An assessment of the environmental knowledge of Standard Five and Seven pupils

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Abstract

The general environmental knowledge of 757 Standard Five and 358 Standard Seven pupils was assessed by means of a self-devised test. For this purpose a sample which consisted of pupils from twelve schools was selected. The sample included children from diverse cultures in different geographical areas and from both 'departmental' and private schools. By means of an analysis of variance it was ascertained that significant differences in knowledge exist among the subgroups in the sample. Pupils from different cultures, types of schools and genders differ significantly in environmental knowledge. Although Standard Seven pupils know significantly more than Standard Five pupils, the achievement levels of both groups were relatively poor. In conclusion some recommendations aiming to improve this level of knowledge are suggested.

1. Introduction

The environmental problems of a country such as the RSA are not so much related to the environment itself as to poor decision making with regard to the environment. *One* of the reasons for poor decision making is a lack of basic environmental knowledge. Stuart (1984:142), for example, sees ignorance as the greatest threat to the environment. This threat may be counteracted by environmental education (EE) with the aim of producing environmentally literate citizens.

Environmental literacy should not, however, be seen as being synonymous with environmental *knowledge* only. According to Hurry (1982:64) environmental literacy involves awareness of the total human environment; knowledge of environmental problems; acquired attitudes and values which lead to positive environmental behaviour; and participation in solving or preventing environmental problems.

Although environmental literacy thus involves more than environmental knowledge, knowledge is an important aspect of being environmentally literate, because it also relates to other aspects of environmental literacy, namely awareness and attitude, and can be formulated as follows:

- Although awareness is not dependent upon the possession of knowledge about the environment, it will be enhanced by such knowledge (Clacherty, 1992: 27).

- Knowledge is seen as an aspect of attitude formation by some authors (Stapp *et al.*, 1983: 12; Schreuder, 1990: 496).

Thus knowledge is seen as an important component (apart from attitudes, skills and locus of control), in determining environmental literacy and therefore responsible environmental behaviour (Ramsey & Hungerford, 1989:29; Monroe & Kaplan, 1988:38). Not surprisingly, Dispoto found that up to 40 percent of people's environmental activity could be explained in terms of their knowledge (Caduto, 1983: 14).

2. Some studies assessing environmental knowledge

Studies assessing environmental knowledge of pupils elsewhere in the world often found that it was disappointing. One such an assessment of 12th-grade pupils was done in the Dominican Republic (Roth & Perez, 1989:10-14). It was ascertained that the average performance of the pupils in a knowledge test was, in general, rather low with an average of 51% correct response rate. On average boys did significantly better than girls. This finding was consistent with some other studies (Berroa & Roth, 1990:24).

In a study by Brody and Koch (1989/90:25) in which 4th-, 8th-, and 11th-grade students' knowledge and understanding of marine science and natural resource issues was determined, it was also found that the level of understanding of basic principles and concepts was disappointing. Likewise, the overall level of ecological knowledge of randomly selected Dominican Republic citizens between the ages of 14 and 64 years was low (Berroa & Roth, 1990:27).

Not surprisingly Gigliotti states that environmental education over the previous decades has produced citizens who are emotionally charged "but woefully lacking in basic ecological knowledge" (Gigliotti, 1990:9).

3. Infusion of environmental education into curricula

Environmental knowledge of pupils may be improved by means of short courses such as those presented by the various EE-centres in the RSA. In this respect it

was found that a five day residential earth education program (called Sunship Earth) increased the ecological knowledge of 5th- and 6th-grade classes in Australia (Keen, 1991:30, 31). However, this program did not result in any significant change in pupils' attitudes. Another course, the IIAT (Issues Investigation and Action Training) was more successful. It promoted not only specific knowledge but also the skills and beliefs critical to environmental literacy at 7th- and 8th-grade level (Ramsey & Hungerford, 1989:30 & 32).

If the abovementioned short courses were successful in positively influencing the environmental knowledge and attitudes of participants, infusion of EE into the curricula of primary and secondary schools may result in developing environmental literacy in pupils – provided that teachers themselves are environmentally literate. It is therefore praiseworthy that the Department of Environment Affairs (1989:7) recommended that the objectives of environmental education be integrated into the curricula of primary and secondary schools. This recommendation has also been made by several South African authors (Clacherty, 1992:29; Knott-Craig, 1980:26; Stuart, 1984:145; Viljoen, 1987:13; Viljoen, 1988:11). Loubser (1991), who accentuated the importance of infusing EE into school curricula, consequently designed a didactic model for environmental education in the formal school system in the RSA.

Although environmental education is essentially *an approach*, the curriculum should also include a component of knowledge. It then seems advisable to assess what pupils of all ages and cultures already know and to use this as a basis for the development of the curriculum.

> Of the many variables that influence learning ... the learner's relevant background knowledge and his or her existing internal conceptual framework are two of the most important (Brody, 1990/91:26).

This principle of going from the known to the unknown is also stressed by Hurry (1982:52).

4. Aim

The purpose of this study was to address the following questions:

* What do Standard Five and Seven pupils of different subgroups know about the environment?

* Do the subgroups differ significantly in environmental knowledge?

The specified subgroups consisted of:

- Standard Five and Standard Seven pupils,

- pupils from different geographical areas,
- diverse culture groups,
- pupils from private and public schools,
- boys and girls,
- pupils belonging to EE-clubs and those who do not belong to such clubs.

The remainder of the article records the attempt to answer these questions.

5. Methodology

For the purpose of this study, a test containing 55 items on general environmental knowledge was developed. The items covered the natural as well as the man-made environment. In accord with the test of Roth and Perez (1989:11) it concentrated on the following concepts: natural resources, ecology, population, culture, pollution/erosion. These concepts were described in brochures obtained from the Department of Environment Affairs. The test items were presented as statements and children were requested to indicate if these statements were true, false or whether they did not know.

Once the items were selected, the test was evaluated by two panels of specialists – lecturers from universities (three) and environmental educators at environmental education centres (five). Subsequently some changes were made and questions added on the man-made environment, for example the social and economic environment. Thereafter a pilot test was done on two groups of Standard Five pupils, namely an Afrikaans and an English speaking group. In total 22 pupils were involved in the pilot test. Only then was permission obtained for using the test in different schools from diverse cultures.

6. Sample and the administering of the test

The study involved a sample of twelve schools which included nine primary schools (757 Standard Five pupils) and three secondary schools (358 Standard Seven pupils). The group of Standard Five pupils included the following subgroups:

- 107 white, Afrikaans speaking pupils from an affluent suburb and 80 white, Afrikaans speaking pupils from a low socio-economic area, (N=187);
- white, English speaking (N=136);
- Indian (N=58);
- black Sotho speaking (N=91);

- coloured (N=101);
- white, Afrikaans speaking from a rural area (N=120);
- 18 girls from a private girls' school and 46 boys from a private boys' school (N=64). These children were from diverse cultures.

Because of practical considerations and time constraints it was decided to include only three Standard Seven subgroups in the research. The subgroup presented the following:

- white, city suburb, Afrikaans speaking pupils (N=97);
- white, city suburb, English speaking pupils (N=176): and
- white, Afrikaans speaking pupils in a rural area (N=85).

Pupils from the Standard Seven subgroups were comparable with regard to socio-economic background. In this regard they were also comparable to the white, primary school group.

In most cases the researcher administered the test herself. However, in three instances a teacher was selected by the principal to administer the test during school hours using Science or Guidance periods. When the test was administered in a black primary school, black Sotho speaking teachers translated the items into Sotho for the children as they were completing them.

7. Statistical analysis

Eventually the following statistical analysis was done:

- *Item analysis* – to assess the degree of difficulty and the discrimination value of each of the items in order to determine which of the items was unsuitable. Thereafter the results of one item were disregarded. The Cronbach Alpha reliability coefficient was calculated. The reliability thus obtained is equal to the averages of all possible bisection reliability coefficients. This reliability is also equal to the reliability obtained with the Kuder-Richardson formula 20. The final Cronbach Alpha reliability coefficient was 0,85.
- *Frequencies* – to assess the average percentage obtained in the test for different groups and subgroups of pupils.
- *Analysis of variance* to determine if significant differences in average performance exist amongst the different subgroups of the sample.

8. Results and discussion

8.1 Age

To ascertain whether the environmental knowledge of *Standard Five* and *Standard Seven* pupils differ significantly, the average test scores of all the white, Standard Five and all the white, Standard Seven pupils were calculated. The results are given in Table 1.

Table 1. Average scores obtained by white Standard Five and Seven pupils in departmental schools

Standard	N	Average %	t-value	df	Probability
5	442	58			
7	358	60	2,3150	798	$p<0,05$

It is clear from Table 1 that, as expected, the average score of the white Standard Seven pupils is higher than that of white Standard Five pupils. Although this difference is significant on the 5% level it is smaller than expected. It is also clear that the average scores of both groups are rather low, namely 58% and 60%.

8.2 Geographical area

The average scores of the Afrikaans speaking Standard Five and Standard Seven pupils from *urban* areas were compared with the average scores of their peers from a *rural* area. The objective was to establish if significant differences exist in average environmental knowledge of similar groups who reside in different geographical areas. The results appear in Table 2.

Table 2. Average test scores obtained by white, Afrikaans speaking Standard Five and Seven pupils of different geographical areas

Standard	Geographical area	N	Average %	t-value	df	Probability
Five	Urban area	187	58			
	Rural area	120	57	0,4094	305	$p>0,05$
Seven	Urban area	97	62			
	Rural area	85	63	0,5753	180	$p>0,05$

When Table 2 is studied, it becomes clear that no significant difference in average test performance exists between same age Afrikaans-speaking children in urban or in rural areas.

8.3 Language

To ascertain whether white, city pupils from different language groups significantly differ in environmental knowledge, the average test scores of the *Afrikaans* and the *English* speaking Standard Five and Seven pupils were compared. The results appear in Table 3.

Table 3. Average test scores obtained by white, Standard Five and Seven pupils of different languages residing in the urban areas

Standard	Language	N	Average %	t-value	df	Probability
Five	Afrikaans	187	58			
	English	136	57	0,8382	321	p>0,05
Seven	Afrikaans	97	62			
	English	176	57	2,4668	271	p<0,05

Table 3 indicates that in the Standard Five group the Afrikaans speaking children scored on average only one percent higher than the English speaking children. This difference is not statistically significant. However, in the Standard Seven group the Afrikaans speaking children achieved an average of four percent higher than the English speaking children. This difference is significant on the 5% level.

8.4 Culture

By means of F-tests the average scores obtained by the six Standard Five subgroups in the urban areas were compared to see if significant differences exist. These subgroups were as follows: *white-Afrikaans; white-English; black-Sotho; Indian; coloured*; and Private school (*diverse cultures*) groups. Table 4 indicates the result.

Table 4. F-value of average scores of six Standard Five urban subgroups

N	Average score of each subgroup %	F-value	df	Probability
101	38			
91	40			
58	46			
64	56			
136	57			
187	58	68,30	5	p<0,001

It is clear from Table 4 that significant differences (on the 1% level) do exist between diverse culture subgroups. The following comparison throws some light on some of the differences that exist.

8.5 Private and public schools

The average test score of the Standard Five pupils from an interracial private school was calculated and compared with the average scores of pupils from primary schools of the *white, black, Indian* and *coloured Departments of Education*. All these were city schools. The results are as shown in Table 5.

Table 5. Differences in average scores obtained by Standard Five pupils in a private school and in departmental schools of different cultures (urban area)

Subgroups	Difference in averages %	Probability
Private and white schools	2 (58-56)	p>0,05
Private and black schools	16 (56-40)	p<0,05
Private and Indian schools	10 (56-46)	p<0,05
Private and coloured schools	18 (56-38)	p<0,05

When studying Table 5 it becomes clear that significant differences in average scores (on the 5% level) exist between the private school subgroup and the black, Indian and coloured school subgroups. The difference in averages between the private school subgroup and the black school children was 16%; between the private school pupils and the Indian school pupils 10%; and between the private school children and the coloured school children 18%.

8.6 Gender

The average scores of *boys* and *girls* from Standards Five and Seven were compared. The results are given in Table 6.

Table 6. Average scores obtained by Standard Five and Seven boys and girls

Standard	Gender	N	Average %	t-value	df	Probability
Five	Boys	385	54			
	Girls	372	49	4,3865	755	p<0,001
Seven	Boys	166	62			
	Girls	192	58	2,7394	356	p<0,05

It is clear from Table 6 that for both age groups the average scores of boys are significantly higher than that of the girls. The difference in average scores of the two genders at primary school level was 5% (significant on the 1% level). The difference in average scores for Standard Seven boys and girls was 4% (significant on the 5% level).

8.7 EE-clubs

To ascertain whether the environmental knowledge of pupils who belong to different EE-clubs (such as Boy Scouts, Pathfinders and Biology/Physical Science clubs) is significantly greater than the knowledge of pupils who do not belong to such clubs, the average test scores of these two groups were compared. The results are given in Table 7.

Table 7. Average scores obtained by Standard Five and Seven pupils who are members of environmental education clubs and those who are not

Standard	Members	N	Average %	t-value	df	Probability
Five	Yes	347	52			
	No	410	51	1,1374	755	p>0,05
Seven	Yes	101	62			
	No	257	59	1,3971	356	p>0,05

Surprisingly, the average test scores of both age groups of pupils who belong to EE-clubs are only marginally higher than the average scores of those who do not belong to these clubs. The differences in averages are, therefore, not significant.

9. Conclusions and discussion

From the above results certain important conclusions may be made:

* In accordance with previous studies to assess environmental knowledge, this study found that the general environmental knowledge of pupils is rather poor. The reason for this may be because, up to now, environmental content has not been infused into *all* the curricula of primary and secondary schools in the RSA.
* Although there is a statistically significant difference in environmental knowledge between Standard Five and Seven pupils for both Afrikaans and English speaking children, this difference in knowledge is less than may be expected. Once again the reason for this may be because no systematic infusion of appropriate environmental content for each cognitive phase, has been made.
* Afrikaans speaking children of the same age but from different geographical areas do not differ significantly in general knowledge about the environment. This means that children from urban areas are not inhibited by a manmade environment to obtain environmental knowledge.
* In this study it was found that Afrikaans speaking Standard Seven pupils in the urban areas knew significantly more about the environment than their English speaking peers. A more intensive study of the relationship between different variables and the environmental knowledge of English and Afrikaans speaking pupils is needed to explain this significant difference.
* Diverse cultural groups in Standard Five may differ significantly in environmental knowledge. This is indicated by the significant difference in environmental knowledge among Standard Five pupils from mixed culture private schools and pupils of the same age from black Sotho speaking, Indian and coloured Departments of Education. In general white, Indian and private school pupils may be from more privileged environments with easier access to television programs about the environment as well as to magazines and newspapers. This could in turn influence environmental knowledge.
* Standard Five as well as Standard Seven boys know significantly more about the environment than girls of the same age. Traditional sex roles which orient boys outdoors and towards the natural sciences, and girls in-

doors and towards the human sciences may influence learning about certain aspects of the environment.

* A conclusion arrived at in this study was that children who belong to EE-clubs do not know significantly more about the environment than children who do not belong to these clubs. More research is needed on the actual functioning of the different kinds of clubs and on their activities to explain this rather surprising conclusion.

10. Recommendations

Knowledge of the environment and its problems is an aspect of environmental literacy. The results obtained by this study suggest that pupils do not seem to have adequate basic knowledge about the environment. Therefore, in order to aid the development of environmental literacy in pupils, issues such as ecology, population, pollution, culture and natural resources should be addressed in the curriculum. However, it must be stressed that positive behaviour towards the environment will not result from a mere increase in factual information about these concepts. On the other hand, constructive behaviour towards the environment will certainly not ensue *without* the necessary knowledge about environmental problems and their possible solutions.

When infusing factual information into the curriculum of *all* subjects but more specifically of subjects such as Biology, Science and Geography, pupils' background knowledge should be taken into account so as to be able to move from the known to the unknown. In this regard it is recommended that the difference in general environmental knowledge among diverse groups should be taken into account.

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