine which we use it hospitals
I liked the way the way living organism interact one another	Because mostly they obtain energy from one another to live
Living organisms on how they interact one another	To protect the biodiversity for future generation
I like the way that living and non-living things interuese each other	Because I learned that thes no species which can jurgirer without the other
How to prevent biodiversity	Because we must know how to prevent animal etc so that the future generation will also us
Everything that I just discovered in it	Because its kind of educational and inspirational to me to sort out with my own community or nation
The environment and the lifestyle	To know how we adapt in different condition
The class activity that we did	Because it was more fun when we were coming up with the ideas and the way we were sharing ideas
Why should we preserve biodiversity. The importance of biodiversity	Because it taught me how can I live a sustainable life
What did you not like about the biodiversity lesson?	**Why did you not like that?**
How climate changes effect the environment	Because there are a lot of effects that climate changes give to human beings and trees like deforestation and flooding
The climate change	Because when it changes and affect being bodly it makes me to be scared
The value of deforestation	Because people they cutting a lot of trees
Uncontrolled mine. Deforestation	They only care about themselves, after goods they gained they is leave the place. they don't know sustainable

Appendix M

The thread like the deforestation, overgrazing, pollution	Because some people they will take it as like fine thy will do it again
How they use to destroy the biodiversity	Because it brought mercy in my mind and the way its being destroyed is badly
When I find out that we humans are also depleting/ causing harm to the environment	It is leading o environmental problems. Some species get extinct
Overgrazing. Deforestation	Overgrazing: Because when you put too many plants on one place the grass will get finished and he animals will die. Deforestation: Because when you cut too many trees soil erosion will occur and this small species such as insects will die
The threat that happen on biodiversity	Because it can lead to soil erosion. Animal will extinct
The threat that happens on the biodiversity	It can lead to losse of natural environment for others not to see the same as it was previously
About on how biodiversity are being care on causes of the biodiversity	Because one causes kill a lot of biodiversity. Because the biodiversity are now take good cared
I did not like about endemic species	Because before I did not know that some organisms we destroy in out environment cannot be found elsewhere
Because before I did not know that some organisms we destroy in out environment cannot be found elsewhere	Because the secondary consumer feeds on other animal which is not good
Over population	Because it will give stress to the government and it's a threat to biodiversity
The part of mining contributing to loss of biodiversity	Mining contribute a lot income to the country
The over-use of some resources like land	The land becomes worse and un-useable to living-organism
To be honest nothing I liked everything even though I did not catch up with some things	LEFT BLANK

Did you understand the lesson?
Yes, I understand the lesson, Yes, Yes, Yes, Very much; Because I have learned about what are good and bad part of human, plant, climate change; Yes, I understand the lesson; Yes, Yes, I understood, because it normally happens in our society/community; Yes, but only a minority of it that I did not understand; Yes, Yes, Yes, Yes I did understand the lesson based on the basic sillarby; Yes, No, because there are certain living organisms that where mentioned that I do not know and I have not seen; Some but not all the thing that they were teaching, LEFT BLANK

How would you explain biodiversity?

Correct Answers	Incorrect Answers
Is the variety of species and how they are adapted to the environment	Is the study of living thing and non-living things and the way they enteruped each other in the ecosystem
Is the variety of living organisms such as people, plants, animals, insect and their interaction	Is the enteracting of living and non-living things according to their ecosystem
To the variety on plant, animal include us people on how we harbity	Is when the environment supply the natural and true
Is the variety of living organisms interacting on one another including plants and animals	Is the study of living and non-living things especially how they adapted in their environment
Is the variety of living organism such as plants, animals and their interaction	Is the variety of living organism and non-living organism in a unic area with plants and animals
Is the variety of living organism such as plants, animals and their interaction	To my own understanding is the life of living and non-living organism in an environment
Is the variety of all living organisms, including animals, plants and micro-organisms and their interaction with each other	Is the variety of all living things and non-living on they interact

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Is the variety of all living organisms and the way they interact to each other	The study of living organism and their environment
Is a variety of all living thing including plants animals	

What are the three types of biodiversity?

Correct Answer	Incorrect Answers
Genetic, Species, Ecological	Species, ecosystem, biome
Genetic, Species, Ecological	Species, ecosystem, biome
Genetic, Species, Ecological	Species, ecological, biome
Genetic, Species, Ecological	Genetic, species
Genetic, Species, Ecological	Species, ecology, ecosystem
Genetic, Species, Ecological	Geneus, species, biomes
Genetic, Species, Ecological	Genetic, evolutionary, species
Genetic, Species, Ecological	Species, genus, ecological
Genetic, Species, Ecological	

Give an example of species diversity.

Correct Answers	Incorrect Answers
Fish, Reptiles, Amphibians	Animal (Lion)
Plants, Animals, People	Cattles
Plant, Human, Animals	Cattle
Animals, Plants, Human	Habitat, Community, Ecosystem
Plants, Animals, Human beings	
Human Being, Donkey, Horse	
Plant, Human Being	
Donkey, Horse, Human Being	
Zebra mating with giraffes. Horse, Mule	
Human Beings, Cattles, Kudus	
Cattle, Human Beings, Goat	
Plants, Animals	
Fish → It lives in the water in order to survive	

What damages biodiversity?

All answers were correct, below is a list of the different answers given
Environmental climate**,** Overgrazing, Deforestation, High Population**,** Over Fishing, Using materials that contain CFC's, uncontrolled mining, tourism, humans, plants, Pollution, Flood, Veld Fire, Animals, Global Warming, Different species that occur for the first time and thes no solution, climatic change, endangered Species, extinction of animal species

How does Biodiversity affect your life?

Most answers were correct. Some learns left the answer blank. Below is a list of the different answers given
Wild animals like lions kill human beings, carbondioxide is released in the body and oxygen to take in, when it overgraze- When it feed on it, it affects me goodly because I am able to see learne bout things that was existing in the pasts, it affect my life in a good way, because it helps me identify different species according to their environment and it helps with the adaptation, drought, soil erosion, food shortage, goodly-living organisms are easy to identify them, by providing food - by providing income - by regulating the climate, it make me study on how we should interact with other species - makes me consume other species and get energy, when we conserve biodiversity we get oxygen, shade and building materials, it affect it positively source it provide food, clothes, luxury goods that we are using now, we get food from plant/animals around us - we depend on the nature to get medicine, it affects my life positively, LEFT BLANK, because it supplies me with all the resources that I need from the environment, more grasses and shrubs are burnt down as no grasses left for animal feed, and in a good way because through biodiversity we depend on each other and we learn from each other

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Appendix M

End of the Day Surveys

Activity	Likes	Dislikes
Lesson Liked: 2 Disliked: 2	1. To sort out different kinds of plants and insects. Similarities and differences 2. It taught me something that I did not know before	1. Because teaching only can not open up a persons mind, while practical is the best because someone can catch and remember something. 2. Simple, because it hurts me when they told us some bad things that is damaging the biodiversity
Setting Traps and Collecting Liked: 4* Disliked: 14 * *some learners only circled collecting biodiversity or setting traps*	1. Simple, because its my first time to know where scorpion are habitat. I was the only one who found it 2. Because I learned more on how to catch/collect living biodiversity in the school ground by using nets and metal pick ups *Just Collecting biodiversity* 3. Because it was much more understand were to find different kind of species and how they adapt to the environment (Only circled the collect biodiversity part of the activity) 4. Because it was more fun when we were chasing after insects and looking for insects or let me say looking for other biodiversity around us	1. Because same area were we went to collect the biodiversity is dangerous 2. Because for example you are running and you did not see the trap so you fell, if it trap a dangerous animal then its dangerous to touch it 3. Because we'll not found good information, the area are suffering many animals and plants die 4. It does not teach me more about identifying but only collecting. I could not identify some of the biodiversity 5. It only teacher me on how to set traps but it did not tell me which trap for which biodiversity 6. I did not collect variety of biodiversity in the traps. It did not give me the change to get biodiversity that I expected to see 7. Because I just collect some that variety of diversity that I wanted to collect 8. Because the same insects are trapped inside the container and its unreliable. 9. Because its like am causing a threat to biodiversity by disturbing. *Just Setting traps* 10. Because it was not reliable as I did not get any biodiversity in all the 4 containers 11. Because it was not really reliable and we didn't catch and species in our group 12. We had to dig holes and set up traps and it was hard to dig the holes 13. Because I did not touch the insect because I did not see how it…? *Just Collecting biodiversity* 14. Because I was afraid of some of the biodiversity that are dangerous
Identifying Liked: 9 Disliked: 1	1. I learn more about the species that I never seen before. I catch some scientific name of the species. I was able to identify biodiversity by myself and I really enjoyed seeing different biodiversity that we collected, so nice. it teached me on how to identify biodiversity and I got a little knowledge on which groups does each biodiversity belongs. 2. I could see the difference through the microscope because when I normally use my eye, I get	1. Because it was difficult for me to identify and by there way everything I like.

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	confused and classify wrongly., but today I got it right. 3. It opens my understanding on how to identify different organism. 4. Because can learn more information around the area or community. 5. Because I learned how to use an electronic microscope to categories or identify different species. Eg. finding their order name. 6. Because I studied on how to classify an organism according to their similarities and I studied their names as well. 7. Identifying biodiversity have taught me a lot of things I have known to which family and the name of that insect	
No circle Liked: 0 Disliked: 2		1. I have seen thing or insect that did see in life because I have touch insect that did not each before. It was fun 2. Because you will discuss more about insects and also plants and their characteristics with their classification

How did you use what you learned in the classroom truck this morning in the field today?
By trying to identify different types of organisms in our school yard
By collecting different biodiversity by planting those small buckets in the soil
You follow how can you catch an animal like a snake or lizard by using a net and small insects by using small metals
checking/ naming biodiversity which I never know by trapping biodiversity and naming them
We used a trap to trap insects and we used small glass bottle tube to put the biodiversity in
I used the sustainable way of resources
we collect the insects, we setter up traps, we classify them
I used them wisely and its accurate equipment
you must used carefully
I saw the variety of diversity. I use them to find different types of species
I was able to identify biodiversity in the field. I saw variety of biodiversity
I learned how to maintain and sustain the environment and different kind of organisms without harming it.
since I learned how to identify species based on features, I used the knowledge to collect biodiversity. I also learned instruments like pick ups, which made it easy for me to use it outside since I was told theyr uses in class
I was able to catch species in a way that they are not harmed and not harm me
SMART Board, microscope, hand lenses, books or textbooks
everything is fantastic and I handle with care and one apparatus makes me to find scorpion.
we used that organism that belongs to the same family has the same characteristics. We did not kill any organism because we were told if you kill than you are affecting biodiversity

Week 2:

What did you like about the biodiversity lesson?	**Why did you like that?**
Everything	Because the teacher taught & explained everything clearly
Tourisms	Because it can come in our country to see many lodge and animals

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I like the way biodiversity produce as with food, water & shelter	Because in more cases we depend on biodiversity
About the danger of loss of biodiversity	Because it teaches me on how should conserve me resources
By knowing the meaning and how to take care of it and what it causes	To know what is it. To know how to take care of it
To take care of our plants, stop cutting down trees	Because it was good for me to take care of the environment
I liked the ecosystem lesson	Because I learned about the food web how animals interact
Liked of knowing different trees liked of knowing living organisms	It teaches me by not deforestation. It teaches me how organisms live
How to protect our environment	Because its beautifying the environment to attract tourisms
How we can protect our nature and by not harming them	It will help our new generation in the future to know our biodiversity
Why is biodiversity important	It teaches us how not to waste the living organisms/ kill the organisms
Important of the biodiversity	Because it helps me to know what is wrong and right on biodiversity
The importance of biodiversity	Because I learned how to protect our animals
Animals & plants	Because we use to get food from animals and plants
Classification of living things	Because the diversity that exists within a species
Species biodiversity	Because it talked about the different types of living organisms with the same species
Clean water, raw materials	To be a healthy person to more clothes
Because I learn more about species	We have not wasting, cutting trees and killing animals
What did you not like about the biodiversity lesson?	**Why did you not like that?**
When we not use/ keep our environment for future	Cause it end up loosing more oxygen
The danger of biodiversity	It encourages me the lose of our resources
To take care of our wild animals. To stop killing the wild animals	Because it is good to us people to stop killing our animals in our country
Human wildlife conflict	Because the animals destroys & the only thing you think of is killing
What damages biodiversity	It has long defenitions
Ecological biodiversity	Because its just like to study on what im done
The system of cutting tree, the system of over using	It cause poor of species
Cutting to much trees without re-planting them	It can causes soil erosion, deforestation, soil will remain bare
Cutting trees (deforestation)	Because if there are no trees meaning there's no producer

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Deforestation, overgrazing	Because cutting to much trees without planting them.
Not to cut down trees, not wasting water	Because we want more fruits and get more vitamin
Blank	Blank
Non	Blank
Nothing, everything seems very important to me	Blank
Nothing	Blank
Nothing	I like it
Nothing because it all bring income to the country	Blank
Nothing	n/a

Did you understand the lesson?
Yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, yes, better for my own understanding, I understand some but not all, yes, because I learned more about how to conserve water & plants, Absolutely, a bit but not that much, I understood the lesson because our teacher was giving answers to every question which was asked

How would you explain biodiversity?

Correct Answers	Incorrect Answers
The variety of all living things	Is a variety of living and non-living things
The variety of all living things	Is a large community where all varies of ecosystem species
The variety of all living things	A life of different something like living organisms
The variety of all living things	Its live and how many plants and animal survive
Variety of all living things including plants and animals	Its when you take care of animals and other natural habitat
Variety of all living things including plants and animals	Is the study/relation between environment & many kind of living organisms
Variety of all living things including plants and animals	Is a variety of living and non-living things
Variety of all living things including plants and animals	
Variety of all living organisms and their ecosystem eg. Plants and animals	
Is the comprise of living environment and their environment	
Including plant and animals in the area	

What are the three types of biodiversity?

Correct Answer	Incorrect Answers
Species, genetic, ecologiolic	Biome, Community, Ecosystem

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Genetic, species, ecological	Biome, community, ecosystem
Species, genetic, ecology	Genetic, habitat, specie
Genetic, species, ecologycal	
Genetic, spacies, ecological	
Species, ecology, genetic	
Genetic, species, ecological	
Genetic, species, ecology	
Genetic, species, ecological	
Genetic, species, ecological	
Genetic, ecological, spacies	
Genetic, species, ecology	
Genetic, species, ecological	
Genetic, species, ecological	
Genetic, species, ecological	

Give an example of species diversity.

Correct Answers	Incorrect Answers
Animals, plants	Biome
Plants, animals	Biomes, habitat
People, animals	Dog
Trees	Cattle
Cattle, goats	Biome
Cattle, goats	Epidemic
Cattle, goats	Human being
Cattle, goats	
Goats, cattle	
Insect, plants	
Cattle, human beings	

What damages biodiversity?

All answers were correct, below is a list of the different answers given
Deforestation, overgrazing, burning the forest, high rainfall, pollution, air pollution, unsustainable use, killing animals, not taking care of it, mining company, flood, drought, climate change, tourism, over population

How does Biodiversity affect your life?

All answers were correct, below is a list of the different answers given
Provide food, provide income through export with other countries, it affects our lives by the different benefits we gain from it, burning the forest, population growth, tourism and recreation, When its very hot, more rain, drought, it affect our life directly, when more animals are killed, contains and help me gain the oxygen, breath in and out, cause food shortage, flood

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occurs, effect good because I get food from animals and plants, we will loss animals, lack of food, cause air pollution, it can cause less oxygen, no shelter, in good way because we get food from plants and animals, no shelters, it cause less oxygen and carbon for breathing, in good ways

End of the Day Surveys

Activity	Likes	Dislikes
Lesson Liked: 8 Disliked: 5	1. Because the lesson went well the teacher was good and made topics clear 2. Because I know from it how to classify living organism according to their kingdom 3. I enjoyed learning about classifying different types of living organisms 4. It taught me the usefulness of living things, non-living thing and the environment 5. It's about real living organisms or variety of living organisms 6. It teaches me more thing especial like what is the meaning and other thing 7. Because I learn more things about variety of living organisms 8. Because I learn more about how to prevent natural for sustainable	**1.** Because in that previous lesson there are same[1] effect of biodiversity **2.** Because some of the lessons I have already forgotten **3.** Because it did not made me to recognized organisms **4.** Because of lesson **5.** Because I just use to see animal in photos but not eye to eye
Setting Traps and Collecting Liked: 4* Disliked: 9 ** some learners only circled collecting biodiversity or setting traps*	**1.** Because before collecting you identify the names so we learn of different species **2.** Because I learn more different kind of insect/animals *Just Collecting biodiversity* 3. Identifying biodiversity *Just setting traps* 4. Because I learn on how to collect insects and how to specify them	**1.** Because we did not set traps **2.** Because only the boys got to set up the traps **3.** Because we didn't get as many biodiversity only small insects **4.** Because I was afraid when collecting a snake can easily bite you **5.** Because we endangered other biodiversity **6.** Because they were no safety such as gloves and long skirts **7.** It takes times to traps an insect and it became harder to traps the species **8.** Because some of the biodiversity is dangerous **9.** Because we were confusing because the are lots of insect.
Identifying Liked: 7 Disliked: 2	**1.** Because we get to identify different organism **2.** Because we get to go out into nature and collect bugs. **3.** Because I have learned on some of insect I have never seen before **4.** Identifying biodiversity was clear to me because it helps me to be able to know of organisms **5.** I have seen that a spider also is having hair **6.** I knew some of the species I had never knew **7.** Because I learned more things the how to identifying and which family they are	**1.** Because it took more time before we finished. **2.** It take lot of time during identifying
No circle		1. Because I did not got some living organisms

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Liked: 0 Disliked: 3		2. None 3. LEFT BLANK

How did you use what you learned in the classroom truck this morning in the field today?
By identifying
By identifying biodiversity according to their groups
By practicing it and collecting biodiversity
I used it to identify the other biodiversity which was trucked from the field
It was clear[1] because from today an not cutting down of trees and wasting of water
It was good its really interesting lesson it makes you know about bio..
By study with own knowledge an based on the environment
Perfect- I used the principles accordingly
We used it by
I used it for ways that I can be able to have ideas about the lesson
I used it on how to collect and classify them into their groups
~~I did not cut the trees~~ Nicely
Setting traps to collect biodiversity
I use m own understandings and ask questions if I don't get it right
Putting/identifying in which they belong in their character
I use it when I'm dealing with biodiversity
They are still in my mind
In the morning it was better but not real better and in the field it was good to know more different kind of animals an plants

Climate Change Survey

What did you like about the climate change lesson?	Why did you like that?
I liked about the carbon foot print	Because it helped me determine the way I contribute to the atmosphere in terms of carbon percentage
I liked the part that we did class activity and about carbon footprint	Because it was more fun when we were sharing ideas about carbon footprint and the answers
How seasons change (summer, winter, spring)	It make crops to produce themselves. Because some plant can only grow during rain season
I like the condition or how the weather changes in the atmosphere	Because I learn more about the weather change

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Making a list of what are the causes and how we stop global warming	Because I really learned that I also contribute to carbon footprint
The way it changes and the causes of the changes	Because there is something that I enjoyed listening to and the was something that I learned from it
How climate change effects people	Because it taught me how to be ready especially for food security as climate changes continuously
The depletion of the ozone layer	Its important to find ways on how to protect the ozone and how it helps us
The ozone layer part	It taught me on how the ozone layer protects us from the ultra-violet rays
Ozone layer	Because it protects us from ultra violet rays from the sun not to reach earth
Ozone layer/global warming	I have learn how does ozone protect us and how global help us about – our live
How can we protect the ozone layer, how can we prevent global warming	It taught me on how as human being are depleting ozone layer without overcoming it
Mitigation and adaptation	Because I learned more on how I should prevent and reduce the emission of the greenhouse effect. Because I learned new things which I have learned before like how plants and animals adapt to different conditions
Efforts how to reduce greenhouse gasses	Because it taught us how we can be friendly to the environment and what is needed to reduce them
Noticing different kind of gases and their effect on climate	It opens my understanding on what to do or not to do about gases
Everything that I was being taught	Because I come up to knew something which I never had knewed before
Good some way is the condition of air from the shot if time	So that we can produce enough food through the rainfall and sometime climate change the earth to be normal
What did you not like about the climate change lesson?	**Why did you not like that?**
None	None
To be honest nothing	X
Noting at all everything was enjoyable	I like it very much
Nothing	N-A
The part that say we are people contributes to global warming	Because it talked more of global warming contributions by living organisms
Global warming	In the increase of the greenhouse gasses based on the increase of temperature

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Pollutuin, when there is no global warming	Because pollination it use to destroy the atmosphere and when there is no global warming people will get diseases eg. skin cancer because of the sun rays
The effects of global warming	It is destroying our biodiversity
Global warming	Because it sometimes affect the environment due to the pressure of it when it takes place
The way it affects (Climate change)	Because it can really cause harm to people
How climate change effects people	Because thought it has some advantages clime change does effect people in a bad way in most cases as it causes flooding, drought etc.
Drought and flood	It kills people and other living organism
When the is drought in the area many people suffer	Because the population of death will be high
Carbon footprint	Because it shows that some countries in the world are affecting other countries by to much carbon which increased global warming
The release of harmful gasses into the atmosphere	It damages the ozone layer which causes flood
What destroy the ozone layer	Cause when you listen to it you will have mercy on it how its being destroyed

Did you understand the lesson?
Yes, yes, yes, yes, yes, yes, yes, yes, very much, yes I did, yes of course, yes I understood the lesson, yes I understood by doing practice on the board, I understood some but not all, not that much- let me say I understood 70% of it, and yes because it is the natural occurring thing that I have seen that was discussed in the lesson therefore it was easy for me to cope

What is Climate Change?

Correct Answers	Incorrect Answers
Is the condtion of the atmosphere over a long period of time	Is the condition in the atmosphere or in a certain country/ area such as temperature/ weather
Is a condition that take in the atmosphere over a long period of time to change	Is a change in season where you will found weather, climate
Is the way how the condition from the atmosphere take place from one season to another over a long period of time	Is when the condition of the atmosphere change from one condition to another
The change in the atmosphere over a long period of time	Is the gradual change over a short period of time on a specific environment in the atmosphere
A condition of the atmosphere over a long period of time	Is a change that occurs a long time do to less and high temperature

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Is the way how weather changes from time to time in a particular area	Is the gradual change in the earths atmosphere
Is the change of the atmosphere over a long period of time	
Is how the condition of the atmosphere changes at a longer period of time at a given or particular place	
Is the change of the atmosphere at a longer period of time	
Is the condition of the atmosphere that place over a long period of time or from season to season	

Why would there be more methane in this region?

Correct Answer	Incorrect Answers
Because of more herds of cattle in the region that can overgraze almost all of the grass	Because they are many smokers
Livestock farming, land fills, decomposition of dead plants	Because people produce more carbon which will react with hydrogen to form methane
There is a lot of farming activities	To make soil fertile
Because the is abundant in livestocks and mostly this region has high number of crop production	Because people are ignoring the rules that they tell them to follow
Because people depend on livestock	It help us from the hotness of the UV rays coming from the main source of energy which is the sun
Because of the plantation of rice and lifestock farming, landfills	To make the soil fertile
Because most families in this region have cattle, they are the ones that escrete their waste products that are concentrated with methane as they dry up	The methane has to be limited because it is a dangerous gas
We keep a lot of cattle at a small piece of land	Because it is more safe than all the gases
	To prevent us from raysing of sun, so that would not get disease

The Ozone layer's main job is to…

Correct Answers	Incorrect Answers
To prevent us from the UV rays	Is the condition or the atmosphere

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Is to trap the ultra violet from the sun coming direct to earth	All region
To protect us from the harmful (UV)	
Prevent the earth from the UV rays from the sun	
Reduce the speed of the ultraviolet rays from the sun	
To trap some UV rays not to reach the atmosphere	
Protect the earth from global warming and UV rays	
Protect/ trap uv rays from the sun which causes skin cancer	
To absorb the UV rays from the sun not to reach the earth surface	
Protect the earth crust from the direct sun UV radiation that heats the earth	
The protect the earth from UV rays	
Filter the harmful UV rays from the sun	
It protects the suns UV rays from reaching the earths surface	
Absorb the harmful UV radiation	
Protect from UV	

Give an example of how you can lighten your carbon foot print?

Correct Answers	Incorrect Answers
By providing farms instead of depending from the shop. By educationg people rather than doing blindly	By not have mo work not keeping yourself busy unneccesarily
Limit the uses of washing machines, limit the use of cars and use bus. The TV must be off when you are not using it.	Educate people how to use electricity
When you leave the room make sure that lights are off and window are open. Use solar rather than electricity	Motivate people, learn more about biodiversity, forbidden new technology
Stop using electric appliances, avoid using pollutant equipments like cars	By deciding which things I does in my community by calculating my percentage

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Do not use van/vehicle, avoid using machines at all times, use natural sources of energy	Everyday, life
Use no CFCs and carbon dioxide equipment	
By reducing the thing that contain CFCs, be reducing the things that is not friendly to the environment	
Avoid littering on a specific environment, by using less electrionic devices, by reducing the use of water	
Use solar as an alternative source of energy instead of pollutuing the air by using electricity as there will be more coal burned	
Reduce the use of electronic devices, use alternative energy	
Use alternative source of energy, keep lights off when not used, use water sustainable	
By providing farms instead of depending from the shop. By educationg people rather than doing blindly	

How does Climate Change affect Kavango?

Correct Answers	Incorrect Answers
It affect in different ways, rainy which makes crops grow, seasonal depends optimum for people	Very much because they are excited about new technologies which include CFC, spray/perfume
In a bad way because during winter all the trees gets to dry and animal cannot get anything to eat	LEFT BLANK
Sporadic floods, agricultural and food security, forest resources, water and fisheries, alternative energy, solar, tourism, economic stress and reduce income, fuel efficiency	
Drought affect Kavango crops will die, destroy the houses, people move to urban areas because the place is destroyed	
It causes drought, it causes floods, and it increases malnutrition	

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Climate change some time in kavango they experience drought and flood	
It affect in so many ways but mostly is flood and drought which increase stress to the government	
It causes flood and drought	
It brought flood in the region, it reduce agriculture process, it brought down the economy	
In a negative way because when there is too much heat in the region there is no rain, then this will encourage drought	
Climate change causes drought in the Kavango as there is little precipitation at certain times	
It affects goodly and badly sometimes. It too cold in a way that some people don't adapt and they get sick and good when it rain time because people farm and support their family	
More floods occur in there /here, more drought, low rainfall	
Cause flood, loss of some biodiversity, tourism will not be attracted to visit	
It affect with flood, poverty	

Heritage Survey

What did you like about the heritage lesson?	Why did you like that?
I liked about the cultural heritage	Because I have seen what kind of traditional clothes do they wear
The part where they showed the different cultures	Because I got to know more where I originally came from
Cultural heritage and natural heritage	Because I have learned on what kind of material can be touched and seen
Cultural heritage	Because it gave me direction of how past can be passed through from generation

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Cultural heritage	Because its gives you a picture about the things their being inherited
About the things they have being inherited from they parents	Because its gives you a picture about the things their being inherited
What kind of things we inherited from our parents	Because it is happening in real life, and it me remember when I was
I like the way we being inheriting different things from our parents	Because it's also a way of presenting our language from being unknown
Oral history and oral tradition I liked this part	Because oral tells you that you are told a story and you need to pass it to others
Oral history. Oral traditional	Because history is my favorite lessons. I enjoy it so much at home or at schools
Is to know different kind of language	Because some of the language we don't use to speak
What cause extinction of language	It is something true that some languages are lost because of not being told in school
Type of heritage	It learn me more about intangible and tangible heritage
The heritage tangible and intangibles because it is very much easy to know about the past	Because it is easy to know what thing needed to touch or see and those you can't see or touch
The lesson itself. It teaches me more about	It makes me to understand what is it
I liked about how our elders come to	Because I wanted to know where did our parents came from
Because I learned more about our tradition	It bass how do we learn and how our culture from
Because can learn more about their past	Because nice lesson
What did you not like about the heritage lesson?	**Why did you not like that?**
Factors that contribute to language extinction	Because some languages are put like endangered languages
Lesson based on endangered tribes or languages	Because if we don't preserve these languages so they soon disappear
Only some language	Because they are difficult to speak
Tangible culture	Because it does not show its physical appearance an cannot be problem
Intangible and tangible culture heritage	Because intangible culture heritage you cannot touch if tangible they gave taken to you special family of your mother and father
How different groups came in Namibia	It has many years, mercy century
The part where they showed the Mopane Worms	Because, it looked disgusting

Is because I so many cultural groups	Because I know on how to ditance the culture
About the oral history	Because it was clear in the topic for tangible and intangible heritage
The word Ethnobotany	Because I did not understand the word very carefully
Because some people that are not inherited something from their parents	When you inherit something from your parent what about other
Nothing. I liked them all	LEFT BLANK
Nothing	I like everything
I enjoy both lessons	N/a
I don't hate the heritage lesson. Definitely I won't tell cause I really like it	I don't hate it
Nothing	LEFT BLANK
Nothing	I like it very much more than better
LEFT BLANK	LEFT BLANK

Did you understand the lesson?
Yes, yes, yes of course, yes, yes, yes, yes, yes that much even to explain I can explain, yes but only that word I did not understand, yes, yes, yes, yes I now understand the lesson, I understand the lesson very well, yes, I understand more about where we come from, yes because I need were we come from, and yes heritage

What is heritage?

All answers were correct
Something you inherited
Is things that we inherit from our parents
Is the physical artifacts and intangible of a group or society
The things we inherit from our parents
Something that you inherit from your parents e.g. a house or a drum
Is the legacy of physical artifacts that are intangible
Something that you inherit from your parents
Something that you can inherit from your parents
The legacy of physical artifacts and intangible
Is something that you gain/get from your parents
Something that you have inherited from your parents
Is when you inherit something from your parent/guardians
Something we can be given by our parents e.g. cattle

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Is the legacy of physical artifacts that are intangible
Is a physical artifacts and intangible things we take over our parent. Something that we inherit from our parents
Something you inherit from your mother or feather
Heritage is something we learn from parents
Something you inherited

What is tangible and intangible heritage?

There was only 1 incomplete response, while the rest were correct	
Tangible	**Intangible**
Tangible is things that you can touch	Intangible things that you cannot touch
Tangible is a material that can we touch	Intangible is a material that we cannot touch
Tangible heritage is something you can touch and see	Intangible heritage is something can't touch but can hear it
Tangible is things that you can touch and see	Intangible is things that you don't see or touch
Tangible something that you can see and touch	Intangible something that you cannot see or touch
Tangible something that we see and touch it	Intangible something that we do not see
Tangible are things that we are able to touch	Intangible are things that we are not able to touch
Tangible is something that you can touch	Intangible is something that you cannot touch
Tangible material that can be touched	Intangible material that cannot be touched
LEFT BLANK	Is something that you see but you cannot touch it
Tangible something that you can touch	Intangible something than you can touch
Tangible are things that you can touch and see	Intangible are things that are touchable
Tangible something we can see	Intangible something can't be touched
Tangible materials that are touchable and seen	Intangible things that are not touchable here and seen
Tangible things we touch and see	Intangible things unseen
Tangible somethings that we can see and touch	Intangible somethings that we cannot touch
Tangible things you can touch e.g. book, clothes	Intangible things you cannot touch e.g. song, storytelling
Tangible is something that you can touch	Intangible heritage something that cannot touch

Give an example of tangible heritage.

In their responses, some learners gave both correct and incorrect answers. The different answers given are listed below	
Correct Answers	**Incorrect Answers**
Clothes	Beats
Beads	Culture

Crafts	Tradition
A flag	
A flower	
A Tshirt	
Cow	
Books	
Shoes	
Cattle	
Cultural Dress	

What is natural heritage?

Correct Answers	Incorrect Answers
Thing that we inherit but made by nature	Materials that are untouchable and are usually felt in other ways
Is something that can inherit from the God	LEFT BLANK
Things that we inherit from God	Material that are not touchable and usually felt in other ways
Something that we inherit from the nature e.g. fruits and hunting	Something that we inherit by natural like a place for the grandparents
Something that you inherit naturally God	Materials that are not touchable and usually felt in other ways tactile e.g. dancing
Something that made by God which you inherit to use it for a while	
Is something made by God e.g. trees, cattle, water	
Things inherited natural by God such the surrounding	
Something we inherit from natural resources e.g. land	
Natural heritage includes medical plants and services for ecosystems	
Is something that we get from nature or made by Good	
Aspect and landscape, natural features that may have culture attributes	
Natural heritage is made by God like trees	

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How did the heritage lesson apply to your life?

All answers were correct, below is a list of the different answers given
Very well, healthy, it taught about the different cultures and where they originated from, it helps me to know about our past, well at first it was a bit harder it really gives something in me, it good, good, it apply good understandable, it applies with good things that I keep safe and not get lost, it in a good because I knew what to tell to my friends, it gives me a direction about people they have being inherited long time, convinced me in different attitude, it makes me feel good because it is part of life, it did give me an advantage because it tells you how you can inherit things from people and the natural, goodly because that is what's happen truly around us, it applies how did our tradition inherited something from its parents, I know where I come from how we started until we are using pen and books, and to cut more trees

End of the Day Survey

Activity	**Likes**	**Dislikes**
Lesson 8 Liked 4 Disliked	1. Because it remainted about something we herite from our parent. 2. Because the lesson taught me many things like cultural heritage & natural heritage 3. Because it mostly consisted to touchable and untouchable things like song and clothes 4. Because I learnt more about our culture 5. Because it teaches me more about it and for me to know the type of heritage 6. It convinced me that heritage began from our cultural leader / past generations 7. Because it teach us not to lose our culture 8. For me not to live my culture I have learned different cultures	1. Because can not touch 2. Becous I did not understand more about it 3. Some times it might make us inherite witchcraft from our parents
Working Together 1 Liked	1. Because, we let our imagination fly free & we got creative	1. Because working together will not get the words or remaind them 2. Because it does not teach us about all the things that are in the heritage and culture topics 3. Because some of our friends could not talk to give us idea

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5 Disliked		4. Because I didn't any group work to share/ create idea 5. Because I was not taught on it that how to work together to create ideas
Culture Performance 8 Liked 6 Disliked	1. Because we performed well 2. I learn more about other culture and I learn how to dance other culture 3. Because we learned more about how to dance, sing and to know other cultures 4. Because to know how to dance different culture 5. Because I saw how do the gciriku dance their culture and Herero's also 6. Because we learned the some calture of different tribes 7. Because it can rember your culture 8. Because their traditional way of dressing 9. Because their traditional way of dressing shocked me	1. Because, we didn't get to perform 2. Because I feal pain when I am dancing 3. Because some groups didn't performed they refused to perform 4. Because our group didn't perform 5. Because some of the tribes that were performing I did not understand the language 6. Some really don't know to do it perfectly or correct
No Circle 1 Liked 3 Disliked	1. I like because not to for get about the past of our culture	1. I enjoyed all the activities 2. I liked them all but that was the best 3. Nothing

End of the Week Survey

During the week, did you get to come up to use the SMART Board?
Week 1: Yes. Yes. Yes, because during our project presentation we used it. Yes. Yes. Yes. Yes. Yes, I do. Yes. Yes. Yes. Yes, when we presented our field visit. Yes. Yes. Yes. Yes. Very much.
Week 2: Yes but not much. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes. Yes.

How did the SMART Board affect your learning? Did it make it easier or more difficult?
Week 1:
It make it more easier
It is easier because I learn more even on the picture.

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The SMART Board affected our learning in a good way. It made it easier that we could see visible picture big ones.
When the teacher was pressing on it and it was so easier for me and it also makes work to be easily. Yes it make it easier
It make it easier because the SMART Board affect learning it easier
In a good way because I was able to listen or tell while reading because it did not take time to show information/present the lesson
It made it easier for my understanding. This is because presenting with a SMART Board is fun since I made use of pictures.
It make it easier. Instead of us to learn thinks without seeing things that we are talking about but we see the on SMART Board.
It was much helpful. It was easier because I got to see things in colour during the lessons
It did make it easier
Its efficiency and accurate system as it problems ideas on pictures related to the topics
It affected my lessons in a good way course it is easier to use, fast and also save time.
Positively. It made it easy not like the chalk board.
It show clearly pictures and words which is easier to use/explain
It make it easier
It affected my learning in a good way because it made our learning very easier and fast it was very useful to me.
It make me easier to understand the lesson and gain more skills about the topic that we were taught.

Week 2:
It affect my learning in good way. Easier
It made it more easier
It made our learning easier
It made it easier
Easier
It made the learning easier
I make it easier
It improve my learning and it was more easy
Easier
Easier
Easier
Easier because everything is visible in the SMART Board e.g. the pictures
Easier

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Easier
It improve me and make me easier to learn
I make it easier
Yes it made it easier

Rank the days according to your favorite. Put a 1 next to your favorite day. *(*Many learners misunderstood the question in the first week. Some ranked all days as "1." Some learners gave alternative written responses not provided in this table. Incorrect completion of the question was not included in our data analysis.)*

Biodiversity lesson and collecting specimens	Climate change lesson and outdoor card game	Exploring the River field trip and starting projects	Creating an Environmental Club and working on project	Presenting Projects
1	1	5	1	1
1	2	3	4	5
1	5	3	4	2
1	2	3	4	5
1	1	2	1	1
1	3	1	1	2
5	1	2	3	4
1	2	3	4	5
4	2	1	3	5
1	4	2	5	3
1	2	3	4	5
1	3	2	5	4
1	1	2	1	1
1	1	1	1	1
1	1	1	1	1

Biodiversity Lesson	Heritage Lesson	Field Trip to the Game Park	Creating an Environmental Club	
1	2	4	3	n/a
4	3	1	2	n/a
2	1	3	4	n/a
3	1	4	2	n/a
4	1	2	3	n/a
4	2	3	1	n/a
4	2	3	1	n/a

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1	2	4	3	n/a
2	1	4	3	n/a
1	2	3	4	n/a
1	2	3	4	n/a
2	1	3	4	n/a
1	2	3	4	n/a
3	4	2	1	n/a
4	1	3	2	n/a
2	3	4	1	n/a

How would you feel about learning about more environmental topics?
Week 1:
I feel good because I learned more about environment, the problem of the environment and how to reduce the problem or how to overcome them
I feel extremely good because I learn more about our environment and insects and how can we take care of our environment.
Feel good, because I never knew some of the organisms within the environment that I saw and I would like to continue and see more.
I will feel good because it teaches and remind me on how to take care of the environment things which is existing on it.
I would feel good because I am learning how can preventing the environment and the biodiversity around the community
I will feel good because it will expand my knowledge and thinking capacity, it will help me know the right procedure/process
Good, because it is building or strengthening my foundation as I want to work in the ministry of Agriculture.
I feel good. I have learn more about how to take care of the environment. It was fun
Very good, because I'm going to change my carbon footprint.
I feel very much happy and I feel like we should do it each and every month
Feel good to know more
I will feel good, I want to be more skilled. I want to know more about nature.
Truly speaking I will be looking forward to learn more topic of this kind since it's educational and it's good for my environment.
I would feel good. I learned more and expand my knowledge by thinking nicely and understanding the topic
I will feel very comfortable, because you will be able to know more about the environment so that the future generations will benefit

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I would feel good because I want to know more about our environment and our biodiversity I think it will be a good idea to learn more of environmental topics
Feeling bad because of our carbon foot print

Week 2:
I feel good because its my responsibility to know my natural environment
I feel proud very much of it
Feel proud of myself
I would feel very proud
I'm proud of it
I would feelt good because I gain more skills and knowledge
I can feelt fantastic and very happy
I would feel proud that I love my environment, I become to know what's wrong and write to the environment
I would feel good
Good- because it easy to catch up different ideas
I feel much exited and motivated
I would feel good because I would like to know more
Good
Very good because its like wer a gain skills about it
Feel good because I want to know more than that I learn during the week
I feel good
I could feel good

Did you have fun this week?
Week 1:
Yes it was very fun I'm feeling like not going back home I want to stay here with you guys.
Yes, when we were exploring to the river some were taking them self fortose
Yes we had climate change game, soccer and birthday party for Steven.
Yes very much
Yes
Yes this week that I enjoyed most and I feel good that it could not supposed to be a week but a month.
Yes, because I learned a lot of things and have seen some things I have never seen.
Yes, I have fun. Like when we where play soccer on day + night time
Yes!!!!

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Very much
Yes
Yes, I enjoyed fieldtrip and sports
Very much
Yes.
Very much
I was beyond fun I had a great time with every body
Very much we were having fun.

Week 2:
Yes
Yes
Yes
Very much
Yes
Yes
Yes
Yes
Yes
Very much. The week was so good and I was excited about it
Very much yes I did
Yes
Yes
Yes
Yes
Yes I have
Yes a lot

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APPENDIX N: CLASSROOM OBSERVATIONS

Lesson Observation Form

Chandlor Lyles	April 20, 2015	Maria Mwengere	Biodiversity
Observer	Date	School	Lesson

		How many students (are)...?	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
At 5 minute mark	1	Sitting up and listening	17	17	14	17	17	17	17	17	17	17	15	17
	2	Participating in side conversations	0	0	0	0	0	0	0	0	0	0	0	0
	3	Maintaining eye contact	17	17	17	17	17	17	17	17	17	17	17	17
	4	Expressing confusion/ frustration	0	0	0	0	0	0	0	0	0	0	1	0
	5	Appear to be having fun	17	17	17	17	17	17	17	17	17	17	16	17
During the 5 minutes	6	Asking insightful questions	3	0	1	5	5	0	1	1	0	0	0	0
	7	Willingly responding to questions	2	17	4	3	8	2	0	0	0	0	0	0
	8	Willingly participating in activities	2	2	3	17	1	17	17	17	17	17	17	17
	9	Giving correct answers to questions	2	2	6	7	1	6	2	0	0	0	0	0
	10	Working together on activities	0	0	0	0	0	0	17	17	17	16	16	17
	11	Discussing answers/activities	1	0	3	15	0	0	0	17	17	17	17	17
	12	Repeatedly asking clarifying questions	0	0	0	2	2	0	0	1	0	0	0	0

Additional comments (Label: question#letter ex: 2C)

17 learners observed
10F: Species diversity slide - learners showed confusion
G-L: Learners completed classroom activity

		How many students (are)...?	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)
At 5 minute mark	1	Sitting up and listening	17	16	14	15	13	14	11	11	10	12	11	8
	2	Participating in side conversations	0	2	3	0	0	0	2	4	0	0	2	0
	3	Maintaining eye contact	17	15	12	15	14	12	12	9	8	12	12	10
	4	Expressing confusion/ frustration	0	0	0	0	0	0	0	0	0	0	0	0
	5	Appear to be having fun	17	14	12	13	9	14	10	14	9	11	13	5
During the 5 minutes	6	Asking insightful questions	1	0	11	11	8	0	0	2	1	0	1	0
	7	Willingly responding to questions	0	0	1	0	4	15	1	2	2	7	0	12
	8	Willingly participating in activities	17	14	1	1	4	15	1	2	0	0	7	1
	9	Giving correct answers to questions	0	0	0	4	4	4	3	2	1	2	3	10
	10	Working together on activities	17	14	0	0	0	0	0	0	0	0	0	0
	11	Discussing answers/activities	17	14	0	1	2	0	2	0	6	1	8	10
	12	Repeatedly asking clarifying questions	0	0	0	0	2	0	1	0	6	0	0	0

Additional comments (Label: question#letter ex: 2C)

M-S: Learners presented activity results

Appendix N

Lesson Observation Form

Emily Dunham	April 21, 2015	Maria Mwengere	Climate Change
Observer	Date	School	Lesson

	How many students (are)...?	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
At 5 minute mark	1 Sitting up and listening	17	17	16	17	17	15	17	17	15	16	15	14
	2 Participating in side conversations	0	0	0	0	0	0	0	0	2	0	2	0
	3 Maintaining eye contact	15	16	13	16	15	15	16	15	13	17	14	15
	4 Expressing confusion/ frustration	0	0	7	0	2	2	0	0	0	0	5	0
	5 Appear to be having fun	16	13	5	15	4	8	13	10	14	5	3	3
During the 5 minutes	6 Asking insightful questions	0	0	3	1	2	2	0	2	3	2	3	0
	7 Willingly responding to questions	10	3	3	15	3	8	3	4	7	4	10	5
	8 Willingly participating in activities	17	15	10	17	12	10	15	12	13	10	13	10
	9 Giving correct answers to questions	4	3	3	9	10	6	4	3	5	3	3	5
	10 Working together on activities	7	5	12	13	10	15	9	10	14	7	15	15
	11 Discussing answers/activities	7	5	12	15	13	17	9	10	14	10	16	5
	12 Repeatedly asking clarifying questions	0	0	0	0	1	3	0	0	0	0	1	0

Additional comments (Label: question#letter ex: 2C)

17 learners observed

7 learners came up to the board

"I kind of liked the classroom activity we did yesterday. Sharing ideas and working together."

5C & 7C: Learners were enthusiastic and giving good answers but not everyone was participating

9D: Learners debated about greenhouse gasses

11C: Explanation of methane was confusing

G: "Do you feel like a small break?" Learners responded, "No! I am very much interested."

H: Students identified drought, flooding, deforestation, and dependence on farming. "When there's drought, there is no food and just hunger in the region. There is a lot of starvation and poverty."

5I: Same learners answering questions

K: Learners explained problems exist because of poverty

6L: Learners came up to explain global warming with pictures

	How many students (are)...?	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)
At 5 minute mark	1 Sitting up and listening	17	16	16	15	16	14	12	13	10	12	9	
	2 Participating in side conversations	0	0	4	4	2	0	0	0	0	0	7	
	3 Maintaining eye contact	17	14	16	14	n/a	14	14	16	13	n/a	12	
	4 Expressing confusion/ frustration	0	0	4	2	3	0	8	0	7	0	0	
	5 Appear to be having fun	15	12	15	7	10	17	10	12	3	5	5	
During the 5 minutes	6 Asking insightful questions	2	0	2	3	0	2	3	4	1	0	2	
	7 Willingly responding to questions	12	10	7	10	17	13	10	10	5	17	12	
	8 Willingly participating in activities	15	13	16	10	17	13	15	15	12	17	10	
	9 Giving correct answers to questions	3	4	3	3	n/a	2	3	3	3	n/a	4	
	10 Working together on activities	10	12	15	10	n/a	16	13	15	10	n/a	9	
	11 Discussing answers/activities	15	14	15	15	n/a	16	15	16	10	n/a	13	
	12 Repeatedly asking clarifying questions	0	0	2	4	5	0	2	1	2	2	1	

Additional comments (Label: question#letter ex: 2C)

O: Getting off topic about irrelevant subjects

Q: Learners didn't understand carbon foot print. They thought it was when you leave foot prints in the mud → Maybe the picture was confusing?

U: Seemed confused about mitigation/adaptation

U: "I very much want this [SMART board] for my school because it is so easy to learn from and understand."

X: Calculating carbon foot print activity

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Appendix N

Lesson Observation Form

Amy Misera	April 27, 2015	Martin Ndumda	Biodiversity
Observer	Date	School	Lesson

		How many students (are)...?	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
At 5 min mark	1	Sitting up and listening	18	16	14	18	16	18	18	16	18	17	n/a	n/a
	2	Participating in side conversations	0	2	4	0	2	0	0	2	0	2	n/a	n/a
	3	Maintaining eye contact	18	16	18	16	18	18	18	16	17	18	n/a	n/a
	4	Expressing confusion/ frustration	0	0	0	0	0	0	0	0	0	0	0	0
	5	Appear to be having fun	14	6	14	15	2	7	4	14	14	14	16	16
During the 5 mins	6	Asking insightful questions	0	0	0	0	0	0	0	0	0	0	n/a	n/a
	7	Willingly responding to questions	4	2	4	5	1	3	2	4	n/a	n/a	n/a	n/a
	8	Willingly participating in activities	n/a	n/a	2	n/a	1	n/a	n/a	n/a	n/a	n/a	18	18
	9	Giving correct answers to questions	2	1	3	1	0	0	0	0	2	0	n/a	n/a
	10	Working together on activities	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	18	18
	11	Discussing answers/activities	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	18	18
	12	Repeatedly asking clarifying questions	0	0	0	0	0	0	0	0	0	0	1	0

Additional comments (Label: question#letter ex: 2C)

Maria told learners not to write everything down in notebooks. **K&L:** the learners were doing an activity, It lasted for 25 mins.

5C: Maria had learners come up to board, once one person came to the board, more hands raised

7A-F: listed animals that live in this area **7I&J:** no questions were asked that required learners to raise hands

7H: Biscuits were used to encourage learners to answer. It created more participation

Another learner joined halfway through Total: 19

		How many learners (are)...?	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)
At 5 min mark	1	Sitting up and listening	18	16	15	14	15	14	12	11	13	10	7	9
	2	Participating in side conversations	0	0	2	2	0	2	0	2	4	3	2	0
	3	Maintaining eye contact	15	16	15	14	15	14	9	12	10	12	9	10
	4	Expressing confusion/ frustration	0	0	2	0	0	0	1	0	3	0	0	0
	5	Appear to be having fun	2	4	4	12	7	3	2	2	2	4	0	4
During the 5 mins	6	Asking insightful questions	0	0	1	1	0	0	0	0	0	0	0	0
	7	Willingly responding to questions	2	0	2	4	3	2	n/a	n/a	n/a	4	0	4
	8	Willingly participating in activities	2	2	2	0	3	1	n/a	n/a	n/a	0	0	4
	9	Giving correct answers to questions	2	1	2	3	3	4	n/a	n/a	n/a	4	0	3
	10	Working together on activities	n/a	2	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	11	Discussing answers/activities	2	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	0	2
	12	Repeatedly asking clarifying questions	0	0	0	0	0	0	0	0	0	0	0	0

Additional comments (Label: question#letter ex: 2C)

4&5: Learners had trouble understanding concepts and lost interest.

6-12N,O,P: During this time the biomes were being described. Mostly just yes/no questions. Not much interaction, when some questions were asked they did not get answered/

Using the smart board increases the participation of the learners, but not for very long.

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Appendix N

Lesson Observation Form

Ben Hawks	April 28, 2015	Martin Ndumba	Heritage
Observer	Date	School	Lesson

		How many students (are)...?	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
At 5 minute mark	1	Sitting up and listening	16	18	18	18	17	18	18	17	18	17	18	17
	2	Participating in side conversations	0	0	0	0	0	0	0	0	2	0	0	4
	3	Maintaining eye contact	18	18	18	17	17	18	18	17	18	17	18	17
	4	Expressing confusion/ frustration	0	0	0	0	0	0	0	0	0	0	0	0
	5	Appear to be having fun	10	4	0	15	10	5	0	4	6	15	9	16
During the 5 minutes	6	Asking insightful questions	0	0	0	0	0	0	0	0	2	0	2	4
	7	Willingly responding to questions	4	2	4	18	10	5	8	7	4	7	8	10
	8	Willingly participating in activities	18	n/a	n/a	18	5	6	n/a	8	4	18	10	14
	9	Giving correct answers to questions	15	2	4	18	10	3	6	6	6	8	8	10
	10	Working together on activities	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	11	Discussing answers/activities	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	n/a	n/a	n/a	8
	12	Repeatedly asking clarifying questions	0	0	0	0	0	0	0	0	0	0	0	0

Additional comments (Label: question#letter ex: 2C)

18 learners observed
Two learners arrived late, and one learner was not present
9A and D- The teacher asked the class questions that all (or most) learners answered in unison

		How many students (are)...?	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)
At 5 minute mark	1	Sitting up and listening	17	13	15	13	11	12	[redacted]					
	2	Participating in side conversations	0	2	0	3	2	0						
	3	Maintaining eye contact	16	12	13	9	10	12						
	4	Expressing confusion/ frustration	0	0	0	0	0	0						
	5	Appear to be having fun	5	3	6	0	3	6						
During the 5 minutes	6	Asking insightful questions	0	0	0	0	0	0						
	7	Willingly responding to questions	2	5	8	3	4	4						
	8	Willingly participating in activities	n/a	n/a	n/a	n/a	4	3						
	9	Giving correct answers to questions	2	3	5	1	8	4						
	10	Working together on activities	n/a	n/a	n/a	n/a	n/a	3						
	11	Discussing answers/activities	n/a	n/a	n/a	n/a	n/a	n/a						
	12	Repeatedly asking clarifying questions	0	0	0	0	0	0						

Additional comments (Label: question#letter ex: 2C)

In the afternoon, learners split into five groups based on culture. In these groups, they prepared cultural activities (song, dance, etc.) to be presented in the evening. Larger groups presented two activities

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