

Pupils' environmental awareness and knowledge: A springboard for action in primary schools in Kenya's Rift valley

Sammy M. Mutisya
Narok Teachers Training College, Kenya

Miles Barker
University of Waikato, New Zealand

Abstract

This study was carried out with 276 standard eight pupils in eleven primary schools in the rural town of Narok in Kenya's Rift Valley. It evaluated their awareness of key environmental issues in their local area and their knowledge about the causes, effects and solutions pertaining to these environmental issues. A descriptive research design was used and data was collected using the Pupils' Environmental Education Questionnaire (PEEQ). The study found that most pupils were aware of the key environmental issues in their local area and they also understood the causes of some of these environmental issues. The study further found that pupils had ideas about solutions to some of the environmental issues. This data was used as a springboard for exploring ways by which environmental education (EE) in primary schools might capitalise on pupil knowledge, and hence progress towards environmental action taking; and how this might occur through primary school pupils being nurtured into the role of informed decision-makers and action-takers. The study also recommends that EE should be taught both theoretically in class and practically in the environment, providing solutions to local environmental issues. Further, it suggests that primary school teachers' in-service training should include interactive teaching pedagogies to enhancing active teaching and learning of EE. It recommends that Ministry of Education should develop and implement an EE policy which empowers schools (teachers and pupils) and surrounding communities to collaborate in taking action to conserve their immediate environments.

Key words: *Environmental issues, environmental awareness*

Introduction

Environmental problems have tremendously increased at the global, regional and local levels during the last few decades. Issues related to environmental problems have become a major concern for the international community, particularly for educational policy makers and curriculum developers. Several intervention measures and strategies have been considered. Among these is the use of the school curriculum to enhance public awareness of the need for environmental preservation and protection.

One of the most challenging objectives of education is to produce people who are aware of their environment and are ready to conserve it for future generations. Tsuma, (1998, pp. 180-185) explains that our environment comprises abiotic factors, such as land, water, atmosphere, climate and biotic factors such as animals, micro-organisms as well as human social factors. In the context of these complex, inter-related factors, Environmental Education (EE) is an important tool for solving various environmental problems caused by human activities. Tsuma adds that EE creates environmental awareness among communities since it is conducted in both formal and informal settings, and also that EE contributes towards increased appreciation of the value of all resources and the need to manage these resources sustainably and rationally. Korir (1987) contends that without EE people would continue to mismanage and destroy the environment on which their existence depends. EE therefore should aim at raising pupils' environmental awareness and instilling positive environmental values.

According to Laddawan and Joan (1987), primary school children are the key to EE because they are at an age when important attitudes can be formed and encouraged, and thus EE could be expected to have maximum impact in primary schools. The Koech Commission of Inquiry into the Education System of Kenya recommended teaching of EE in both primary and secondary schools (Republic of Kenya, 1999). The Kenya Institute of Education (2002) states that the objectives of EE in Kenya's primary schools are to develop positive attitudes about the environment, to manage and conserve available resources, and to develop awareness and appreciation of the environment.

To this end, EE has been integrated and infused in an interdisciplinary way across Kenya's primary, secondary and tertiary education systems. In primary schools, EE has been infused especially rigorously into science and social studies, and environmental values have also been integrated in English, mathematics and creative art. Because the great majority of Kenyans do not progress beyond primary school, this is where creating environmental awareness (and hence reducing threats to human survival) is paramount. As the Kenya National Environmental Action Plan (NEAP, 1994) points out, EE has also been strengthened in schools through co-curricular activities such as wildlife clubs, Boys Scouts and Girl Guides. However, prior to the present study, and despite the inclusion of EE in school curricula and in co-curricular activities, no evaluation has been undertaken to assess primary school pupils' awareness of the key environmental issues in their local areas and whether they have knowledge about causes, effects and solutions of the environmental issues.

Statement of the Problem

The earth's resources, despite having supported life for thousands of years, today face serious environmental challenges created by humans struggling to meet basic needs, namely access to food, water, clothing and shelter (Muthoka, Rego & Rimbui 1998, pp. 1 - 18). The United Nations Millennium Development Goal (MDG) number 7 states that United Nation member countries should integrate principles of sustainable development into their policies and programmes to ensure environmental sustainability (Wikipedia, 2008). Without EE, people will fail to look for solutions to environmental degradation and to conserve their environments and hence there is no likelihood of achieving this MDG. Wilson (1994, pp. 1 - 5) asserts that children must acquire environmental knowledge, skills and attitudes in their early years or be at risk of never developing them. EE should therefore aim at developing positive attitudes and raising awareness about the environment and managing and conserving available resources. The present study evaluated the pupils' awareness of the key

environmental issues in their local areas and their knowledge about the causes, effects and solutions of these environmental issues.

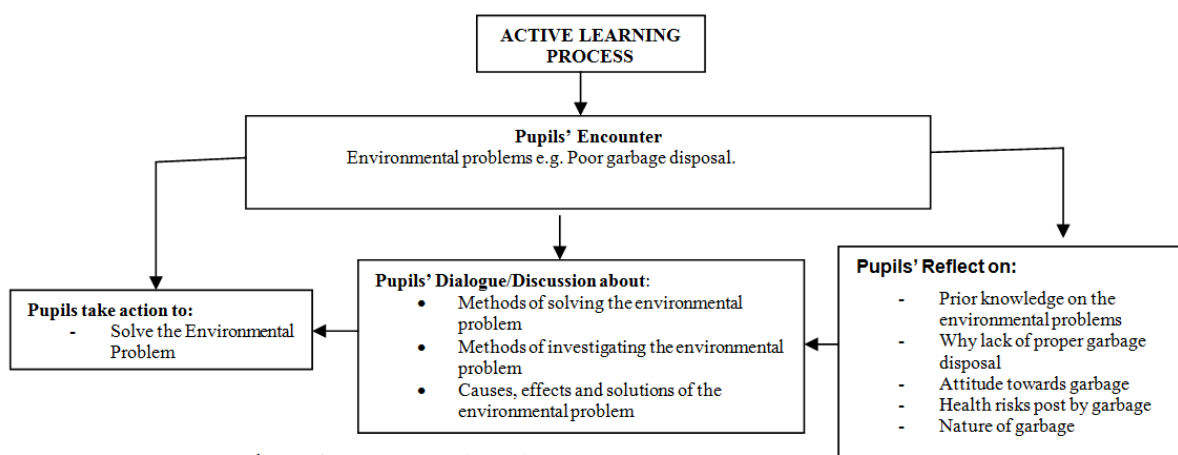
Purpose of the Study

Specifically, the study sought to find out whether primary school pupils could identify environmental degradation taking place in their local areas, and were aware of causes, effects and solutions pertaining to these environmental issues.

Theoretical Framework

The theoretical framework of the study was based on a socially critical approach (Kemmis, Cole & Sugget, 1983, pp. 13 - 44) that portrays knowledge as being constructed through social interaction. Hence knowledge has meaning to pupils since the process of learning has significance in their social context. In an active learning process, the teacher designs activities that help learners to develop an understanding of environmental issues and the ability to make judgments on how resources could be developed, managed and utilized. The activities designed are relevant to the learners' local environment. The learners are required to work in groups and are able to develop some of the skills needed for independent learning. Learners need to interact with each other and think critically about the environmental issues in their school surroundings. Based on this approach, EE learning should be an active process where pupils encounter environmental issues in their immediate environment, think about how to resolve them, discuss the solutions with fellow pupils, and take action to resolve the environmental issues.

Environmental Education as a Process of Active Learning



Source: Kemmis, Cole & Sugget (1983)

Kemmis, Cole and Sugget (1983) claim that if EE is presented as an active learning process (see diagram above) there is an increased likelihood that pupils' awareness of the key environmental issues in their local areas and their knowledge about the causes, effects and solutions of these environmental issues will be augmented and they will better be able to conserve their environments.

Methodology

Research Design

This study adopted a descriptive survey research design, one which does not manipulate variables or arrange for events to happen (Orodho, 2003). This was used to evaluate pupils' awareness of the key environmental issues in their local areas and their knowledge about the

causes, effects and solutions of these environmental issues in the Central Division of Narok North District. This district is a sub-division of Kenya's large Rift Valley province in the South Rift. The district is home to the famous Maasai Mara game Reserve and the Mau forest which is a major water reservoir in Kenya. There has been environmental degradation within the district which has threatened these two Kenyan natural resources and hence this district was chosen. The accessible population for the study were all the standard 8 pupils (between 14 and 16 years) in Central Division. The Division is divided into four zones (see table 1). Some schools in Ole Sankale and Ilmashariani zones are urban while the other zones are rural. Standard 8 pupils had already been exposed to the whole primary school curriculum.

Population

The target population was all the primary school pupils in Central Division of Narok North District. The accessible population was all the standard 8 pupils. The division had 44 public primary schools with 964 standard eight pupils (Ministry of Education, 2007) (see Table 1 and 2).

Table 1. The accessible pupil population for the study, located in four zones of Central Division. Numbers of schools are shown in brackets. Source: Ministry of Education Narok North, (2007).

Zone	Total
Ngoben (8)	139
Ole-sankale (12)	407
Olchorro (14)	134
Ilmashariani (10)	284
Total (44)	964

Sampling Procedures and Sample Size

Proportional random samples of schools and pupils were selected from each zone and school respectively (see Table 2). However, where the proposed sample size per school was more than the school accessible population of standard 8 pupils extra schools were randomly sampled within the same zone.

Table 2. Sampled Schools for the study, located in four zones of Central Division. Numbers of sampled pupils are shown in brackets.

Zone	Total
Ngoben (51)	1
Ole-sankale (76)	3
Olchorro (89)	4
Ilmashariani (64)	3
Total (280)	11

According to Fraenkel and Wallen (2000), a simple random sample is one in which each member of the population has an equal and independent chance of being selected, while a proportional sample is where the sample size is a fraction of the whole sample size. Ministry of Education (2007) indicates that there were 964 standard eight pupils in Central Division of Narok North District. When the population is more than 10,000 individuals, 384 of them are recommended as the desired sample size (Mugenda & Mugenda, 1999). The accessible population in this study was 964 standard eight pupils.

Mugenda and Mugenda recommend the formula:

$$nf = \frac{n}{1 + \frac{n}{N}} \quad \text{to be used to calculate samples size.}$$

According to the above formula:

nf= desired sample size when the population is less than 10,000,

n= desired sample when the population is more than 10,000,

N= estimate of the population size.

Using the above formula sample size is:

$$nf = \frac{384}{1 + \frac{384}{964}} = 274.29 = 274 \text{ pupils.}$$

To cater for those subjects that would decline to participate or dropped out during the process of investigation, the study proposed a sample size of 280 (see Table 2). However, a total of 276 standard 8 pupils were finally sampled and participated in the study.

Instrumentation

The Pupils Environmental Education Questionnaire

A pencil-and-paper survey, the Pupils' Environmental Education Questionnaire, PEEQ (Refer Appendix), which was developed by the researchers, comprised 13 structured questions. The items covered 3 key environmental issues experienced within Narok North District: namely, deforestation, water pollution and land pollution. Pupils' identified and selected the environmental issues in their local areas and what they thought were the causes, effects and solutions to the identified environmental issues or gave their own opinions. Pupils' opinions were categorized according to the selected responses. Percentages of the items which pupils selected or volunteered were calculated.

Data Collection

The researchers visited the eleven schools and self administered the PEEQ questionnaire to the pupils in similar settings. This was to ensure a high return rate. Permission to carry the research was obtained in advance from the Ministry of Education, the District Education office; school principals and the pupils themselves. The researchers informed all the school administration, teachers and pupils of the purpose of research, the expected duration of participation, and the procedure to be followed after data collection. Dates for administering the questionnaire were mutually agreed between the researchers, school heads, teachers and the pupils. The researchers also informed the respondents about the extent of privacy and confidentiality, the value of the research, and guaranteed that the data would be used for no other purposes. The pupils also had the right to remain anonymous and to decline to respond to items if they so wished. The researchers undertook to be sensitive to human dignity and to collect the returns for analysis immediately on completion.

Data analysis

Content analysis techniques were applied on the data generated by PEEQ. Content analysis is a multipurpose method for data collection, analysis and for investigating a variety of problems in which the communication serves as the basis for inference (Majumdar, 2005). Descriptive statistics were used to portray the sets of categories formed from the data. Descriptive statistics enable the researcher to meaningfully describe a distribution of

measurements (Mugenda & Mugenda, 1999) and also to describe, organize and summarize data (Fain 1999).

Results

The results on pupils' awareness of environmental degradation revealed that 83.6 per cent of pupils had observed uncontrolled cutting of trees in forests near their villages (Table 3). This observation by the pupil is supported by National Environmental Management Authority (NEMA) (2006). NEMA observes there has been forest destruction in Narok North District. This suggests that pupils are aware of deforestation as an environmental issue in their areas. Ewaso Ngiro South Development Authority (ENSDA) (2005) observes that from 2003 to 2005, 1,755 hectares of forest were destroyed inside and outside Mau Forest in Narok North District. These observations give plausibility to the pupils' 83.6% 'yes' response concerning the occurrence of forest destruction.

Table 4 shows that most homes in the study area used water from rivers (88.8%), rain (83.7%) and boreholes (54.4%). The other sources of water were dams (24.6%), wells (18.5%), and springs (12.7%). However, 43.1% of the pupils perceived the water used in most homes to be dirty (see Table 5). According to ENSDA (2005), the key water sources in Central Division are boreholes, rain water and rivers.

According to NEMA (2006), and in contrast with the students' perceptions, only 10 % of the population in Central Division of Narok North District has access to safe drinking water since most of the open water sources are polluted. This suggests that, despite the fact that pupils are observant of their environments; some environmental problems are not easily identifiable by pupils. Some water pollutants are not directly observable and require analysis of the quality of water for their identification. Hence there are some environmental problems that may not be known to pupils because, by their nature, they are not directly observable. Pupils may perceive rain water as being clean because it appears to be clear and without visible solid materials in it. Nonetheless, it may be polluted, especially during harvesting and storage, by agrochemicals and microorganisms.

Table 6 revealed that most pupils (69.5 %) considered Narok town to be dirty. Paper (68.5%) and plastics (64.1%) were identified as the most common solid wastes. According to NEMA (2006), a lack of specified accessible dumping sites and poor dumping practices by the residents has caused land pollution in Narok Town. This observation is also concordant with the pupils' responses. Narok Town lacks specified dumping sites near residential and business areas. Poorly disposed solid wastes are common in the town. Hence most pupils gave a correct observation of the standards of cleanliness of the town. This suggests that pupils have experienced land pollution and have knowledge of what makes an environment to be dirty or clean.

Table 3. Student Observation of Destruction of Forest (N=276)

Response	Number of pupils (%)
Yes	229 (83.6)
No	51 (16.4)
Total	276 (100)

Table 4. Students' Citing of Main Sources of Water Used in their own Homes (N=276)

Response	Number of pupils (%)
River	245 (88.8)
Wells	51 (18.5)
Rain	231 (83.7)
Dams	68 (24.6)
Springs	35 (12.7)
Boreholes	153 (54.4)

Note: The responses are multiple and therefore do not add to 100%

Table 5. Students' Opinions of Water Quality Used in Homes Generally (N=264)

Response	Number of pupils (%)
Clean	151 (56.9)
Dirty	115 (43.1)
Total	276 (100)

Table 6. Students' Opinions of the Standard of Cleanliness of Narok Town (N=276)

Response	Number of pupils (%)
Clean	83 (30.5)
Dirty	189 (69.5)
Total	276 (100)

Awareness of Causes of Environmental Degradation

The PEEQ questionnaire also interrogated whether standard 8 primary school pupils were aware of human activities causing environmental degradation. The causes of deforestation, land pollution by garbage and water pollution were investigated. Pupils' responded by ticking the human activities causing the specified environmental problem in their immediate environment and their responses were categorised (see Table 7).

Table 7. Pupils' Perceptions of Human Activities Destroying Forest (N=276)

Responses	Number of pupils (%)
Human settlement	85 (30.8)
Clearing land for farming	126 (46.7)
Wildfires	24 (8.7)
Cutting firewood	120 (43.5)
Sale of timber	120 (43.5)
Charcoal burning	211(76.4)

Note: The responses are multiple and therefore do not add to 100%

Charcoal burning (76.4%) was the major factors selected but others were clearing land for farming (46.7 per cent), the sale of timber (43.5 per cent), cutting fire wood (43.5 per cent) and human settlement (30.8 per cent). Reports by NEMA (2006) and ENSDA (2005) have also documented human settlement, sale of timber, clearing land for farming and charcoal burning as the main human activities causing forest destruction in the District. Hence the pupils' are aware of the impact of human activities on their environment. The results concerning whether pupils were aware of human activities polluting water from their sources are shown in Table 8.

Table 8. Pupils' Perceptions Human Activities Polluting Water sources (N=276)

Responses	Number of pupils (%)
Sewage	79 (28.6)
Fertilizers	56 (20.3)
Soil	42 (15.2)
Chemicals	81 (29.3)
Human faeces	64 (23.2)

Note: The responses are multiple and therefore do not add to 100%

The results revealed that very few pupils (between 15.2% and 29.3%) were aware of human activities polluting their water sources and hence many pupils considered the water used in their homes to be clean. NEMA (2006) reports increasing pollution levels in all open water sources in Narok District. According to NEMA, fertilizers, soil and agro-chemicals are the major water pollutants in the District. Pollution by sewage is common in Narok town while water pollution by human faeces could not be ruled out since most rural homesteads lack a toilet. By contrast, the incidences of pupils who identified the main human activities generating these pollutants as sewage and human faeces were 28.6% and 23.2% percent respectively. These observations indicate pupil misperceptions; they do not agree with the Narok North District water quality findings by NEMA. Hence pupils are significantly unaware of how their activities in the environment were affecting the quality of water from different sources. The results on whether pupils were aware of human activities that affect the scenic beauty of an environment, and pupils' awareness of common solid wastes affecting the scenic beauty of Narok town, are shown in Table 9 and 10.

Table 9. Pupils' Perceptions of Human Activities Lowering Cleanliness Standards of Narok Town (N=276)

Responses	Number of pupils (%)
Oil spills	24 (8.7)
Poor sewage disposal	149 (54.0)
Straying of cows to town	37 (13.4)
Poor solid waste disposal	171 (62.0)
Congestion in town	33 (12.0)

Note: The responses are multiple and therefore do not add to 100%

Table 10. Pupils' Perceptions of Common Solid Wastes Found In Narok Town (N=276)

Responses	Number of pupils (%)
Papers	189 (68.5)
Plastics	177 (64.1)
Bottles	76 (27.5)
Food remains	87 (31.5)
Tins	88 (32.0)

Note: The responses are multiple and therefore do not add to 100%

The results revealed that majority of the pupils identified solid waste disposal (62.0%) and poor sewage disposal (54.0%) as the main human activities lowering the standards of cleanliness of Narok Town. Paper (68.5%) and plastics (64.1%) were identified as the most common solid wastes found in Narok Town (see Table 9). These solid wastes have also been identified by NEMA (2006) as common and poorly disposed within Narok town. Narok town also lacks a sewerage system and sewage is poorly disposed. Oil spills are, in fact, rare and mostly happen in motor vehicle garages, while livestock only access Narok Town as they go to River Narok for watering. Hence the pupils' observations of the pollutants of the town are correct.

Identification of Effects of Environmental Degradation

The PEEQ was also used to evaluate whether Standard 8 primary school pupils were aware of the effects of deforestation, poor solid disposal and water pollution taking place in their environment. Pupils responded by ticking the specific effects of the mentioned environmental problem, and their responses were categorized (See Tables 11 and 12).

Table 11. Pupils' Perceptions of the Effects of Forest Destruction (N=276)

Response	Number of pupils (%)
Floods during rainy season	162 (58.7)
Outbreak of diseases	88 (31.9)
Reduction in amount of rainfall	197 (71.4)
Human wildlife conflicts	122 (44.2)
Disappearance of plant species	143 (51.8)
Soil erosion	220 (79.7)
Inadequate water	185 (67.0)

Note: The responses are multiple and therefore do not add to 100%

The majority of the pupils identified soil erosion (79.7%) and reduction in amount of rainfall (71.4%) as the major effect of destroying forest followed by inadequate water, floods during rainy season and disappearance of plant species. Muthoka, Rego and Rimbui (1998) have also indicated the same effects thus the pupils' responses are plausible. By contrast, few pupils also identified outbreak of diseases as effects of destruction of forest. The results on pupils' awareness of effects of poor solid waste disposal are shown in Table 12 and discussed.

Table 12. Pupils' Perceptions of Problems Associated With Poor Solid Waste Disposal (N=276)

Response	Number of pupils (%)
Increase in water-borne diseases	126 (45.7)
Breeding ground for mosquitoes	146 (52.9)
Rusting of iron sheet roofs	77 (27.9)
Spoiling scenic beauty	162 (58.7)
Increased livestock diseases	105 (38.0)

Note: The responses are multiple and therefore do not add to 100%

The above results show that majority of the pupils identified spoiling of scenic beauty (58.7 per cent) and the creation of breeding grounds for mosquitoes (52.9 per cent) as problems associated with poor disposal of garbage; 45.7% also identified increase in water-borne diseases as an effect of poor disposal of solid wastes. Solid wastes hold water, hence creating breeding ground for mosquitoes. They also litter the environment and spoil the beauty of the environment. Thus, again, the responses by the pupils are plausible. The results concerning primary school pupils' awareness of the effects of water pollution are shown in Table 13.

Table 13. Pupils' Perceptions of Diseases Associated With Lack of Clean Drinking Water (N=276)

Response	Number of pupils (%)
Malaria	96 (34.8)
Typhoid	236 (85.5)
Amoebiasis	67 (24.3)
Brucellosis	21 (7.6)
Pneumonia	83 (30.1)
Bilharzias	178 (64.5)
Influenza	50 (18.1)
Cholera	228 (82.6)

Note: The responses are multiple and therefore do not add to 100%

The majority identified typhoid (85.5%), cholera (82.6%) and bilharzia (64.5%) as diseases associated with lack of clean drinking water. These responses by the pupils are correct since the pathogens that cause these diseases are found in polluted water (Muchiri 2001). Though amoebiasis is a water-borne disease associated with polluted water, only a few pupils (24.3 per cent) identified it. A few pupils had misconceptions that malaria, brucellosis, pneumonia and influenza are diseases associated with lack of clean drinking water. According to Muchiri (2001), the pathogens that cause these diseases are not found in water.

Pupils' Solutions to Environmental Degradation

The PEEQ was also used to investigate whether primary school pupils were aware of solutions to environmental degradation taking place in their environment. Pupils volunteered solutions to deforestation and ticked the best procedure for handling solid waste from given options. Pupils' responses about the handling of solid wastes were categorised according to the selected opinion as follows:

- Putting organic and inorganic wastes in same waste bin
- Separating waste into organic and inorganic and then putting each in separate waste bins
- Using organic and inorganic wastes to make manure
- Separating the organic and inorganic wastes and using inorganic wastes to make manure and recycling organic wastes
- Separating the waste into organic and inorganic and using organic wastes to make manure and recycling the inorganic wastes.

The results concerning pupils' awareness of solutions to deforestation taking place in their immediate environment are shown in Table 14.

Table 14. Pupils' Proposed Solutions to Forest Destruction (N=276)

Response	Number of pupils (%)
Re-afforestation	149 (54.0)
Use of firewood instead of charcoal	39 (14.1)
Keeping livestock instead of crop farming	46 (16.7)
Planting fast growing trees for firewood	104 (37.7)
Use energy saving jikos for cooking	154 (56.9)
Use solar energy for cooking	168 (60.9)

Note: The responses are multiple and therefore do not add to 100%

The results revealed that many pupils considered use of solar energy (60.9 per cent), energy saving jikos (56.9 per cent) and re-afforestation (54.0 per cent) as solutions to deforestation. Use of energy saving jikos, re-afforestation and use of alternative sources of energy like solar are some of the solutions to deforestation (AFEW, 2006). The responses by pupils are therefore valid solutions to deforestation since they aim at reducing the demand for wood

energy and reforestation. These measures will reduce forest destruction and promote sustainable use of forests respectively. Therefore these pupils' explanations are the appropriate solutions to deforestation. A few pupils (37.7 per cent) identified planting of fast growing tree species for firewood as a solution to deforestation. This explanation is also correct because it ensures sustainable supply of firewood. Other responses given by the pupils were; use of firewood instead of charcoal (16.7 per cent) and keeping livestock instead of crop farming (14.1 per cent). Firewood use leads to cutting of trees to get firewood while keeping livestock requires pasture land which is created by clearing forests. The results concerning pupils' awareness of how to handle solid waste in their environment are shown in Table 15.

Table 15. Pupils' Proposed Solutions to Poor Waste Disposal (N=276)

Response	Number of pupils (%)
Putting them in same waste bin	34 (12.3)
Separating and putting in different waste bins	17 (6.2)
Using them to make manure	19 (6.9)
Separate, recycle organic waste and use inorganic to make manure	65 (23.6)
Separate, use organic to make manure and recycle inorganic	80 (29.1)

Note: The responses are multiple and therefore do not add to 100%

The results in Table 15 show the responses given by pupils concerning solutions to garbage mismanagement. The results revealed that majority of the pupils do not know how to handle organic and inorganic waste. Very few pupils (12.3 per cent) proposed that organic and inorganic waste should be put in the same waste bin while at the same time only a few pupils (6.2 per cent) proposed that organic and inorganic wastes should be separated.

The right procedure of handling solid waste should be separating organic and inorganic waste at the source. Few pupils (6.9 per cent) suggested that organic and inorganic wastes should be used to make manure. Inorganic wastes are not biodegradable hence they should be separated with organic wastes so that only organic wastes are used to make manure. Few pupils (29.1 per cent) proposed that organic wastes and inorganic wastes should be separated and organic waste used to make manure while inorganic waste should be recycled to other useful forms. This is the correct procedure of handling the two types of wastes. That notwithstanding, a few pupils (23.6 per cent) also proposed that organic and inorganic waste should be separated and organic waste recycled while inorganic waste used to make manure. This is a wrong procedure of handling solid waste.

Conclusions

Based on the results of this study it can be concluded that Kenya's standard 8 primary schools pupils in Central Division, Narok North District are aware of the key environmental issues (deforestation, poor solid waste disposal and water pollution) happening in their local areas. It can also be concluded they have knowledge about causes of deforestation and land pollution. Nonetheless, a majority of pupils were not aware of the human activities polluting their water sources. It can further be concluded they have knowledge about the effects of deforestation, water pollution and poor waste disposal. It can also be concluded that standard 8 primary school pupils have knowledge about the solutions to deforestation but are not sure of how solid waste (garbage) should be managed.

Our 'springboard' approach in primary schools, building on existing student knowledge towards effective environmental action is supported by much recent literature. For example, Stern, Powell & Ardoin (2011) advocate a similarly 'constructivist' approach and Jenkins

(2009, p. 32) claims that environmental education “needs to draw on constructivist theory and actively engage students in learning about sustainability issues generally using cooperative or collaborative strategies”. Again, the broadening of a knowledge base into meaningful action has often been advocated in terms of a ‘head, hands, heart’ rubric (for example, Sipos Battisti and Grimm, 2008) or an ‘in, about and for’ scenario (Barker & Rogers, 2004) leading to full integrated human participation (Littleddyke, 2008). That such a shift in educational approach worldwide is radical (Sterling, 2001) and transformative (Rathzel & Uzzell, 2009) has frequently been pointed out and its difficulties are not to be under-estimated (Kmel & Naglic, 2009; Holbrook, 2009; Tal, 2010).

Implications for Current Primary School Practice in Kenya

How might such an educational transformation actually be effected in the Kenyan Rift Valley schools we studied? Our research offers evidence that primary school pupils in the study area have observed some environmental degradation in their surrounding environments and are aware of the effects of these on environmental degradation. Despite the fact that pupils have better understanding and awareness, the gap between that and achieving effective solutions to environmental degradation is huge. There is a clear need for environmental education in these primary schools to go beyond knowledge about the environment to action taking. Primary school pupils should be nurtured into the role of informed decision-makers and action-takers. EE should therefore be taught both theoretically in class and practically in the environment providing solutions to local environmental issues. Primary school teachers should receive in-service training on interactive teaching pedagogies for enhancing active teaching and learning in EE and at least be aware of the claimed benefits (Chang, 2007) that might accrue from Internet involvement (even if this is currently some way off in rural Kenya). The Ministry of Education could support these developments by devising and promulgating environmental policy which empowers schools (teachers and pupils) and surrounding communities to collaborate in taking action to conserve their immediate environments.

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APPENDIX: PUPILS' ENVIRONMENTAL EDUCATION QUESTIONNAIRE (PEEQ)

Instruction

- a. Please read each item carefully before answering them.**
- b. All information given will be treated with confidence**

1. (a) Is there uncontrolled cutting down of trees in your environment? (Tick one and if the answer is No go to question 2)

Yes	
No	

(b) Which of the following human activities contributed most to the uncontrolled destruction of the forest? (Tick 4 of the most common)

Human settlement	
Clearing land for farming	
Wild fires	
Cutting firewood	
Sale of timber	
Charcoal burning	

(c) What should people in your area do to conserve their forest? (Give at least 3 solutions)

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(d) Which problems are people in your home area likely to face in future because of destroying their forest? (Tick at least five problems)

Floods during the rainy season	
Outbreak of diseases	
Reduction in amount of rainfall	
Human wildlife conflicts	
Disappearance of plant varieties	
Soil erosion	
Inadequate water	

2. (a) How would you describe the standards of cleanliness of Narok town? (Tick one, if the answer is very clean or clean go to question 3)

Very clean	
Clean	
Dirty	
Very dirty	

(b) Which of the following human activities have contributed to the low standards of cleanliness of Narok town? (Tick any 2 of the most common)

Oil spills from motor vehicles	
Poor sewage disposal	
Straying of cows to the town	
Poor waste disposal by people	
Congestion in town	

(c) Which of the following solid wastes are commonly found in Narok town dumping sites?

(Tick at most 3 of the most common)

Papers	
Tins	
Bottles	
Plastics	
Food remains	

(d) How should residents of Narok town handle both organic and inorganic wastes from their homes? (Tick one of the most appropriate)

Put them in the same waste bin	
Separate and put them in different waste bins	
Use them to make manure	
Separate and recycle organic waste and use inorganic waste to make manure	
Separate and use organic waste to make manure and recycle inorganic waste	

(e) Which of the following problems would you associated with poor solid waste disposal?

(Tick 3 of the most common)

Increase in water-borne diseases	
Breeding grounds for mosquitoes	
Rusting of iron sheet roofs in town	
Spoil the beauty of the surrounding	
Increase in livestock diseases	

3. (a) What are the main source(s) of the water used in your home? (Tick at most 3 of the most common)

River	
Well	
Rain	
Dam	
Springs	
Borehole	

(b) How would you consider the quality of water from your source(s)? (Tick one and if your answer is very clean or clean go to question 3d)

Very clean	
Clean	
Dirty	
Very dirty	

(c) Which human activities have led to the low quality of water from your source(s)? (Tick 3 of the most common)

Untreated sewage from homesteads	
Fertilizers used in farming	
Soil due to poor farming methods	
Chemicals used in farming	
Contamination by human faeces	

(d) Which of the following diseases are associated with lack of clean drinking water? (Tick 4 only)

Malaria	
Typhoid	
Amoebiasis	
Brucellosis	
Pneumonia	
Bilharzias	
Influenza	
Cholera	