

AN UNDERSTANDING OF ENVIRONMENTAL CONCEPTS AND ISSUES AMONG GRADE 10-12 STUDENTS FROM URBAN AND RURAL SCHOOLS

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Several researchers have noted that the knowledge and awareness of students with regard to environmental concepts and issues are at a low level. The assumption is that pupils from urban schools are more knowledgeable about environmental concepts and issues than those from rural schools. The major aim of this study is to assess the knowledge and understanding of Grade 10-12 students about selected environmental concepts and issues such as population, ozone layer, green house effect, and acid rain. Another aim of this study is to find out whether there is any difference between the knowledge and awareness of Grade 10-12 students to environmental issues with regard to the location of their schools. This study was conducted at four secondary schools. The study involved the use of questionnaire, observation of the school settings and discussions with some students. It was found that students' knowledge and awareness of environmental issues are limited and that students from schools in urban areas had better scores than students from schools in rural areas. The results indicate that the majority of students have low levels of environmental knowledge.

INTRODUCTION

There is general concern about the increasing deterioration and exploitation of the natural environment. Most of the environmental degradation that continues to occur today is the result of the failure of our society and its educational systems to provide citizens with the basic understandings and skills needed to make informed choices about interactions and interrelationships in the environment (Roth, 1992). An understanding about the basic interactions between humans and the environment, and skills are needed to make informed choices.

In view of the increasingly serious global impacts resulting from human activities it is important that children understand that environments change. They also need general principles to find solutions to specific environmental problems confronting modern society. Therefore, it was necessary to investigate the knowledge and understanding of Grade 10-12 students about environmental concepts and issues.

AIMS OF THE STUDY

The major aim of this study was to investigate the knowledge and understanding of Grade 10-12 students about selected environmental issues such as energy, population, wildlife, endangered species, ozone layers, green house effect and acid rain. Another aim of this study was to find out whether there is any difference between the knowledge and awareness of environmental issues Grade 10-12 students, from schools in urban and rural settings.

AN UNDERSTANDING OF ENVIRONMENTAL CONCEPTS AMONG STUDENTS

Several studies on specific aspects of environmental knowledge (pollution, water, acid rain, ozone layer, energy) indicate that students have low levels of environmental knowledge (Blum, 1987; Dlamini, 1995; Gambro & Switzky, 1996). According to Blum (1987) the factual and conceptual knowledge of students in the four countries studied (United States, Australia, England and Israel) are low. Eloranta, Antila & Heinonen (1998) noted that children with few experiences of the environment conceive it in a very different fashion from the others. Dlamini (1995) noted that an alarming number of pupils in the North West Province (South Africa) are environmentally illiterate. At the same time, children living in different environments may have radically different views of the environment. This poses special problems to environmental education.

Various researchers noted that place of residence (Arcury & Christianson, 1993; Willers, 1996), exposure to environmental education programmes (Willers, 1996), home language (Grieve & Van Staden, 1985; Willers, 1996), age group (Van Liere & Dunlap, 1980; Willers, 1996), gender (Blocker & Eckberg, 1989; Grieve & Van Staden, 1985; Schahn & Holzer, 1990; Willers, 1996), leisure time (Willers, 1996), educational qualifications (Arcury & Christianson, 1993; Grieve & Van Staden, 1985; Van Liere & Dunlap, 1980; Willers, 1996), occupation (Buttel, 1979) career in science and watching science programmes on television (Samdahl & Robertson,

1989), socioeconomic status, religious beliefs, and political ideology (Samdahl & Robertson, 1989; Van Liere & Dunlap, 1980), membership of organisations which aim to promote awareness of and care for the natural environment, hobbies, leisure, and sporting activities (Grieve & Van Staden, 1985), social norms (Lowe & Pinhey, 1982), social class and income (Arcury & Christianson, 1993; Samdahl & Robertson, 1989) are all variables in the prediction of environmental concern. Empirical evidence on the direction of the relationship with these variables is conflicting. It is possible that the direction of the relationships between variables changes with time. For example, the relationship of urban-rural residence to environmental characteristics is ambiguous. Some of the studies have found that environmental concern of urban residents is significantly greater than that of rural residents, but the actual differences are not large (Arcury & Christianson, 1993). Empirical evidence on the direction of the relationship between the variables, environmental knowledge, attitudes and concern are also conflicting. As there is disagreement about the direction of relationships between different variables, therefore, there is a need to investigate the understanding of environmental concepts and issues among Grade 10-12 students from rural and urban schools.

METHOD OF THE STUDY

To achieve the aims of this study, arrangements were made to visit four secondary schools. This included two former Model C schools (urban) in Gauteng province and two schools (rural) in Mpumalanga

province. I requested four teachers, one teacher from each school selected for this study, to choose students from Grade 10-12 who wish to participate in the study. I expected that students in Grade 10-12 would have acquired a basic understanding of environmental concepts and issues.

The study involved the use of a questionnaire, observation of the school settings and discussions with some students. The use of a questionnaire was preferred for this study as it was difficult to assess the knowledge and awareness of students by discussions with many students and observing many school settings. Due to time and financial constraints it was not possible to reach as many schools and students. The questionnaire was compiled from various sources and consists of three sections. Section A covered background information of students with regard to age, gender, grade, and information with regard to the location of school and type of school. Section B consisted of ten multiple choice questions with one correct answer and four distracters (which included a 'don't know' response to each item). It is expected that 'don't know' responses would reduce guesswork associated with multiple choice questions and also avoid forcing respondents to give a seemingly committed reply if they did not know the answer. The assumption is that use of 'don't know' responses would result in honest answers. The items on the questionnaire (see Table 1) did not represent an exhaustive measure of environmental knowledge on each issue. The correct response to each item is denoted by an asterisk (*).

Table 1: Items in Section B of the Questionnaire

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|---|
| <p>1. At the present time, where does most of the energy used in this country come from?</p> <p>a. Nuclear reactors</p> <p>b. Burning of fuels *</p> <p>c. Falling waters</p> <p>d. Solar batteries</p> <p>e. Don't know</p> |
| <p>2. The burning of fossil fuels has increased the carbon dioxide content of the atmosphere. What is the most immediate effect that this increasing amount of carbon dioxide is likely to have on our planet?</p> <p>a. A warmer climate *</p> <p>b. A cooler climate</p> <p>c. Decreased relative humidity</p> <p>d. Increased relative humidity</p> <p>e. Don't know</p> |

3. Concern has been expressed about the greenhouse effect of carbon dioxide on earth's atmosphere. The carbon dioxide allows sunlight to penetrate to the surface but blocks long-wave infrared radiation from escaping to space. If we continue to burn fuels at an increasing rate, all of the following are likely to occur except:

- a. Atmospheric carbon dioxide will increase
- b. Less heat will be trapped in the atmosphere *
- c. Sea levels will rise
- d. The antarctic ice sheet will become smaller
- e. Don't know

4. What happens to the sulphur dioxide released by a factory's smoke?

- a. The sulphur dioxide stays in the air for ever.
- b. The sulphur dioxide immediately falls to the earth as dust.
- c. The sulphur dioxide eventually falls to the earth as acid rain. *
- d. The sulphur dioxide escapes from the atmosphere into space.
- e. Don't know

5. A paper manufacturing company in your area produces large amounts of sulphuric acid as a waste product. In spite of efforts to carefully dispose of the waste, some acid continually escapes recovery and pollutes a nearby river, affecting wildlife and recreation. The company employs many area residents. Which of the following solutions to help stop the pollution would be preferred by the community?

- a. Moving the company to a more isolated area and giving worker the option to move.
- b. Adding a substance to the escaping acid to neutralize it. *
- c. Adding an acid with a higher pH to the escaping acid.
- d. Storing the escaping acid in large holding tanks and then taking it to an industrial waste landfill.
- e. Don't know

6. Which single factor has contributed most to causing species of wildlife to become endangered (threatened with extinction)?

- a. Introduction of other species.
- b. Pesticides.
- c. Sport hunting.
- d. Loss of habitat. *
- e. Don't know

7. When wildlife is overcrowded:

- a. Females may produce fewer young.
- b. The animals may destroy the vegetation that serves as a source of food and cover.
- c. The surplus animals may eventually die due to starvation, disease, and other natural causes.
- d. All of the above. *
- e. Don't know

8. The ozone layer
- Is a layer of gas. *
 - Is around the sun.
 - Is found inside the spray can.
 - Is a layer of liquid.
 - Don't know
9. Holes in the ozone layer are made worse
- By radioactivity from nuclear power stations.
 - By gases called CFCs. *
 - By the Green house effect.
 - Because the sea is getting polluted.
 - Don't know.
10. If the holes in the ozone layer get worse
- The green house effect will get worse.
 - Crops will grow faster.
 - More people will have problems with their eyes. *
 - More fish will be poisoned in the sea.
 - Don't know

* correct response.

Section C of the questionnaire consisted of 10 Likert-type items in which the students had to choose from a 5-item scale whether they strongly agree, agree, were neutral, disagree or strongly disagree with the given statements in Table 3.

ANALYSIS AND DISCUSSION

The sample (n=118) consisted of 56 (47,5%) male students and 62 (52,5%) female students. There were 38 students (52,6 % males and 47,4 % females) from the

Table 2: Percentages of correct student responses to items in Section B

Item	Content	Correct Responses (%)	
		Urban (n=38)	Rural (n=80)
1	Sources of energy	44,7 (26,3)	17,5 (8,5)
2	Effect of an increase in the level of carbon dioxide	71,1 (23,7)	25,0 (1,3)
3	Greenhouse effect	26,3 (15,8)	22,5 (2,5)
4	Sulphur dioxide from factory smoke	63,2 (13,2)	25,0 (0,0)
5	Pollution from factories	31,6 (13,2)	15,0 (5,0)
6	Extinction of species	57,9 (10,5)	33,8 (5,0)
7	Overcrowding of wildlife	57,9 (5,3)	20,0 (1,3)
8	Nature of Ozone layer	84,2 (5,3)	28,8 (2,5)
9	Causes of degradation of the Ozone layer	68,4 (7,9)	32,5 (12,5)
10	Consequences of the depletion of the Ozone layer	10,5 (15,8)	35,0 (5,0)

urban schools and 80 students (45% males and 55% females) from the rural schools. They had an average age of 17,9 years.

During scoring, one mark was given to each correct answer for items in Section B of the questionnaire. Response to each item was converted to a percentage for the urban and rural schools and is given in Table 2. The 'don't know' responses to each one of the items in Section B are given in brackets ().

Students (44,7%) from urban schools knew that most of the energy used in this country come from the burning of fuels as compared to only 17,5% from rural schools. The students (71,1% from urban schools and 25,0% from rural schools) also knew that the burning of fuels had increased the carbon dioxide content of the atmosphere and can effect a warmer climate. It must be noted that only 26,3 % (urban) and 22,5% (rural) students knew that less heat would be trapped in the atmosphere if we continue to burn fuels at an increasing rate. It was noted by 63,2% (urban) and 25% (rural) students that sulphur dioxide released from factory smoke eventually fall to the earth as acid rain. Only 31% (urban) and 15% (rural) students were able to make suggestions for solving pollution from the factories. Students (urban = 57,9% and rural = 33,8%) knew that loss of habitat is the single factor contributing the most to causing species of wildlife becoming endangered. It was found that 57,9% (urban) and only 20,0% (rural) students were knowledgeable about concepts related to crowding of wildlife. The majority (84,2%) of urban students were knowledgeable about the nature of the ozone layer. Only 28,8% of rural students gave the right answer to this item. It must be noted that the cause of degradation of the ozone layer is known to 68,4% urban and 32,5% of the rural students. The last item (the consequences of the depletion of the ozone layer) was very poorly answered by the students from urban schools. Only 10,5% (urban) and 35,0% (rural) students answered this item. Students from urban schools scored on more than half of the items on section B of the questionnaire while students from the rural schools scored on less than half of the items.

Students from urban schools are more knowledgeable about the topics covered in Items 8 (nature of the ozone layer - 84,2%), 2 (effect of an increase in the level of carbon dioxide - 71,1%), 9 (causes of degradation of the ozone layer - 68,4%), 4 (sulphur dioxide from factory smoke - 63,2%), 6 (extinction of species - 57,9%) and 7 (crowding of wildlife - 57,9%). The percentage of correct responses of students from rural schools, from highest score to lowest score, are as

follows: Item 10 (consequences of the depletion of the ozone layer - 35,0%), 6 (extinction of species - 33,8%), 9 (causes of degradation of the ozone layer - 32,5%), 8 (nature of the ozone layer - 28,8%), 2 (effect of an increase in the level of carbon dioxide - 25,0%) and item 4 (sulphur dioxide from factory smoke - 25,0%) respectively. The students from the rural schools were found to be generally weaker in the knowledge of environmental concepts and issues than the students from urban schools.

From the analysis of the questionnaire it was found that students' knowledge and awareness of environmental concepts and issues are limited. It was found that students from urban areas had better scores than those from rural areas. It may be assumed that several factors might have resulted in the better scores obtained by pupils from urban areas, for example, general background knowledge of students, the type of school (public or private), exposure to print and electronic media. The majority of the students from urban schools were able to recognise basic facts concerning environmental problems; however, most students could not apply their knowledge to comprehend the consequences or suggest potential solutions related to the problems.

The 'don't know' responses to each of the items in Section B (given in brackets in Table 2) is an indication of the understanding about environmental concepts and issues. It also indicates the honest responses of the students who completed the questionnaire. This is especially true in the case of the students from urban schools. It seems the students from the rural schools were not always honest about the 'don't know' responses. For example, in item 5 (how to stop pollution from factories) only 15% from the rural school gave the correct answer. It is important to note that only 5% indicated that they 'don't know' the topic.

In Section C of the questionnaire, the mean responses to the ten items were calculated. The items were scored using strongly agree (+2), agree (+1), neither (0), disagree (-1), and strongly disagree (-2). The items 3, 5, 7, 8 and 9 are negative items. The mean response for each item in Section C of the questionnaire is given in Table 3. The percentage response to items in Section C is provided in Table 4. It must be noted for example that 56,3% of the rural students are aware that if a drought exist in a certain area and plants die off, the predators in the area will also be in danger of extinction. Only 36,3% of the rural students and 15,8% of the urban students strongly agreed to item 2. This means that they have only a minimal

knowledge of the transfer of energy in an ecosystem. Although 65,8% of urban students stated recycling paper will result in fewer trees being cut for commercial purposes, only 22,5% strongly agreed with this statement. Students from urban and rural schools were not very sure about how the nature reserves may supply food to local communities by culling overpopulated species. Less than 25% of urban and rural students strongly agreed to the statement that we are approaching the limit of the number of people the earth can support, an indication that they need to know more about population growth and carrying capacity. Very few students are aware that the quantity of water on earth is not constant and may not be used over and over again. The majority of the students in urban (71,1%) schools strongly disagreed with item 5 (disposal of factory waste). The majority of the

students understand that overgrazing, veld fires and use of pesticides are harmful to the environment. The students were not very sure about the role of the government to look after the environment and to solve environmental problems. This study reveals the levels of environmental knowledge of students from urban and rural areas from schools selected for this study. The combined results from urban and rural schools indicate that the majority of the students have low levels of environmental knowledge.

It was found from observation that the students in the urban schools were exposed to various teaching methods and were involved in projects that are related to environmental aspects. This indicates that there is a possible cross-curricular approach in teaching in the urban schools. It seems that attempts by rural teachers

Table 3: Mean responses to items in Section C of the Questionnaire

Item	Statement	Mean	
		Urban	Rural
1	If a drought exists in a certain area and plants die off, the predators in the area will also be in danger of extinction.	1,13	1,09
2	Energy from sunlight which reaches the earth are utilised by plants and may be utilised by animals which eats the plants.	0,13	0,48
3	The quantity of water on earth is constant and may be used over and over again.	0,53	0,75
4	Recycling paper will result in fewer trees being cut for commercial purposes.	1,11	0,24
5	Factory waste may be disposed in rivers because it has no effect on biological life in the rivers.	1,29	0,90
6	Nature reserves may supply food to local communities when overpopulated species are culled.	0,32	0,24
7	Overgrazing and veld fires are not always harmful to the environment, because natural ecosystems may recover on their own.	0,58	0,45
8	When pesticides are used to kill insects, no other animals are affected once the insects are dead.	1,37	0,64
9	It is the Governments responsibility to look after the environment and to solve environmental problems.	0,24	0,31
10	We are approaching the limit of the number of people the earth can support.	0,21	0,13

Table 4: Percentage response to items in Section C of the Questionnaire

Item	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	U *	R*	U	R	U	R	U	R	U	R
1	47,4	56,3	23,7	23,8	23,7	3,8	5,3	5,0	0,0	6,3
2	15,8	36,3	21,1	26,3	36,8	7,5	13,2	11,3	13,2	20,0
3	15,8	47,5	10,5	18,8	21,0	6,3	10,5	8,8	42,1	15,0
4	65,8	22,5	10,5	20,0	7,9	18,8	5,3	28,8	13,2	6,3
5	10,5	18,4	0,0	10,0	7,9	5,0	7,9	25,0	71,1	46,3
6	23,7	22,5	15,8	28,8	39,5	8,8	10,5	17,5	10,5	16,3
7	2,6	11,3	10,5	23,8	42,1	7,5	15,8	16,3	28,9	37,5
8	7,9	10,0	0,0	16,3	13,2	8,8	5,3	20,0	73,7	40,0
9	18,4	35,0	26,3	22,3	31,6	3,8	7,9	16,3	15,8	22,5
10	23,7	17,5	23,7	20,0	23,7	15,0	7,9	25,0	21,1	21,3

U* Urban (n=38) R* Rural (n=80)

at a cross-curricular approach are hampered by the socio-economic status of most rural communities. It is important to note that not all rural schools have facilities that would help them understand and practically see the realities of environmental issues. A large percentage of the rural communities is poor due to apartheid legislation.

From discussions with some of the students in rural schools it emerged that the relevance of environmental aspects in different subject areas is not always related to the lives of the students. This could be because teachers often stress the learning of information rather than developing concepts, skills, attitudes and values (Ballantyne & Tooth-Aston, 1987). Their teaching styles are influenced by examinations that require the reproduction of facts. Examiners ask questions that discourage learners from understanding the interrelationships between subjects. Bantu Education entrenched this type of learning and teaching approach, which deprives students of chances to explore, create, hypothesise, manipulate materials, and predict. This indicates the need to employ different teaching strategies, for example, projects and discussions on environmental issues.

Knowledge of environmental concepts and issues is necessary to maintain environmental quality.

Environmental awareness and responsibility is a key factor that should be taught in our schools so that one can make the right decisions to protect the environment. It is believed that what is learnt by students at an early age will have a strong influence upon their attitudes, values, decisions, and ways of solving environmental problems. To this end, Bueth & Smallwood (1987) noted that better informed teachers can probably help their students become more aware of their environment. It is high time to realise that the problems of the environment can only be solved as we develop environmental literacy of students and their teachers (Chacko, 1998).

CONCLUSION

There is a dire need to maintain the quality of the environment. If we could produce environmentally literate citizens, we would at least begin to solve the environmental problems in time. It was found that environmental knowledge and awareness of the majority of the students who participated in this study are at a low level. The students from urban schools are more knowledgeable about environmental concepts and issues than those from rural schools.

Various researchers have indicated that environmental awareness and knowledge differ when it comes to

specific environmental issues. Therefore, it is necessary to carry out further research into students' knowledge and awareness of various environmental issues.

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