

Exploring South African High School Students' Knowledge of Environmental Pollution: A Comparative Study

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Abstract

Globally, environmental pollution, most especially in the industrialised nations, has remain a serious problem. Despite these, knowledge of young students about environmental pollution has been reported to be inadequate. This study examined high school students' knowledge of environmental pollution in two South African provinces. The study was descriptive comparative in design. A total of 453 and 330 high school students in grades 8 to 12 from Mpumalanga (coal mining region) and Gauteng (non-coal mining region) provinces respectively were randomly selected for the study. A 12-item semi-structured self-administered questionnaire was used in eliciting information on environmental pollution. Data were analysed using descriptive statistics and unpaired t-tests. Participants age ranged from 13 years to 23 years (M = 16.1; SD = 1.75). Statistically significant differences in knowledge was reported between students from Mpumalanga and Gauteng provinces. Newspaper was ranked as the most important source of information on environmental pollution by students from both provinces.

Introduction

Over the past ages, our environment has been threatened by lots of problems. One of such problems is environmental pollution. Environmental pollution has been a major problem throughout the world since the onset of industrial age resulting in population growth and increased urbanization. This environmental pollution is

persistently and adversely affecting the quality of air, water supplies, plant and animal species and human beings. The problems caused by pollutants released from industries have resulted in problems such as climate change, global warming and acidrain all over the world.

People living around industries are reported to be more vulnerable to the effects of myriads of pollutants that

are released (Briggs, 2003). Fossil fuel activities such as coal mining and combustion have been reported as one of the causes of environmental pollution in many nations of the world. These have also resulted in various health problems (Horton, Mortensen, Iossifova, Wald & Burgess, 2013). In Africa particularly South Africa, the domestic sector especially coal burning from power stations for generating electricity is responsible for high levels of air pollution (Department of Environmental Affairs and Tourism [RSA], 2005). Similarly with respect to water pollution high rates of urbanization and industrialization are reported to have aggravated the threat to wetland resources (Coetzee, 1999).

In recognition of the environmental issues, for many years now efforts have been made by the international community looking for ways and means to address these problems (Brundtland, 1987). Despite all the major efforts to address environmental problems, it is reported that, the more they try, the less sustainable our world environment is becoming (Govindaswamy, 2006). It is therefore opined that a solution to environmental problems will require environmental education, proper understanding and knowledge of it which has to be deeply incorporated in the education system at all levels of education (Shukla, 2001 as cited by Shobeiri, Omidvar, & Prahallada, 2007). It is averred that if an acceptable level of global environmental sustainability is to be achieved, then there is an urgent need for every citizen to be empowered with essential knowledge and information about the environment (Govindaswamy, 2006). This will enable everyone to participate in making decisions and changing daily routines and lifestyles that leads to the degradation of the environment (Myers & Macnaghten, 1998)

Knowledge according to the Tbilisi Declarations is defined as to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of the environment and its associate problems (UNESCO-UNEP, 1978). A number of research studies have compared the levels of

environmental knowledge of students between two locations. They have also examined this from students' socio demographic perspective. For example, Mohanty & Sarmah (2012) compared the levels of environmental knowledge of Indian students from both urban and rural settlements with reference to their gender and locations. The authors reported statistically significant differences between students from these two locations (Mohanty & Sarmah, 2012).

Similarly, a comparative study of Canadian and Taiwanese Children revealed statistically significant differences in their levels of knowledge between these two countries. These authors also went further to determine the effect of socio demographic variables such as gender on five environmental variables including knowledge. It was reported that with respect to gender there were significant differences between the two groups in all the environmental variables investigated except knowledge. In order words, there were no significant gender differences between the two groups with respect to knowledge (Huang & Yore, 2003). It is to be noted that these authors examined five different environmental variables, only one of which (*knowledge*) was investigated in this present study.

Other than investigating students' environmental knowledge with respect to their socio demographic variables, researchers have also gone further to examine students' sources of environmental information. These sources of information could vary from people to the media, in the form of both print and electronic from country to country. For instance a comparative study of Canadian and Taiwanese children reported television as the most important source of environmental information for students from both countries (Huang and Yore, 2003).

A similar study conducted among Indian and Filipino students television reported that these students identified as the most important source while magazines and newspapers were secondary (Chapman & Sharma, 2001). These students further indicated that their parents

were poor sources of environmental information compared to any other (*ibid.*).

Proper and adequate knowledge of the environment and associated problems is very important. This is because it will help people in displaying positive attitude towards the environment and also take necessary actions in solving those problems and also to further protect the environment (Stevenson, Peterson, Bondell, Mertig & Moore, 2013). This is very important for the younger generations who will later inherit this present environment and that they will grow up be the next generation of leaders. It is averred in a study that students' positive attitudes towards the environment will be determined by the amount of knowledge they have acquired (Harun, Hock, & Othman, 2011).

Numerous studies conducted in different parts of the world have reported low levels of knowledge among students which affected their attitude towards the environment. (c.f., Alp, Ertepinar, Tekkaya, & Yilmaz; DeChano 2006; Hausbeck, Milbrath, & Enright, 1992; Lasso de la Vega, 2006; Makki, Abd-El-Khalick, & Boujaoude's, 2003). For instance, a study conducted in Nigeria reported a very low level of environmental knowledge among students (Ibrahim & Babayemi, 2010). These researchers bemoaned the fact that the mean knowledge score of the students was not just low but very low which affected their attitude towards the environment (Ibrahim & Babayemi, 2010). A related study conducted among Dutch secondary school students reported that "...students' knowledge about environmental problems was fragmentary and often incorrect ..." (Kuhlemeier, Van Den Bergh, & Lagerweij, 1999, p. 4).

In South Africa, not many studies have been conducted in this particular area of study. It is in the light of this that the authors of this present study intended to assess the levels of knowledge of high school students about environmental pollution from two South African provinces. The knowledge of high school students living in two different environmental

conditions (coal and non-coal mining areas) was specifically compared.

Materials and Methods

Study area

This comparative study was conducted in two locations. The first was Emalahleni a town in Mpumalanga province in the coal belt of South Africa. This town is dotted with coal mines and this product is generally hauled by trucks to harbours in the coast for export internationally. Also found in this town are coal-fired electricity generating power stations and foundries that burn coal for energy. The coal-fired power stations and foundries too, release noxious gases such as carbon monoxide, carbon dioxide and sulphur-dioxide. All these pollutants must affect the livelihood of people and school children living in the immediate vicinity. The second location was Soshanguve which is located in Gauteng Province. A distinguishing feature between the two sites is that the latter is in a non-coal mining area that comprised people and school children that do not experience daily pollution from the coal mines.

Participants

Participants from the coal mining environment were 423 while those from the non-coal mining environment were 330. The participants were from five schools in each area. From the mining area schools were selected because they were in the vicinity of the mines. On the other hand, the five schools from the non-coal mining environment were in the vicinity of a university in Gauteng. In each Province, one hundred questionnaires were administered to students in each of the five schools. In each Province, five hundred students were selected, one hundred students who were from grades eight to twelve in each of the schools. One hundred questionnaires were administered to students in each of the five schools.

Instruments and Procedures

Data was collected by means of a questionnaire made up of a combination of three parts. The first part requested participants to provide socio demographic information which included gender and school type. The second part *Knowledge* scale comprised 12 - items on a 5 point Likert type scale on environmental pollution issues. The third part was an open-ended question comprising ten items requesting the students to indicate their sources of information with regards to environmental pollution. In this part, students from both provinces were asked to write down and rate in terms of importance to them, the sources that they gathered information from about environmental pollution where the highest was 1 and lowest 10.

The questionnaire used in the second part was a 12 - item Likert type scale adapted from three other questionnaires (Yilmaz, Boone, & Anderson, 2004; Lasso de la Vega, 2006; Bas, Teksoz & Ertepinar 2011). Participants were requested to register their views on a five point scale anchored by 1 = Strongly Disagree and 5 = Strongly Agree. In South Africa students do not take environmental education as a subject. So the basis for choosing 12 items was because the

researcher looked into the secondary school curriculum for Grades 8 – 12 in subjects where environmental concepts are taught. These concepts were mentioned in subjects such as Life orientation as well as in Life and Natural Sciences. For instance, item statements contained concepts such as climate change, ozone layer depletion, global warming, and acid rain all taken from the curriculum. The questionnaires were administered to students with the help of some educators in the various schools. The same questionnaires were administered to students in the two provinces. This was intentional because the main purpose of this study was to compare the levels of knowledge of students between two provinces. The completed questionnaires were collected a week later. All analyses in this study were computed using IBM's SPSS © version 19.

Results*Socio Demographic Information*

There were 753 students, who were in Grades 8 to 12 from the two study sites. Their ages ranged from 13 years – 23 years ($M = 16.1$ years; $SD = 1.75$). A more detailed biographical data of the respondents is outlined in Table 1 below.

Table 1: Socio Demographic Information Depicting the Gender and School Type of Students from Mpumalanga (N = 423) and Gauteng (N =330)

Variable	Province			
	Mpumalanga		Gauteng	
	n	%	n	%
Gender				
Male	189	44.7	150	45.5
Female	234	55.3	180	54.5
School type				
Public	250	59.1	243	73.6
Private	173	40.9	87	26.4

Table 2: Means, Standard Deviations and t-tests of the Knowledge Variable with Respect to Students' Gender and School Type

Variable	School type	Province				t	df
		Mpumalanga	Gauteng				
		M	SD	M	SD		
Knowledge		48.8	5.8	31.4	6.1	40.08*	751
Knowledge	Males	43.3	5.4	31.93	6.3	17.93*	337
	Females	40.6	5.9	30.99	5.9	16.41*	412
Knowledge	Public	42.1	5.9	32.31	6.3	17.83*	491
	Private	41.4	5.6	28.92	4.4	18.14*	258

* $p < 0.0055$

Students' knowledge against gender and school type

Here t-tests were conducted from the same data sets. In order to eliminate a type 1 error, that is, (a greater chance of detecting what appears to be a significant finding in error), a Bonferroni adjustment was applied. So, if significance was set at a p value of .05 then this was adjusted to the value of .0055 was (.05/9 = .0055).

In comparing mean scores of students from the two Provinces, the unpaired t-test was performed to evaluate differences in the levels of Knowledge for the two provinces. The result showed statistically significant differences between the two provinces [$t_{\text{Knowledge}} (751) = 40.082, p = .0001$]. Here, students from Mpumalanga Province had higher levels of Knowledge than their counterparts in Gauteng Province (see Table 2).

In terms of gender, statistically significant differences were computed for both males [$t (337) = 17.93, p = 0.0001$] and females [$t (412) = 16.41, p = 0.0001$]. In both instances, it may be seen from Table 2 that students from Mpumalanga Province had significantly higher mean scores than those from Gauteng Province with respect to gender. Regarding the school

type statistically significant differences were computed for public schools [$t (491) = 17.833, p = 0.0001$] and private schools [$t (258) = 18.139, p = 0.0001$]. Also here, students from Mpumalanga Province had higher levels of Knowledge than their counterparts in Gauteng Province.

Sources of Environmental Information

Here, Students from both Provinces were asked to rank ten different sources of environmental information in the order of importance to them where the highest was 1 and lowest 10. It is observable from Table 3 that the rankings were virtually the same for six sources. Newspapers were reported to be the highest source of information for about a quarter of the students [Mpumalanga (24.4%); [Gauteng (28.8%)]. This was followed by school lessons at 19.84% and 21.55% respectively. Differences were reported only for four sources of information (in bold type on Table 3). These for example related to magazines and television. Sources such as Parents and friends were the least ranked sources by students from both Provinces.

Table 3: Rankings of Students' Sources of Environmental Information

Sources	Province			
	Mpumalanga		Gauteng	
	%	Ranking	%	Ranking
Newspapers	24.4	1	28.8	1
Magazines	7.7	4	7.6	3
Television	7.6	5	6.3	6
Radio	7.0	6	6.6	5
Internet	7.9	3	7.2	4
Books	6.3	10	5.1	10
Parents	6.5	7	5.7	7
Friends	6.3	9	5.6	9
Extra-Curricular Activities	6.4	8	5.7	8
School lessons	19.9	2	21.6	2

Discussion

This study sought to compare the knowledge of South African's high school students from two provinces about environmental pollution. This was examined with reference to their socio demographic variables which included gender and school type. Furthermore, students' sources of environmental information were determined.

As regards students' knowledge, the result revealed statistically significant differences between the two provinces. Here, students from Mpumalanga province had higher mean scores than their counterparts in Gauteng Province. This result agrees with comparative studies conducted among students between two locations in India (Sarmah & Mohanty, 2012) and China (Tiefenbacher, He, Hong & Hong 2011) where statistically significant differences were reported. On the other hand, a study between United States and Singapore students reported no significant differences (Benton, Raymond, Funkhouse & Ray, 1994). With respect to students' socio demographic variables, statistically significantly gender differences were established as also reported for comparative studies conducted in other countries (Benton, *et al.*, 1994; Huang & Yore, 2003).

However the study of Shobeiri, *et al.*, (2007) reported no significant differences for gender between two countries. With respects to

school type effect, statistically significant differences were reported in this study. The result of this present study is in agreement with the following studies where significant differences were also reported for school type in India (Shobeiri *et al.*, 2007) and Turkey (Tuncer, Ertepinar, Tekkaya & Sungur, 2005). However, a study conducted in Nigeria reported no significant differences for school type (Akomolafe, 2011).

Lastly, as regards students' sources of environmental information, newspapers were identified as most important by students in both Provinces. This finding is similar to that reported in Singapore where media (newspapers, magazines radio and television) were reported to be the highest (53.7%) source of environmental information for students which was followed by school [30.7%] (Ivy, Road, Lee, & Chuan, 1998).

It is reported in this present study that there were statistically significant differences with regards to all the variables tested between the two groups of students. In all, students from Mpumalanga province had higher mean scores than their counterparts in Gauteng province. Mpumalanga students' higher mean scores we assume might be due to the fact that they school and live in a polluted area and experience this problem as part of their daily lives. However, this pollution problem Mpumalanga students experience daily we feel might have motivated them to have demonstrated a higher level of

knowledge about environmental pollution than their counterparts in the non-polluted environment.

On the other hand, Gauteng students' significantly lower scores to the best of our knowledge might be due to the fact there are little or no environmental challenges in this particular area. This assumption can be supported with a study conducted in South Africa, which reported that those most directly affected by pollution were most likely see it as a problem than those who are not affected (Anderson *et al.*, 2007).

With respect to sources of environmental information, we report that among all the other sources, newspapers were rated as most importantly by students in both Provinces. We can deduce from this result that media has a very strong influence on students' environmental knowledge in both Provinces. The fact that newspapers were mostly rated instead of school lessons by students in both Provinces should be a cause for concern to the education community. This may be due to the fact that these environmental concepts are not taught effectively by teachers like they teach other concepts. It may be that they only concentrate on the concepts they are familiar and comfortable with and avoid or give less attention to those they do not know. It is therefore recommended that school lessons should be the primary source through which students get environmental information while other sources should be secondary.

Conclusion

It is very important for children in their teenage years to be prepared to know and made aware of environmental matters. This is because they will grow to be conscious and responsible adults who will take care of their environment. They will not only protect the environment now and in future, they will also pass the information and knowledge they acquire now to their families and friends and later passed on to the next generation. As we can see in the result that parents and friends were ranked as

least sources of environmental information.

Recommendations

Adequate knowledge about the environment and its associated problem is very important. We therefore recommend that proper trainings should be given to teachers that handle these environmental concepts in the classrooms. This will enable them to teach the concepts to their students effectively. In fact it is reported that teachers' understanding and basic knowledge about environmental concepts they teach in the classrooms goes a long way in affecting and influencing their students' knowledge about the concepts. If therefore teachers themselves are not environmentally literate, it will be impossible for environmentally literate students to be produced (Loubser, Swanepoel, and Chacko, 2001).

As it was mentioned earlier on that the selected schools in Mpumalanga Province are located around the mines and allied industries that emit pollutants which are assumed to affect the health of these children, it is therefore recommended that appropriate measures should be taken by the school management to safeguard their health and that of their teachers. It is also suggested that government can make policies that schools should not be cited close to coal mines and foundries and existing schools may be relocated far away from these industries.

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