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Learning Environmental Issues from a Secondary School Curriculum: The Case of Learners in Mamelodi Township, South Africa

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Abstract: In South Africa, the National Curriculum Statement-Curriculum and Assessment Policy Statement (NCS-CAPS), which came into effect in 2011, was expected to play a critical role in raising environmental literacy among school learners. However, no detailed studies have evaluated its effectiveness in fulfilling this role, especially within schools in peri-urban areas. Consequently, this paper evaluated the level of environmental awareness, perceptions, and participation amongst secondary school learners in the peri-urban area of Mamelodi Township. Primary data for this evaluation research were collected from Grade 9 and Grade 11 secondary school learners by means of a close-ended questionnaire. The results revealed the important role played by school subjects such as Geography, Biology, and Life Orientation while other school subjects were less frequently acknowledged by the learners. The research also revealed the different sources of environmental learning, environmental awareness, as well as environmental problems that the learners were familiar with. However, in some instances, there were statistically significant differences between Grade 9 and Grade 11 learners, thus indicating differences in the learning content and the degree to which environmental education was taught in the different grades.

Keywords: environmental education; secondary schools; peri-urban areas; school subjects; environmental awareness; statistically significant differences

Citation: Ndzimbomvu, N.T.; Rampedi, I.T.; Kemp, M.E. Learning Environmental Issues from a Secondary School Curriculum: The Case of Learners in Mamelodi Township, South Africa. *Sustainability* **2021**, *13*, 9149. <https://doi.org/10.3390/su13169149>

Academic Editor: Andrea Weinberg

Received: 10 July 2021

Accepted: 10 August 2021

Published: 16 August 2021

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1. Introduction

The vital role and importance of environmental education (EE) is recognised internationally as one of the strategies to encourage pro-environmental behaviour and sustainable living amongst citizens of any country. As early as 1972, the United Nations Conference held in Stockholm on the Human Environment urged all countries to consider incorporating EE in their formal education curricula [1,2]. This impetus gained momentum in Tbilisi during another conference held in 1977 to establish objectives, pedagogical principles, and implementation strategies for developing environmental education nationally and internationally [2–4]. The purpose of these conferences was to empower countries with environmental knowledge whilst encouraging them to maintain their environmental integrity [1,5]. In many respects, EE is becoming the foundation for achieving environmental sustainability and sustainable living [6,7]. The EE concept initially focussed on understanding the human–environment relationship. Over time, however, its meaning has evolved to a more sophisticated interpretation of humanity's interaction with all aspects of the environment, including the biophysical and socio-economic components [5]. EE aims to develop skills, attitudes, and values, which are necessary to comprehend and appreciate the relationship between people and their socio-economic and biophysical environments [8]. Thus, the increasing call for EE is ultimately a call for global, regional,

and local action to address environmental challenges threatening the biosphere, as well as the social, economic, and political aspects of society [6,9–11]. More pertinently, it is a call for national education systems to foster the development of a citizenry that is not only environmentally literate, but is also concerned with meeting man's material and energy needs in a way that demonstrates care for the environment for the benefit of current and future generations [5,12,13].

In South Africa, the White Paper on Education and Training presented the first official inclusion of EE into the country's curriculum [14]. Although not widely accepted due to political changes taking place in the country at that time, the White Paper on Education and Training offered a significant statement that EE was a fundamental element in all formal and non-formal education and training programmes in South Africa [5]. This statement was critical in ensuring that the country encouraged the rise of an environmentally literate citizenry conducive for participation in environmental protection measures [5,14]. From the introduction of Curriculum 2005 in 1997 to the current National Curriculum Statement-Curriculum and Assessment Policy Statement (NCS-CAPS), which came into effect in 2011 [15], the Department of Basic Education has accommodated EE in South African classrooms, across all learning areas, commencing from Grade R to Grade 12 in the national school system [16–18]. Thus, the commitment of the Department of Basic Education to have EE taught in South African schools is illustrated in the NCS-CAPS [17,18]. This policy statement contains various key principles that include human rights, inclusivity, and environmental and social justice [19]. Essentially, the NCS-CAPS principles draw from Section 24 of the Bill of Rights as defined in the Constitution of the Republic of South Africa [20], which makes provision for everyone to live in an environment that is not harmful to their health or well-being as a basic human right and highlights the importance of environmental protection for the benefit of present and future generations.

Furthermore, NCS-CAPS encapsulates principle number two and four (h) of Chapter one of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) [21]. Principle two states that environmental management must serve the physical, psychological, developmental, cultural, and social needs of people, while principle four (h) illustrates the importance of promoting EE and raising environmental awareness for community well-being and empowerment [21]. The NCS-CAPS evidently strives to promote the infusion of these principles and practices to achieve social and environmental justice [15,17]. The critical aim of the NCS-CAPS is to produce learners who are able to utilise science and technology to improve the environmental quality and the health of fellow citizens responsibly [15,18,19]. The formal basic education system in South Africa is currently categorised in to two bands; namely, the General Education and Training (GET) band comprising Grades R–9, and the Further Education and Training (FET) band comprising Grades 10–12 [19]. The secondary school education structure encompasses both the GET and FET bands and comprises Grades 8–12 [19]. The average age group for secondary schooling in South Africa is between 14–18 years [19]. According to Sinha et al. [9], this is one of the most receptive groups of the population, and thus amenable to understanding and addressing environmental challenges that the world is facing today. This view is supported by several researchers [4,5,22,23] who maintain that secondary school learners are educable, and if properly taught and supported, can acquire the capacity to understand the impacts and implications of environmental degradation. Furthermore, Lekgeu et al. [24] assert that secondary school learners represent future decision makers who will design environmental policy, legislation, and relevant practices, and thus serve as a proxy for the next generation.

While the goals of EE are to create environmental awareness, improve environmental perceptions, and encourage people to participate meaningfully in local environmental activities [4,6,9,25], several studies highlight the environmental concerns in peri-urban South African secondary schools. Such concerns include inappropriate waste disposal, wasting water and electricity, and the decline of biophysical resources such as biodiversity, soil, and water bodies [26]. Komane [27] indicated that learners in peri-urban secondary schools in the City of Tshwane Metropolitan Municipality (Gauteng province) have limited

knowledge and understanding of environmental conservation and protection. This was supported by another study conducted in the Mogwase township, a peri-urban area in the North West province, which indicated that secondary schools learners were not participating meaningfully in environmental initiatives at their schools and in their communities [28]. It is, therefore, imperative to undertake evaluation studies from time to time in order to understand the extent of environmental awareness, perceptions, and participation amongst secondary school learners in matters involving environmental management. On-going evaluation studies are important as the school curriculum in South Africa has adopted the current NCS-CAPS, whose implementation is challenged by insufficient training of educators, inadequate allocation of time and resources, and too much paperwork [16]. Insights from evaluation studies may provide key information for the process of curriculum implementation to increase effectiveness and efficiency. Therefore, the aim of the study was to evaluate the level of environmental awareness, perceptions and participation amongst secondary school learners in the peri-urban area of Mamelodi township in the City of Tshwane Metropolitan Municipality (CTMM), South Africa. The primary data were collected from Grade 9 and 11 secondary school learners. These specific groups were selected because they were in the final phase of the basic education system and represented both the GET and FET bands, respectively. To address the research aim, the following questions were formulated:

- i. What is the level of environmental awareness of secondary school learners in the peri-urban Mamelodi Township?
- ii. What are the environmental perceptions of secondary school learners in this township?
- iii. What is the level of environmental participation of secondary school learners in this township?
- iv. Are there differences between Grade 9 and 11 learners?

To illuminate the results, the following hypotheses were formulated:

- i. There are statistically significant differences in environmental awareness amongst Grade 9 and Grade 11 learners;
- ii. There are statistically significant differences in environmental practices between Grade 9 and Grade 11 learners; and
- iii. There are statistically significant differences between Grade 9 and Grade 11 learners in the intent to act in an environmentally responsible way.

2. Study Area and Research Design

2.1. Study Area

The study was conducted amongst secondary schools in the peri-urban Mamelodi township, a densely populated residential area located in the City of Tshwane Metropolitan Municipality (CTMM) (Figure 1). The CTMM is one of three capital cities of South Africa and located in the Gauteng province. The municipality contributes about 30% of the Gauteng province's GDP and has an estimated land size of 6345 km², which stretches for 121 km from east to west and 108 km from north to south, making it the third largest city in the world after New York in the United States of America, and Yokohama in Tokyo [29].

Approximately 41.7% of the land mass in the CTMM is regarded as a natural area [30] and land use activities include mining, manufacturing industries, commercial enterprises, community services, and urban population settlements [31,32]. However, the CTMM is committed to the protection and proper management of environmental resources, along with the reduction of solid waste generation and greenhouse gas emissions, the maintenance of biodiversity and nature resorts, and the transition to renewable energy generation [33].

Figure 1. The geographical location of Mamelodi within the City of Tshwane Metropolitan Municipality.

Mamelodi township is located about 28 km south east of the central business district of Pretoria in Region 6 of the CTMM [33]. The Moretele river divides this township into two broad sections, namely, Mamelodi East and Mamelodi West [34]. The population size comprises approximately 410,000 local inhabitants and 54,000 households, of which about 50% are informal dwelling units [35]. The area has relatively low income and poor communities and unemployment is about 20%. Nearly 50% of the households earn less than R 3200 per month [33]. In terms of education, only about 70% of the population in the area completed Grade 9 or higher education, and an estimated 48% completed matric or higher education [33]. The area has inadequate and fragmented socio-economic infrastructures, which include roads and transportation, telecommunication, energy and water supply, sanitation, as well as limited natural open spaces and communal parks [30,36]. Solid waste management in Mamelodi, as with other townships in CTMM, is problematic as waste disposal is hampered by illegal dumping in open spaces and street corners. The poor management of such wastes is posing a risk to public health and contributes to widespread land and water pollution, thus raising a need for improved environmental sanitation and pro-environmental practices amongst residents.

2.2. Research Design, Methodology, and Study Limitations

The research design was evaluative in nature. According to Lapan and Marrais [37], there are many types of evaluation methods or approaches, but programme evaluation emphasises how educational and social programmes are implemented, how they operate, and their effect on the organisations under review. Such evaluation can also investigate the effect of the programme on students [37]. The evaluation measured the outcomes of the environmental education implementation process in the curriculum of selected schools rather than focussing on the process itself. Thus, the evaluation drew primary data that showed the acquisition of environmental learning content amongst secondary school learners in the study area. To this extent, the teaching content of the different grades was consulted on its relevance to environmental issues and in light of the results generated by

the study. However, an important study limitation that deserves to be mentioned in this research is that the school curriculum is not the only information medium that shapes and moderates the disposition, attitudes, and the environmental perceptions of individuals. Thus, learners in the secondary schools that were sampled for this research are exposed to a variety of internal and external influences that affects their environmental learning, of which the content that is taught from the approved school curriculum is just one out of many factors involved.

2.3. Sampling Procedures

A list of all secondary schools in Mamelodi township was acquired from the Gauteng Department of Education (GDE) with an estimated population of 9440 Grade 9 and 11 learners in 16 schools. In each secondary school, 32 learners (16 in Grade 9 and 16 in Grade 11) were selected, thus, a total sample 512 learners were included. The Krejcie and Morgan sampling table method was used to determine a sample size representative of a given population [38]. Sampling frames were obtained systematically from each of the participating secondary schools, which were randomised before sampling, and every sixth learner in the sampling frame was selected. Such systematic sampling is a form of random sampling and ensures that every unit of the study population has a known and equal chance of being selected [39].

2.4. Primary Data Collection

Primary data were collected through the administration of a structured questionnaire. The questionnaire was divided into four sections, namely, demographic details and the other three sections that included aspects related to (1) environmental awareness, (2) perceptions, and (3) participation. The environmental awareness section contained questions that assessed knowledge of specific environmental problems, as well as their management. This section also investigated the different sources of environmental learning at school and in the communities where the respondents lived. The environmental awareness section assessed how respondents viewed the environment in relation to other factors of society, such as the economy and various social aspects. This section determined the value that respondents placed on the environment and environmental protection. By contrast, the environmental participation section ascertained the participation levels of respondents in current environmental activities, and possible participation in future environmental activities or practices.

2.5. Data Analysis and Interpretation

Questionnaire responses were coded and entered into Excel 2016 for data analysis. Apart from descriptive statistical analyses, inferential statistics were employed to analyse the data, and included the Chi square test and an Analysis of Variance (ANOVA). According to Gravetter and Wallnau [40], the Chi-square test is appropriate to determine whether the frequency of specific cases varies among levels of a given factor, or among combinations of levels of two or more factors. This test indicated any significant differences between the populations [40].

2.6. Ethical Considerations

The research conducted complied with the ethical requirements specified by the General/Human Research Ethics Committee at the University of the Free State, South Africa. Of importance was the precondition of obtaining prior informed consent (PIC) from respondents before any data collection procedures. Obtaining PIC meant that the respondents were duly informed on the research aim and purpose and they were given a clear choice to participate, and in making such a decision, their dignity, well-being, and privacy and confidentiality were protected. Moreover, the respondents were at liberty to terminate their participation during the data collection process without incurring any harm or loss of any privilege.

To achieve these requirements, a formal application to conduct research at the 16 secondary schools in Mamelodi township was submitted to the GDE, and permission was granted. Another application was submitted and approved by the General/Human Research Ethics Committee at the University of Free State. Letters were sent to the principals of each of the 16 secondary schools in Mamelodi requesting permission to conduct research, especially regarding the logistical arrangements on the dates and times for data collection. Consent letters were sent to the parents of the learners for their approval. As a result, only those respondents whose parents expressed their willingness to participate in the evaluation research were included in data collection. Details such as the names of the selected secondary schools and that of the individual learners were coded to ensure anonymity of the respective schools and protection of learners' personal information.

3. Results and Discussion

3.1. Demographic Profiles of Respondents

Of the 512 administered questionnaires, 448 were populated properly and returned. The gender of respondents per grade is given in Figure 2. From the total respondents, 47% ($n = 212$) were female learners and 53% ($n = 236$) were male learners. For Grade 9, 48% ($n = 107$) of respondents were females and 52% ($n = 116$) were males. Similarly, for Grade 11, 46% ($n = 103$) of respondents were females while 54% ($n = 121$) were males. Based on these results, there appeared to be more boys than girls in the selected secondary schools in Mamelodi for both grades, although in 2013, the percentage of girls (49%) enrolled for Grade 9 was nearly similar as for boys (51%) in the Gauteng province of South Africa [41].

Figure 2. Gender of respondents per grade ($n = 448$).

3.2. School Subjects with Environmental Education Content

The respondents had to list the secondary school subjects that promoted learning about the environment. Respondents reported that the main subject that informed and enlightened them about the natural environment and aspects of the human environment was Geography. This school subject was mentioned by 58% ($n = 260$) of learners, representing 39% ($n = 87$) of Grade 9 and 77% ($n = 172$) of Grade 11 learners. This finding is similar to an evaluation study conducted by Mwenda [42] on subjects that delivered environmental education in the curriculum of ordinary secondary schools in Tanzania. In the Tanzanian study, both Biology and Geography had relatively larger content of environmental concepts

than other school subjects [42]. However, Geography had comparatively more content about environmental issues than Biology and other school subjects. In the South African Grade 11 Geography school curriculum, the content encompasses concepts related to natural ecosystems and the environmental impact of human activities as well as the need for sustainable development [43]. Therefore, learners are taught the significance of water bodies and how humans negatively impact rivers, wetlands, and the oceans through water pollution and the over-exploitation of available fish stocks and marine resources. Furthermore, the interplay between uneven development and sustainability receives attention while the changing patterns of industrial activities, transportation, national and world trade as well as settlement patterns are taught [43].

The school subject of Natural Science, which is a combination of life science as well as chemical and physical sciences, was reported to include environmental issues by 54% ($n = 241$) of learners, of which 86% ($n = 193$) were in Grade 9 and 21% ($n = 47$) were in Grade 11. One reason to account for this discrepancy is that Natural Science is only taught in Grade 9, but it is subdivided into two distinct subjects, namely, Life Science and Physical Science in Grade 11. Subsequently, there is likely to be fewer enrolments in Grade 11 than is the case for Grade 9 Natural Science. Nonetheless, the curriculum for Physical Science is not directly related to the global issues of environmental degradation. Instead, Physical Science focusses on the properties of materials and matter, mechanics, electromagnetism, waves, sound, and chemical changes. However, the Life Science curriculum includes environmental aspects such as the anatomy and physiology of life forms, and more specifically, population ecology, environmental problems, and their impact on the sustainability of natural ecosystems and public health [43]. The school subject of Life Orientation (LO) was reported to include environmental issues by 52% ($n = 233$) of learners, of which 64% ($n = 143$) were in Grade 9 and 40% ($n = 90$) in Grade 11. Life Orientation in both school grades is based on understanding the constitutional rights of South African citizens, physical education, development of the self in society, promotion of human health, as well as social and environmental responsibilities [43]. By contrast, the least reported school subjects for the promotion and acquisition of environmental knowledge were Home Languages, Creative Arts, Dramatic Arts, Economic Management Science, English, and Mathematics. These subjects do not include environmental education content and as a result, they were reported by only one learner (0.2%) in Grade 9.

3.3. Sources for Learning about Environmental Issues

One of the goals in the South African 2030 National Development Plan is to provide quality education so that learners are provided with knowledge and skills for the advancement of sustainable development and lifestyles to minimise environmental problems and other societal ills [44]. In Figure 3, the results on the main sources from which learners obtained key information about specific environmental problems are indicated. The majority of learners obtained information mainly from their schools when compared to other sources such as family, popular media, the internet and books, and friends. This pattern was very pronounced for environmental problems such as air pollution ($n = 372$; 81%), solid waste pollution ($n = 363$; 81%), climate change ($n = 347$; 77%), and water pollution ($n = 346$; 77%).

With these findings, the important role and influence of schools in imparting and understanding environmental knowledge to learners is clearly demonstrated. Thus, the schools in this study area appeared to be well positioned to promote EE in their curriculum, thus increasing environmental awareness amongst the learners. The next important source of environmental information was the internet and books as well as popular media such as television, newspapers, or magazines. These information sources may be outside of the formal classrooms although they are accessible from school libraries, internet facilities, and other places in the communities where the learners live, and thus are influential in the acquisition of environmental insights. Moreover, in a study conducted in Turkey, it was found that the mass media was one of the key tools that increased the environmental aware-

ness of secondary school learners [45]. Even so, some of the learners never accessed and received any such information from the different sources, indicated in Figure 3, especially for environmental problems such as deforestation ($n = 70$), acid rain ($n = 77$), extinction of biological species ($n = 99$), and infestation caused by alien and invasive species ($n = 161$).

Figure 3. Main sources of environmental information amongst learners ($n = 448$).

3.4. Awareness of Environmental Problems amongst Learners

A comparison between Grade 9 and Grade 11 learners on the extent to which they were aware of specific environmental problems is summarised in Table 1. Out of the ten different environmental problems listed in Table 1, eight were significantly different amongst the Grades ($p < 0.05$). The mean values were significantly higher for Grade 11 learners compared to Grade 9 learners, which meant that they were more aware of environmental problems than the Grade 9s. For environmental problems such as acid rain and water pollution, there was no statistical evidence to suggest differences amongst the Grades.

The Grade 11 learners were more aware in all of the eight statistically significant environmental problems than Grade 9 learners. This was attributed to the fact that the school syllabus of Grade 11 learners is in the FET phase of secondary schooling, which is comparatively more detailed than the lower grades, thus yielding greater exposure to environmental themes than the previous school grades.

Table 1. Awareness levels of environmental problems between Grade 9 and 11 learners ($n = 448$).

Question	Combined Average	Grade 9	Grade 11	<i>p</i> -Value
Air pollution	2.42	2.17	2.67	0.00
Soil erosion	2.09	1.83	2.34	0.00
Climate change	2.31	2.12	2.49	0.00
Acid rain	1.35	1.40	1.30	0.29
Solid waste	2.19	2.05	2.33	0.00
Water pollution	2.75	2.71	2.78	0.09
Alien invasive species	1.14	0.81	1.47	0.00
Deforestation	1.81	1.26	2.35	0.00
Overpopulation	2.29	2.09	2.50	0.00
Extinction of plants and animals	1.64	1.15	2.13	0.00

3.5. Environmental Perceptions between Grade 9 and Grade 11 Learners

The differences in environmental perception amongst Grade 9 and 11 learners were tested by analysing their responses to certain statements, which reflected the importance they attached to concepts and values associated with the environment. The findings are indicated in Table 2. The differences in average responses between the grades were statistically significant for half of these statements. Such statements related to their understanding of environmental issues as well as the dynamics involved in the human–environment relationship, along with concepts such as human impacts on the environment and making donations to advance the course of environmental conservation. However, there were no statistically significant differences between learners in the two school grades for statements that included perceptions on cleanliness, environmental ethics and intergenerational equity, biodiversity conservation, belief in consequence of self on environmental issues, importance and relevance of EE, and personal responsibility towards environmental protection.

Table 2. Environmental perceptions between Grade 9 and Grade 11 learners ($n = 448$).

Statement	Combined Average	Grade 9	Grade 11	<i>p</i> -Value
Cleanliness	−0.04	−0.10	−0.03	0.28
Environmental ethics and intergenerational equity	−1.16	−1.12	−1.20	0.24
Understanding environmental issues	−1.20	−1.12	−1.29	0.02
Human–environment relationship	−0.22	−0.32	−0.07	0.02
Economy vs environmental protection	−0.03	−0.27	−0.20	0.00
Social factors on environmental protection	0.92	0.71	0.05	0.00
Biodiversity conservation	1.55	1.53	1.57	0.52
Human impacts on environment	−0.83	−0.74	−0.91	0.05
Importance and relevance of environmental education	1.33	1.41	1.25	0.05
Making donations for environmental conservation	0.76	0.87	0.52	0.00
Personal responsibility towards environmental protection	1.34	1.31	1.48	0.15

3.6. Present Environmental Practices amongst Learners

An overview on the extent to which learners undertake environmentally friendly practices is indicated in Figure 4. Practices that were always carried out by the majority of learners were relatively few compared to those that were sometimes carried out. The most frequently undertaken environmental practices ranged from reusing shopping bags (44%), turning off lights and electrical appliances when not used (64%), to turning off tap water when brushing teeth (70%). However, some (30–76%) of these practices were sometimes or occasionally undertaken while others such as school paper recycling (25%) and participation in environmental clubs (47%) were never undertaken. Given these discrepancies, it appeared that environmental practices requiring learners' individual effort were carried out more frequently than those that depended on external factors or some level of organisation in their execution. For example, it was relatively easy to switch off lights at home or in the classroom when illumination was not needed than participation in

an environmental club where affiliation and membership was moderated by extraneous factors.

Figure 4. Overview of environmental practices undertaken by Grade 9 and 11 learners ($n = 448$).

The results depicted in Figure 4 were further analysed and evaluated on whether they were positively or negatively perceived by the learners. To achieve this goal, the responses to each statement were scaled as follows: Never Do It = 0; Disagree = −1; Sometimes Do It = 1; Always Do It = 2. However, amongst the fourteen statements that were assessed, only two exhibited intervals that exceeded 1.5 for turning off the tap when brushing teeth and reusing own shopping bag. With such threshold values, the learners expressed positive responses to these statements ($p < 0.05$; $SD = 0.0459$ and $SD = 0.0598$, respectively). However, for the other remaining twelve statements, the intervals were below the neutral response of 1.5, thus rendering them to be statistically significant negative responses. Given these patterns, it is clear that the learners were engaged in very few environmental

practices, thereby demonstrating either a lack of sound environmental education or lack of commitment to sustainable living even with the requisite environmental education.

The research determined whether there were significant statistical differences amongst learners regarding the environmental practices and the results are depicted in Table 3. For ten out of the fifteen environmental practices, p -values were above the significance level of 0.05, thus indicating statistically insignificant differences in the average responses between Grades. Five statements exhibited p -values that were below 0.05 and included “turning off tap water when brushing teeth”, “turning off lights and electrical appliances when not in use”, “watching wildlife programmes on TV”, “reading books and magazines with environmental content”, and “taking part in environmental activities organised by clubs or organisations”. Thus, for the latter group of practices, there were statistical differences in the average responses between Grade 9 and 11 learners.

Table 3. Statistical comparison of average responses to environmental practices between Grade 9 and 11 learners ($n = 448$).

Statement	Combined Average	Grade 9	Grade 11	p -Value
Turn off the tap when I brush my teeth	1.70	1.75	1.72	0.03
Turn off lights and electrical appliances when I am not using them	0.87	0.89	0.95	0.01
Use own bag from home to carry groceries when I go shopping	1.63	1.61	1.65	0.41
Watch wildlife conservation programmes on TV	0.86	0.92	0.80	0.03
Clean up the environment in any way (pick up waste paper and plastics)	1.23	1.21	1.26	0.30
Read books and magazines with environmental messages	0.13	0.18	0.19	0.03
Plant trees, vegetables or garden at home	1.14	1.14	1.14	0.05
Talk with my friends about environmental problems	1.14	1.11	1.16	0.54
Take short showers (less than 10 min) in order to save water	1.17	1.13	1.21	0.28
Recycle things at home	1.18	1.23	1.13	0.11
Cut down on the amount of waste I create	1.44	1.42	1.34	0.16
Recycle paper at school	1.04	1.02	1.05	0.68
Take part in tree planting day	0.82	0.76	0.95	0.09
Take part in environmental activities organised by clubs or organisations	1.07	1.03	1.11	0.08
Club membership	0.02	0.04	0.004	0.01

3.7. Future and Intended Environmentally Friendly Practices

It was important to assess which environmentally friendly practices learners intended to adopt in the future, and if so, to what extent. The results are summarised in Figure 5. Nearly 50% of learners expressed the possibility of engaging in six different activities, which were regarded as intention to promote their future environmental stewardship. These practices ranged from the being part of community environmental initiatives (49%) to preparedness to contact politicians and express environmental problems faced by their communities (59%). Learners also agreed with the possibility of having part of their salary set aside for environmental protection (52%) as well as donating some of their pocket money to protect critically endangered species, such as rhinos (52%). The other statements had to do with their perceptions about the viability of the public transportation system in South Africa. To this extent, about 36% of learners were not sure whether they would rely on public transportation or buy their own vehicles for personal mobility in the future. The commitment not to buy a car in the future and instead rely on public transportation was not accepted by at least 31% of the learners. These uncertainties amongst the learners are not wholly unexpected nor unreasonable as the South African public transportation system is generally ineffective and inefficient, and it is not clear how it is going to improve in the future [46]. Thus, in most instances, residents who use the public transportation system in South Africa have no other viable alternative means as such a system is a measure of last resort to the passengers due to lack of public safety and reliability [47].

Figure 5. Grade 9 and 11 learners' responses (%) to future environmental practices ($n = 448$).

Table 4 provides a statistical comparison amongst Grade 9 and 11 learners on their intentions to act in a manner that is environmentally responsible. All the p -values were above the significance level of 0.05, which indicated statistically insignificant differences in the average responses given by Grade 9 and 11 learners. The lack of statistical differences between the two groups of learners implied that their future commitments were seen in the same light. Such an outcome was possibly accentuated by the degree of uncertainty in terms of their feasibility and the lack of precise knowledge on how they would implement them in real life.

Table 4. The level of intentions to act environmentally responsible in future between Grade 9 and 11 learners ($n = 448$).

Statement	Combined Average	Grade 9	Grade 11	<i>p</i> -Value
If I knew more about how to take care of the environment, I would take action to do so in my community	2.21	2.16	2.25	0.15
I will take part in any school or organisation that wants to make the natural environment better	2.15	2.08	2.21	0.17
I will volunteer to take part in cleaning up rivers and wetlands in my community	2.26	2.27	2.24	0.73
In future, I am willing to have a part of my salary used to protect the environment	2.01	1.97	2.05	0.26
In future, I will write to politicians about environmental problems that I see in my community	2.04	2.08	2	0.27
I will donate my extra pocket money to save the extinction of black rhinos	1.86	1.87	1.84	0.72
In future, I will use as much petrol, electricity and heaters, as long as I can afford to	1.40	1.56	1.31	0.05
In future, I will not buy a car, but use public transport in order to reduce air pollution	1.09	1.13	1.05	0.33

4. Conclusions and Recommendations

In the evaluation of the extent of environmental awareness, perceptions and participation of Grade 9 and 11 secondary school learners in Mamelodi, a questionnaire was used to obtain primary data from 448 learners amongst 16 different secondary schools in the CTMM. Important insights that may contribute towards increasing the effectiveness of the current NCS-CAPS school curriculum in teaching environmental education were generated. The results were directly relevant to secondary schools in peri-urban areas, where the communities face many socio-economic challenges. The schools functioned as central sources of environmental information for learners, thus influencing their environmental awareness in a positive manner. School subjects that made the greatest contribution towards this goal were Geography (58%), Natural Sciences (54%), and Life Orientation (52%) whilst others such as Home Languages, Mathematics, and Economic Management Science were mentioned by very few (0.2%) learners. While the role of Geography, Natural Science, and Life Orientation may be increased, new ways of building and infusing environmental learning must be explored in the other school subjects. Moreover, there is also a need to build and infuse some of the 17 Sustainable Development Goals into the school curriculum where opportunities exist. Thus, the national education policy must change to incorporate these goals, which entail more than just environmental education (EE). Reforms in school education policy should promote the development of knowledge and skills that can promote quality education (Goal 4), enhance access to clean water and sanitation (Goal 6), build and maintain sustainable cities and communities (Goal 11), and overcome climate change (Goal 13).

The research indicated that learners understood some of the environmental problems and related issues, but their level of awareness differed from one environmental issue to another. Awareness levels were relatively higher amongst Grade 11 learners compared to Grade 9 learners, thus demonstrating differences in the syllabi between these grades. The problems of air and water pollution and solid waste challenges appeared to be well known to most learners. However, not much was known about environmental problems associated with acid rain, alien invasive species, and deforestation, thus identifying shortfalls that need attention in the school curriculum. Generally, learners had moderate to high positive perceptions about the environment and the majority responded meaningfully to a range of environment-related concepts.

Learners indicated that EE was necessary for their schools as well as for their communities. However, learners specified that if they knew more about how to take care of the environment, they would make better contributions in their communities. The most frequent environmental practices amongst the learners included the reuse of shopping bags (44%), turning off lights and electricity on unused appliances (64%), as well as turning off tap water when brushing teeth (70%). However, practices such as school paper recycling (25%) and participation in environmental clubs (47%) were not undertaken by most learners. Statistically significant differences were found for ten out of the fifteen environmental practices that were included in the questionnaire, thus revealing differences between Grade 9 and Grade 11 learners.

Conversely, the study found statistically insignificant differences in the level of environmental participation between Grade 9 and Grade 11 learners. Even though secondary school learners in this research participated in some of the various environmental activities, the majority of them were not participating adequately. This outcome may be a reflection of the lack of opportunities in their home setting and communities where they live. To overcome this shortfall, schools can obtain guidance on how to sensitise learners about participating in the environmental activities that are initiated by organisations such as the Wildlife and Environment Society of South Africa (WESSA) Eco-Schools Programme or the South African Green Schools Programme of the Department of Environmental Affairs. These programmes are taking the NCS-CAPS into consideration when they organise group activities that promote environmental care and protection amongst participants.

Lastly, the research identified the commitment of learners to participate in future environmentally friendly activities, thus giving an idea about their future environmental stewardship. These activities entailed future participation in community environment initiatives (49%) and donating funds for environmental protection (52%). However, they were less inclined to refrain from buying their own cars or vehicles in future, possibly because of the negative perceptions against the public transportation system in South Africa.

Author Contributions: Conceptualisation, N.T.N., I.T.R. and M.E.K.; Formal analysis, N.T.N.; Investigation, N.T.N., M.E.K.; Methodology, N.T.N., I.T.R.; Project administration, M.E.K.; Resources, N.T.N., M.E.K.; Software, N.T.N., M.E.K.; Supervision, I.T.R.; Validation, I.T.R.; Writing—original draft, N.T.N.; Writing—review and editing, N.T.N., I.T.R. and M.E.K. All authors have read and agreed to the published version of the manuscript.

Funding: The APC was funded by the Faculty of Science at the University of Johannesburg in South Africa.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and was approved by the General/Human Research Ethics Committee of The University of the Free State (UFS-HSD2019/1618 on 27 September 2019).

Informed Consent Statement: Permission to conduct this study was firstly obtained from the Gauteng Department of Education and secondly from each of the Principals of the schools that were selected and sampled for this study. Informed consent was further obtained from the parents of all minors (learners) before commencement of the study.

Acknowledgments: We are thankful to all stakeholders, especially the learners who participated in this study. We would also like to thank the anonymous reviewers and Mrs Liesl van der Westhuizen, science writing reviewer at the Faculty of Natural and Agricultural Sciences at the University of the Free State, for her assistance in editing the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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