

Work Integrated Learning: Project Report

Aspects of sustainability learned at NaDEET Centre that is most applicable to the lives of the learners visiting the Centre, looking at energy, water and waste.



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1. Abstract

The study was carried out at NaDEET Centre to find out about the aspects of sustainability learned at the Centre looking at energy, water and waste. A total of 8 groups visited of which only 2 were from a secondary school. To conduct interviews, a structured pre and post visit questionnaire was used and 48 participants were interviewed. A statistical Package for Social Sciences (SPSS) was used to statistically analyse the data. In addition, a Chi-Square test was used to test for the relations between the aspects of sustainability and the participant's response. It was found that the gender, age and school had an influence on how participants respond to the survey.

2. Introduction

Globally, sustainable development is defined as “meeting the needs of the present without compromising the ability of the future generation to meet their needs” (Michalos, Creech, McDonald & Kahlke, 2009). According to Endjala (2013), in 1970 environmental education was a tool used to address issues at the United Nation Conference. Tsibili's declaration (1977) further stated that environmental education should prepare opportunities for people to engage in processes that solve environmental problems and to create a sense of commitment to the environment.

There is a general agreement that human beings and earth are facing serious environmental problems. According to Steffen et al. (2015), climate change, loss of biodiversity and resource scarcity and ecosystem degradation are threatening our modern way of living and life on earth. An ecological footprint which is a measure of human impact on Earth's ecosystems has increased over the years (Miller and Spoolman 2011). Ecological footprint was estimated with the area of wilderness for both land and sea which supply resources to human population, and also the area needed to accommodate waste generated by human.

After signing the commitment at the United Nations Conference on Environmental and Development Summit, Namibia stayed committed to environmental education (Imene, 2010). This led to the establishment of the Directorate of Environmental Affairs (DEA). The DEA ensure that all industrial and development projects go through the process of an environmental impact assessment (EIA) (United Nations, 2002). In 1994 the Namibia

Environmental Education Network (NEEN) was established in order to promote the policy of environmental education through a policy statement “we people of Namibia will actively encourage, support and implement environmental education as a means of achieving Article 95 of the Constitution” (Haindongo, 2013).

Although the Namibian nation is consistently working on improving its self-sufficiency, the country still relies on other nations for electricity (Dunham, Hawks, Lyles and Misera, 2015). Ministry of Mines and Energy (2017) stated that Namibia’s first energy policy was developed between 1996 and 1998, thus resulting in the White Paper on Energy Policy in 1998. For about 20 years the document provided guidance for development in the energy sector. In 2016, the Ministry of Mines and Energy appointed an Energy Policy Update Committee (EPUC) that will be responsible for updating the country’s energy policy.

The White Paper on Energy Policy’s target, stipulates that 75% of electrical energy and 100% of peak electricity demand is to be supplied from local resources. However, for the past decade the country imports 59% of its’ electrical supply. In 2014, Namibia imported 73% of its total energy requirements and 92% of commercial forms of energy, exposing the country to the risk of import dependency. Namibia’s indigenous energy resources, renewable energy in the form of biomass (specifically encroacher bush), solar and wind are available in abundance. In addition, the integration of renewable sources into the society requires further attention. Once this challenge is resolved, the increased uptake of renewables is considered likely. Thus contributes to the country’s energy security and diversify its energy mix.

Many of the regions in southern Africa are experiencing severe water stress and are only left with the option of recycling and augmentation through unconventional avenues such as desalination, artificial aquifers recharge, rainwater harvesting, underground water storage tanks and conjunctive water use to provide drinking water as the aquifers are unsustainably mined (Lahnsteiner, Rensburg and Esterhuizen, 2017). The water crisis is worsened by the rapid population growth and climate change thus increasing the issue of scale; trans-boundary water transfer schemes.

In a survey done by the World Health Organization about 94% of diarrhoeal disease can be prevented by modifying the environment and having access to safe drinking water (Pruss-Ustun, Bos, Gore and Bartram, 2008). According to IWRM Plan Joint Venture Namibia (2010), Namibia is the most arid African country south of the Sahara with low precipitation

that varies from a maximum of 650mm in the north east to less than 50mm per year along the coast. Only 2% of the rainfall ends up as surface run-off while 1% becomes available to recharge groundwater, 83% is lost through evaporation (83%) and 14% is evapotranspiration.

Namibia shares the same climate conditions and biomes as Cape Town, thus the risk of water crisis is the same. This is already evident with the looming water crisis in the nation's capital city, Windhoek (Kambuli, 2016). Integrated Water Resource Management (IWRM) is globally accepted as an essential component of sustainable development in which water is recognised as a key national asset (IWRM Plan Joint Venture Namibia, 2010). IWRM is important in country such as Namibia with low, unpredictable rainfall and extremely high evaporation. The internal annual renewable water resources available from ephemeral rivers and groundwater sources are estimated at 600 million cubic metres.

A clean and healthy environment is important for every society. Waste can be described as anything that is listed as an excess or undesirable product of any activity or process (Ministry of Environment and Tourism, 2008). The Waste Management strategy is for Namibia to become the leading country in Africa in terms of solid waste management by 2028. It is illegal to dump waste anywhere other than a disposal site. Namibia is on the right track in efforts towards environmental protection and sustainable development through the Environmental Management Act at National level. At regional level Namibia is part of the Southern African Development Community that is also aimed at protecting the southern African region and internationally regulated by different United Nations programs that protects the environment; however there is negligence on the implementation of the protection measures stated in these levels.

According to Travel News Namibia (n.d.), Namibia is known as one of the cleanest country in Africa, but there are still urban and rural areas that are faced with serious littering. An effective possible solution to manage waste is to recycle as recycles reduces the amount of land that will be needed to dispose of wastes and it conserves natural resources. Recycling cannot be completed without the participation from the public; therefore NaDEET offers programs to children, youth and adults to raise awareness and highlights the importance of waste management in the environment.

3. Aims and Objectives

This project aimed at finding out which of the aspects of sustainability learned at NaDEET Centre did the visiting learners find most applicable to their lives, looking at energy, water and waste.

In order to achieve the aim, the following objectives were formulated:

- Determine if gender has an influence on the participants answers
- Determine if age has an influence on the participants answers
- Determine if the school has an influence on the participants answers

Research question: Which of the sustainable aspects offered by NaDEET did the learners find most applicable to their lives, looking at energy, water and waste?

4. Hypothesis

H_0 : There is no significant difference between the aspects of sustainability before and after the learners visited NaDEET Centre.

H_A : There is a significant difference between the aspects of sustainability before and after the learners visited NaDEET Centre.

5. Study site

The study was conducted at the Namib Desert Environmental Education Trust (NaDEET) Centre, situated south western part of Namibia, Maltahöhe. NaDEET is a non-profitable organization that was registered in 2003. The coordinates are 25.2269° S, 16.0613° E, on farm Die Duine within the NamibRand Nature Reserve. Centre was opened with a mission to protect Namibia's natural environment by educating the citizens to practice a sustainable lifestyle (Scott and Shaw, 2017). In order to achieve the mission, NaDEET has established three main projects, outreach-community development, environmental education at the NaDEET Centre and environmental literacy projects (NaDEET, 2018). As the philosophy says, 'we practice what we teach', the participants learn and live a sustainable lifestyle.

The organization has an open door policy that allows all Namibians to take part in the programs regardless of their financial status. NaDEET Centre offers unique and specialized programs to schools, communities, educators as well as doing workshops and outreach programs. (NaDEET, 2015). To reach the objective NaDEET focuses on the following programmes; school programmes, educators programme, community programmes, workshops and outreach community development. (NaDEET, 2018). On a weekly basis NaDEET accommodates programmes offering practical hands-on experience about sustainable living and guidelines on how the participants can cope with environmental challenges.



Source: Google (2018)

6. Methods and Materials

The project’s primary method was to conduct one on one interview with the visiting groups from February to May. A simple sampling method was done in order to select the participants from each group. In total 8 schools visited the centre and a total of 6 participants were chosen from each school. A total Of 26 females and 22 males were interviewed. For each group, the interviews were done on the first day of the visit before the participants started with the program and last day of the visit after the participants did the program. The interviews were conducted using a written pre and post visit questionnaire that was orally done (see appendix

1 and 2 for questionnaires). The first section is closed ended and focused on the participant's profile. The second section was open ended and focused on the program offered by NaDEET; mainly on energy, water and waste. A pilot test study was carried out to assess for errors before obtaining actual data from the school participants.

The pre-survey investigates the participant's home situation as well knowledge, attitude and awareness focusing on energy, water and waste. The post-survey aimed at detecting any changes in environmental understanding after completing the four day program. In order to analyse if the program was effective, the researcher interviewed the same participants for both pre and post survey. The questionnaires targeted upper primary as well as lower secondary school learners. As participants are under aged consent form was given to the supervisors (Appendix 3).

All meta data was recorded into an excel sheet. From this sheet data was analysed into the three categories, energy, water and waste. Data were further analysed using SPSS and Chi-Square test to test the relations between the aspects of sustainability and the participant's responses.

7. Results

7.1 Determine if gender has an influence on the participant's response

A percentage 43.8 of the females and 33.3% of male participants said solar cooking is more environmental friendly. No participants mentioned the use of firewood and 2.1% of female mentioned that both solar and gas is environmental friendly. An equal 2.1% of both females and males said solar and fuel-efficient stove is friendly to the environment. Males (8.3%) and females (4.2%) said that electric stove is more environmental friendly.

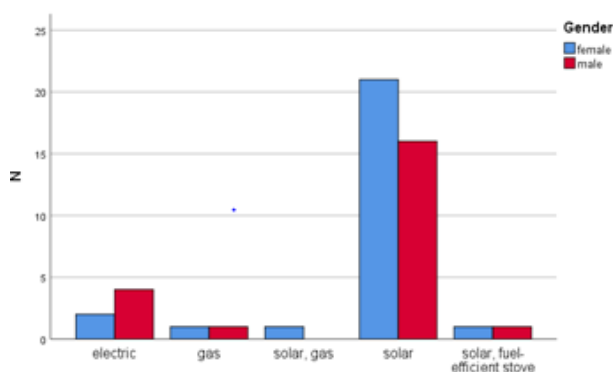


Figure 1: Type of cooking equipment perceived as environmental friendly

Compared to males, females have more different reasons about the benefits of using solar energy. Thus indicating that female has a better understanding than male. A total of 13.6% males do not know the advantages while 22.9 % said that it saves energy (Figure 2). In the post survey, males have shown a more understanding about the advantages of solar energy (Figure 3).

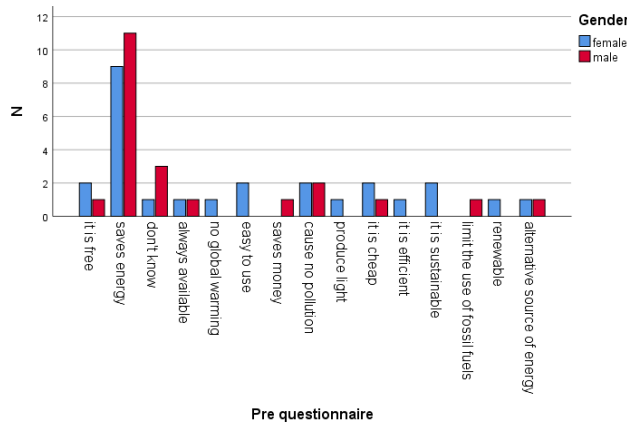


Figure 2: Advantages of using energy from the sun (pre survey)

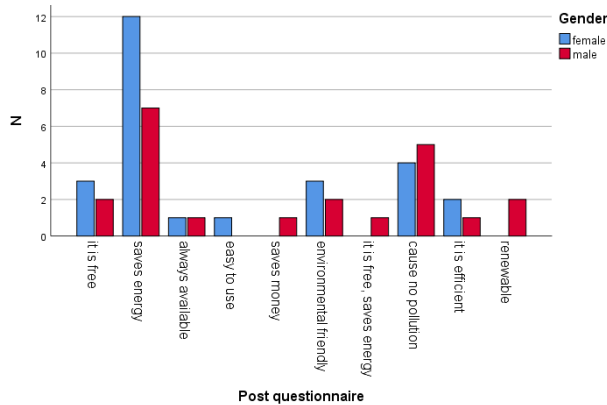


Figure 3: Advantages of using energy from the sun (post survey)

Figure 4 shows that 43.8% of females and 33.3% of males will use solar cooking home. This could be that at this age females tend to be more in the kitchen than males.

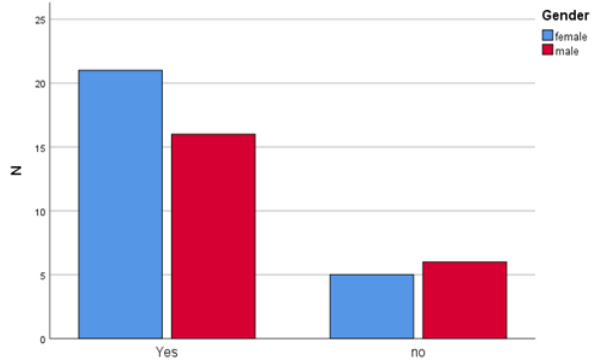


Figure 4: Number of participants willing to solar cook

More than half of the males (51.7%) and females (48.3%) indicated that if there is a broken tap at school participants will inform the teacher (Figure 5). However 2.1% of males indicated if encountered a leaking tap, participants will pass by and pretend as if did not see it and another 2.1% is not aware of what a leaking tap is. Figure 6 indicates that the participants attitude have changed as participants will either tell a teache or try to fix the tap.

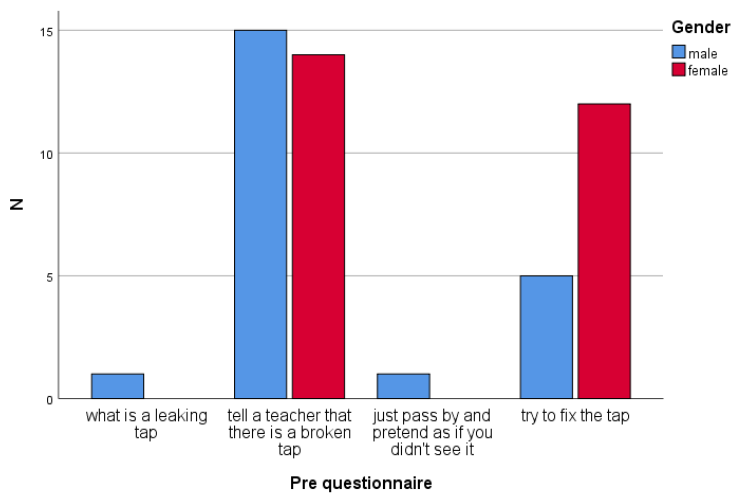


Figure 5: Action taken by participants if there is a leaking tap (pre-survey)

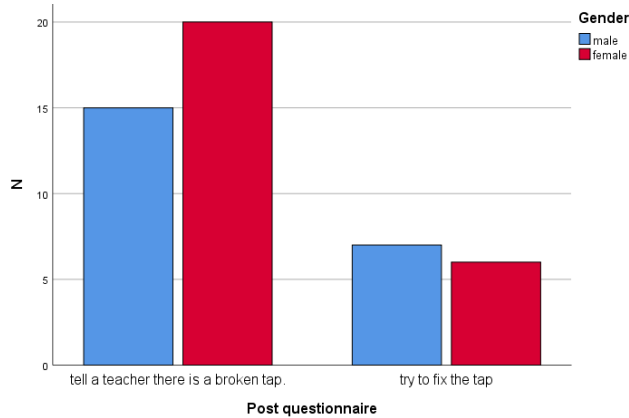


Figure 6: Action taken by participants if there is a leaking tap (post survey)

A total of 53.1% of females and 46.7% of males recycle (Figure 7). While 2.1% of female throws waste on the ground indicate a bad attitude towards waste management. The rest of the participants make use of the services offered by the town to dispose of waste.

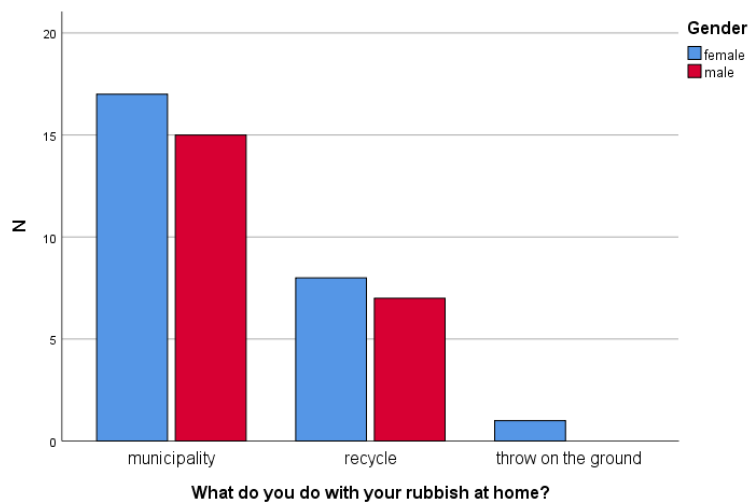


Figure 7: Action taken by participants to manage waste

7.2 Determine if age has an influence on the participant's response

Most of the participants at age 13 heard about solar cooking at school (31.3%). Age 11 (2.1%) and 12 (6.3%) never heard about solar cooking before.

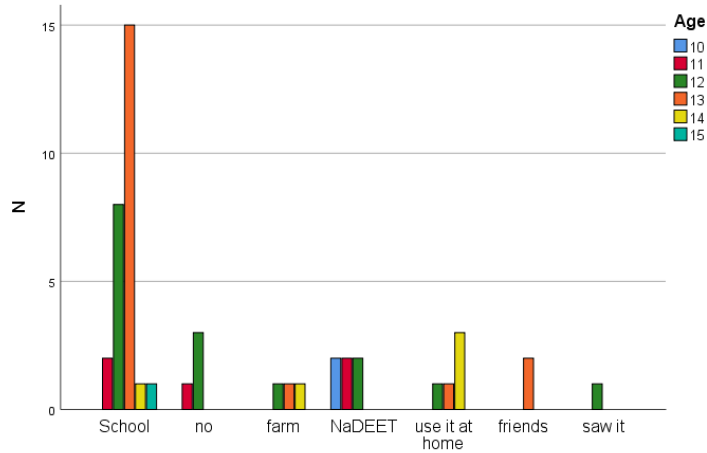


Figure 8: Places where participants heard about solar cooking

Figure 9 indicates that age 12 mostly use grey water for gardening (56.3%). At age 13 a percentage of 60 do not re use grey water.

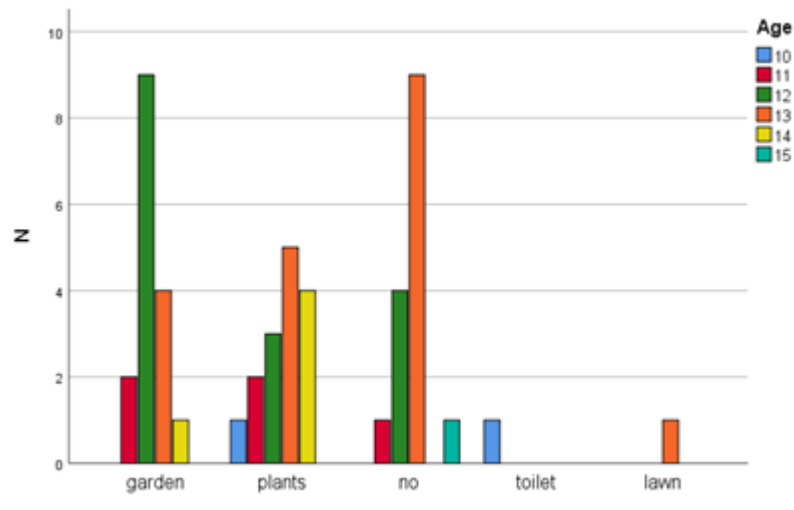


Figure 9: How participants manage grey water

Figure 10 indicates that age 15 does not implement 3R at home. Participants between the age of 12 (40%) and 13 (43.3%) implements the 3R the most.

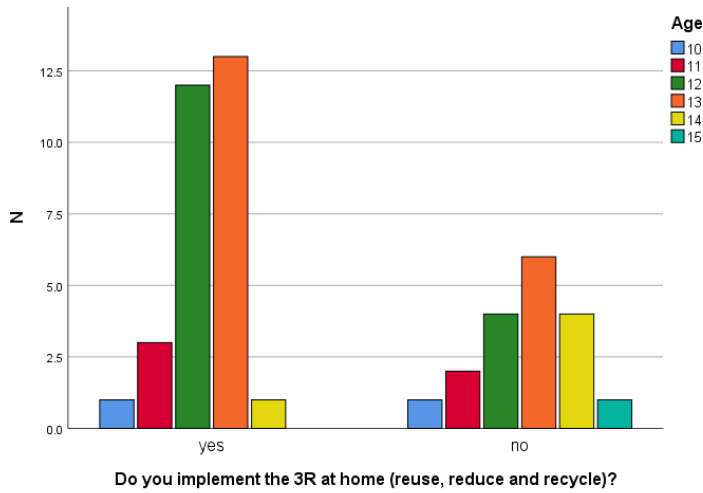


Figure 10: Implementation of the 3R at home

7.3 Determine if age has an influence on the participant's response

Figure 11 indicates schools such as \neq Oan//Ob (14.8%) and Rehoboth (22.2%) only heard about solar cooking at school. 83.3% of participants from Amazing kids mostly heard about solar cooking at NaDEET. This is mainly because most of participants from this group were at NaDEET before. A total of 40% of each of the St Pauls group and 20% of Waldorf make use of solar cooking at home.

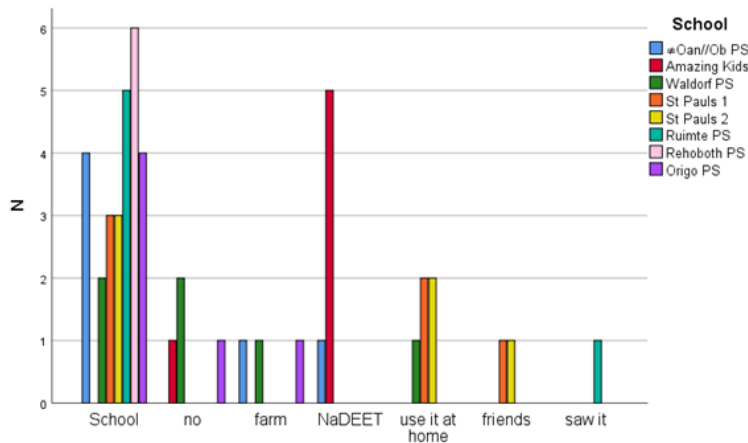


Figure 11: Places where participants heard about solar cooking

Participants from ≠Oan//Ob (2.1%) are not aware of the challenges of introducing solar cooking Figure 12. However we also have schools such as Amazing Kids and Waldorf that already make use of solar cooking.

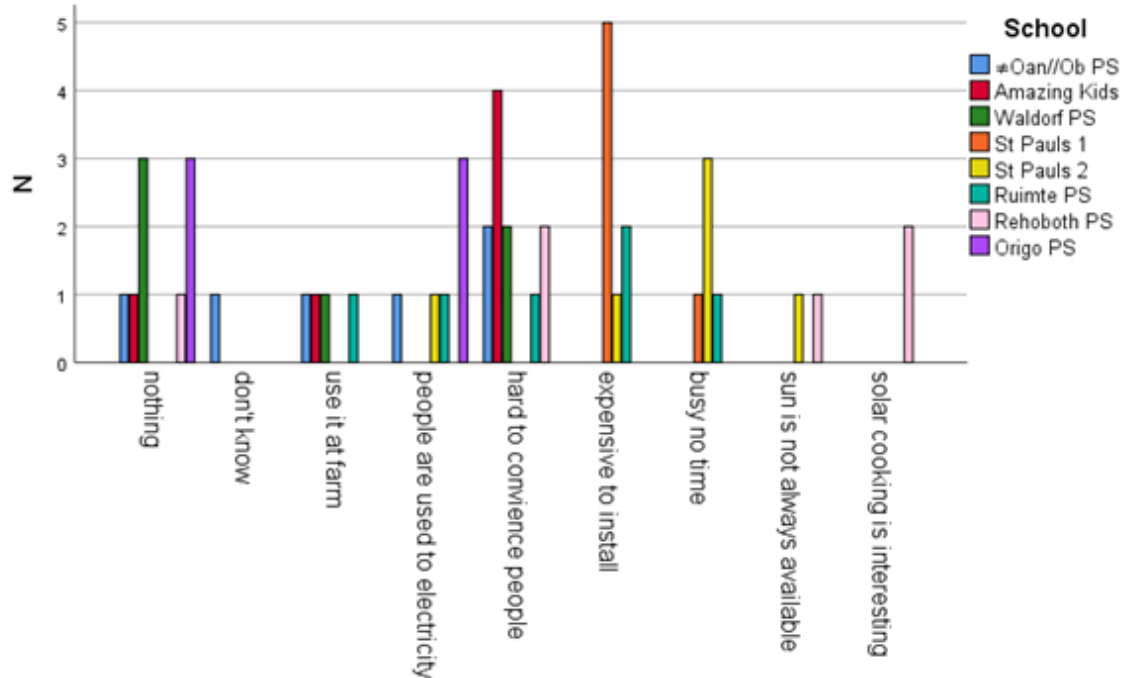


Figure 12: Challenges to introduce solar cooking

Rehoboth schools mostly use grey water for gardening (83.3%) (Figure13). The graph further indicates that from each school there are participants that do not make use of grey water.

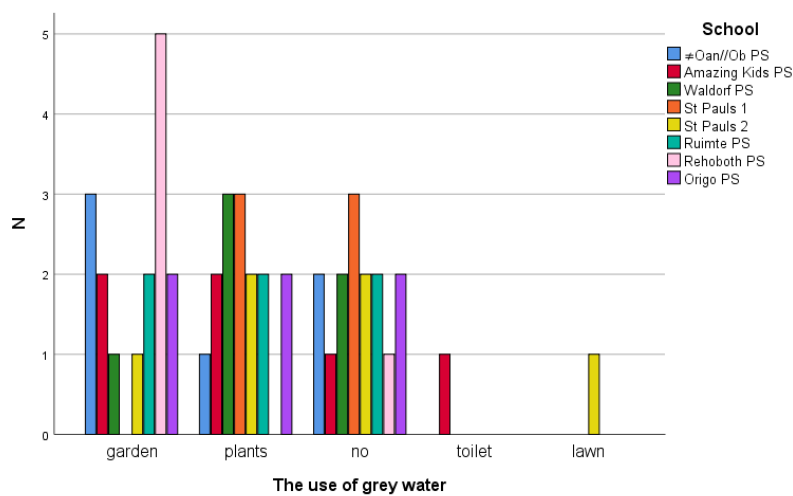
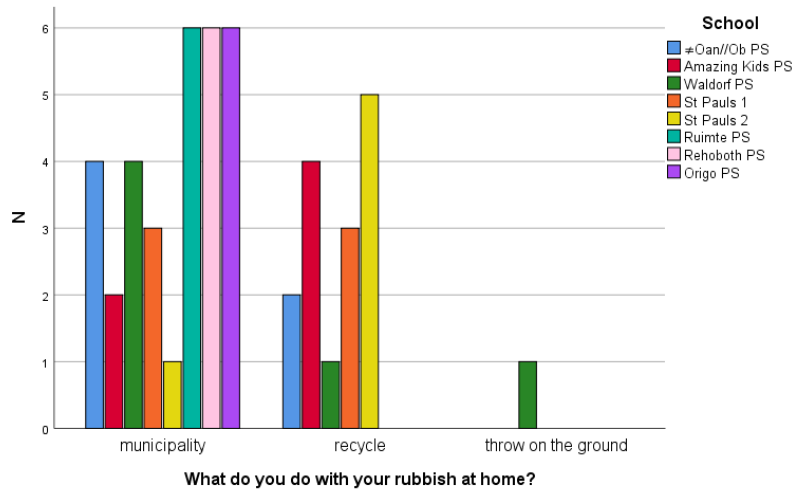


Figure 13: How participants manage grey water

Figure 14 indicates that all schools dispose of waste by having the municipality pick up the wastes. Only Waldorf (12.5%) throw waste on the ground.



7.4 Summary of how gender, age and school influence participants responses

Questions	N	Gender			Age			School		
		χ^2	df	P value	χ^2	Df	P value	χ^2	df	P value
What type of cooking equipment do you use at home	48	.231	5	6.587	.206	25	30.514	.223	35	41.043
What type of energy source do you think is suitable for cooking that is environment friendly	48	.732	4	2.023	.532	20	18.848	.440	28	28.468
What are the advantages of using energy from the sun	48	.632	14	11.614	.047	70	90.942	.120	98	114.667
What are the advantages of using energy from the sun	48	.650	9	6.875	.973	45	28.558	.053	63	82.171
Have you heard about solar cooking before? Where?	48	.068	6	11.748	.017	30	48.749	.003	42	71.141
What do you think about solar cooking	48	.653	15	12.338	.945	75	56.555	.050	105	129.867

Will you use solar cooking at home	48	.509	1	4.36	.509	5	4.288	.594	7	5.543
What do you think will be the challenges for you to introduce solar cooking at home	48	568	8	6.715	.945	75	56.555	.001	56	95.358
In terms of energy what does NaDEET do that is similar to your daily activities	48	.287	2	2.497	.931	40	27.614	.643	14	11.546

Table 1: Summary results of gender, age and school influence on participants' response to questions on energy.

Shaded = significant, $p < 0.05$, level of significance = 0.005

Table 2: Summary results of gender, age and school influence on students' response to questions on water.

Questions	N	Gender			Age			School		
		χ^2	df	P value	χ^2	df	P value	χ^2	df	P value
On a regular day, how often do you wash your body?	48	.214	3	4.477	.944	15	7.435	.236	21	25.274
You are passing by a leaking tap at school. What will you do?	48	.202	3	4.616	.597	15	13.064	.248	21	24.990
You are passing by a leaking tap at school. What will you do?	48	.497	1	4.61	.744	5	2.716	.467	7	6.646
Do you reuse grey water (water that is already used, e.g. for washing dishes or clothes)? What do you use it for?	48	.535	4	3.138	.005	20	40.333	.507	28	27.200
Why is it important to use as little water as possible?	48	.559	6	4.878	.639	30	26.691	.804	42	34.034
Why is it important to use as little water as possible?	48	.105	8	13.209	.337	40	43.187	.034	56	76.726

Shaded = significant, $p < 0.05$, level of significance = 0.005.

Table 3: Summary results of gender, age and school influence on students' response to questions on waste

Questions	N	Gender			Age			School		
		χ^2	df	P value	χ^2	df	P value	χ^2	df	P value
Do you compost or give food scraps to domestic animals?	48	.010	1	6.684	.665	5	3.225	.402	7	7.263
Do you take a plastic bag from the shop when you go for shopping?	48	.300	1	1.074	.261	5	6.501	.408	7	7.200
Do you take a plastic bag from the shop when you go for shopping?	48	.624	1	.240	.137	5	8.373	.444	7	6.857
Do you implement the 3R at home (reuse, reduce and recycle)	48	.100	1	2.708	.219	5	7.018	.455	7	6.756
What do you do with your rubbish at home?	48	.649	2	.864	.578	10	8.521	.015	14	27.833

Shaded = significant, $p < 0.05$, level of significance = 0.005.

8. Discussion

Since 2003 NaDEET has been continually building and upgrading the data base in order to improve its services to the Namibian school. The Centre is located in the Hardap region therefore most of the visiting schools are from this region. From the eight schools that visited; three schools were from Windhoek and four were from Rehoboth. Only one secondary school visited NaDEET.

8.1 Determine if gender has an influence on the participant's response

More females indicated that compared to other cooking equipment, solar cooking is more environmental friendly. Indicating that females have a better understanding of which cooking equipment is more sustainable. Even after doing the program there are still participants that

opt for electricity as the best option. However both females and males indicated that using open fire is bad for the environment as it causes pollution and it is not efficient. The pre survey has indicated that males do not have an in depth understanding of why it is more sustainable to use other alternative energy sources such as solar energy. This could be an indication as why more males perceive electrical cooking as more sustainable than other equipment. The post survey has showed that males have a better understanding than females indicating that males did learn from the program. More than a half of the participants from both genders are willing to use solar cooking as it is environmental friendly, saves energy and it is efficient. More males opt for this option solar energy saves money.

In the pre survey for water conservation, male participants do not know what a leaking tap is and if encounter one the participants will pass by and pretend as if did not see it. This shows that there is a lack of awareness within the males and perhaps males see nothing wrong with a leaking tap. However the post survey indicates that when both genders encounter a leaking tape, the participants will try to fix the tap and inform a teacher.

Less than 5% of the females throw waste on the ground. This is a surprise because females are perceived to be neater than the males. This attitude is influenced by the participant's knowledge about the environment as well the type of community the participants live in.

8.2 Determine if age has an influence on the participant's response

At the age of 11 to 15 most of the participants heard about solar cooking at school. This may be that at this age participants are being taught at school about alternative sources of energy as this is part of the Namibian upper primary school curriculum. The participants at the age of 11-12 heard about solar cooking at NaDEET and this is because this age group contains participants that were previously at NaDEET.

There is a relationship between the age of participants and how the participants manage grey water (Table 2). Only participants at the age 13 use grey water for the lawn. At the age of 10, the participants only use grey water for plants and toilet. Participants at this age normally do what elders tell them to do therefore this participants do not explore other options.

Between the ages of 12 to 13 participants do implement the 3R of recycling. Very often at this age participants get projects from school. The projects encourage participants to be creative thus making use of recyclable materials.

8.3 Determine if school has an influence on the participant's response

Most of the participants from Amazing Kids Private School heard about solar cooking at NaDEET as this is the group that was previously visited the Centre. School location does have an influence on where the participants heard about solar cooking. Most of these schools are from Hardap region and that is the town with most solar cooking equipment. NaDEET did outreach programs in this region therefore it influences where the participants heard about solar cooking and the participants perception of it. These schools bring participants to NaDEET each and every year and learners usually share the experience with peers.

Participant's challenges to introduce solar cooking also depend on the school. Schools such as St Pauls will not have time for solar cooking, because, participants are busy and will not have time for solar cooking. For all the school introducing solar cooking is a challenge as people have access to electricity which is perceived as more convenient. Other challenges that influence the implementation is the costs to obtain the equipment, weather conditions and the education of the elders at home about the use of this energy.

The findings indicate that there is little change on how school influence the participants to use grey water.

The location of the school influences how participants manage their wastes. Most of the schools that recycle are from Windhoek (Figure 14). This is one of the towns that have access to recycling companies. However there are participants from Waldorf that throw wastes on the ground. This is also influenced by the home situation of the participants and how the adults in that community manage waste.

8.4 Summary of how gender, age and school influence participant's responses

The chi-square test found strong relations between the participant's response to gender, age and school. This means that the gender, age and which school participants are from

influenced how participants understood the aspects of sustainability. Thus affecting the way participants responded to the survey.

9. Conclusion and Recommendations

As the earth is faced with many environmental issues that are threatening our way of living, Namibia grew with establishing programmes, projects and organisations to extend environmental literacy to the citizens of Namibia. Before visiting the centre most of the participants were not aware of the three aspects of sustainability. The gender, age and the school participants are from affects the way in which participants' respond.

Therefore the researcher recommends developing television or radio competitions to create awareness about waste management, energy and water conservation. Conduct a follow-up research project on the same participants to analyse the effectiveness of the program after a year or a longer period of time. More surveys that will evaluate how the program offered by NaDEET influence the participants to live a sustainable life as well as comparing which of the three categories; energy, water and waste do participants find more applicable to their lives. Ensure that for each visiting group there is a participant that has a leadership role at school as these learners are highly respected at schools and has the power to influence and empower other learners.

10. Limitation

The project was based on groups visiting NaDEET Centre and due to the tight schedule of the program; there was limited time to interview all the participants. Due to limited duration of work integrated learning, the research could not interview participants from rural schools.

11. Acknowledgement

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Appendices

Appendix 1: Pre-Aspects of Sustainability Questionnaire for visiting groups 2018

Office use: Identity number

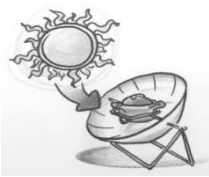
Age:.....

Tick one:

Male

Female

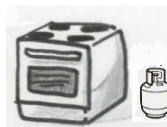
1. What type of energy source do you use at home for cooking?



Solar



Electric



Gas



Open fire



Fuel-efficient stove

2. On a regular day, how often do you wash your body?

Once a day		Twice a day		More than twice a day		Every second day	
------------	--	-------------	--	-----------------------	--	------------------	--

3. You are passing by a leaking tap at school. What will you do?

- What is a leaking tap?
- Just pass by and pretend as if you did not see it.
- Try to fix the tap.
- Tell a teacher that there is a broken tap.

4. Do you compost or give food scraps to domestic animals?

Yes		No	
-----	--	----	--

5. Do you accept a plastic bag when you go for shopping?

Yes		No	
-----	--	----	--

6. Do you implement the 3R at home (reuse, reduce and recycle)?

Yes		No	
-----	--	----	--

7. Have you heard about solar cooking before? Where?

8. What do you think about solar cooking?

9. What are the advantages of using energy from the sun?

10. Do you reuse grey water (water that is already used, e.g. for washing dishes or clothes)? What do you use it for?

11. Why is it important to use as little water as possible?

12. What do you do with your rubbish at home?

13. Do you think littering is an environmental problem? Why?

Thank you - your participation is highly appreciated!

Appendix 2: Post-Aspects of Sustainability Questionnaire for visiting groups 2018

Office use: Identity number

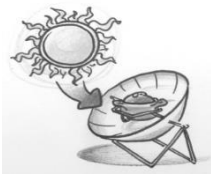
Age:.....

Tick one:

Male

Female

1. What type of energy source do you think is suitable for cooking that is environment friendly?



Solar

Electric

Gas

Open fire

Fuel-efficient stove

2. You are passing by a leaking tap at school. What will you do?

- a) What is a leaking tap?
- b) Just pass by and pretend as if you did not see it.
- c) Try to fix the tap.
- d) Tell a teacher that there is a broken tap.

3. Will you take a shopping bag when you are going for shopping?

Yes		No	
-----	--	----	--

4. What are the advantages of using energy from the sun?

5. Will you use solar cooking at home? Why?

6. What do you think will be the challenges for you to introduce solar cooking at home?
7. In terms of energy, what does NaDEET do that is similar to your daily activities?
8. Why is it important to use as little water as possible?
9. Name three things taught by NaDEET that you will do at home/school to save water.
10. Why is it important not to litter?
11. What can you do to reduce littering?
12. What do you understand by the term sustainability?

Thank you - your participation is highly appreciated!

Appendix 3: Consent Form

My name is Tuwilika Efeni Shihepo, a student from the Namibia University of Science and Technology (NUST). I am conducting a study on the aspects of sustainability learned at NaDEET Centre that learners find most applicable to their lives, looking at energy, water and waste.

Participants are expected to be open and honest in answering, as this will determine the results of the study and the recommendations resulting from this research study. Participants are allowed to withdraw and discontinue participation without penalty. The study data will be coded so that it does not link to the participant's names thus it guarantees confidentiality. The participant's identity will not be released during the study or process of data analysis.

The following are the names of the participants that will take part in the survey. Should the teacher agree to grant permission, please sign the consent form.

1.
2.
3.
4.
5.
6.

Teachers' name in print	Signature
.....
Date	Researcher's signature
.....