

Full Length Research Paper

Environmental education as a tool for raising awareness about the damage caused by air pollution

Claudia Ramos de Rainho Ribeiro¹, Claudia Alessandra Fortes Aiub², Israel Felzenszwalb^{3*}

Laboratório de Mutagênese Ambiental, Instituto de Biologia Roberto Alcântara Gomes, Universidade do Estado do Rio de Janeiro, Av.28 de de, setembro 87 fds, 205551-030, Rio de Janeiro, Brazil.

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Environmental education is a tool that helps people tackle socioenvironmental problems and conflicts. It is designed to educate the population about the problems caused to human health and the planet. In the present work we analyzed how students understand the effects of atmospheric air pollution. We worked with elementary schoolchildren and a group of youths and adults, both from CIEP Leonel de Moura Brizola, a school in Rio de Janeiro. We told the younger children a story and asked them to make posters about the problems we had presented. We gave a seminar to the youths and adults, which was followed by a discussion on the damage caused by air pollution. The school teachers were also present at these activities. Our observations suggest that the pupils understood the subject well. Both groups were able to suggest ways of decreasing the emission of pollutants, but the elementary schoolchildren were more participative. We suggest that environmental education should be geared towards the interests of the group of students in question.

Keywords: Environmental education, air pollution, elementary school students, youth and adult education.

INTRODUCTION

Environmental education has been identified as one of the main ways of developing the capacity to deal with socioenvironmental problems and conflicts (Farias et al., 2007). It has started being used as a novel approach in different contexts, such as its incorporation into national education and environment public policies¹ and in a broader context of information flows, such as educational mediation (Carvalho, 2001).

Environmental education can give individuals experiences of the wider world and the opportunity to discuss environmental issues, the importance of the environment to health and life quality, and the relationships between the prevailing economic model and environmental degradation (Moradillo and Oki, 2004; Santos, 2006).

In Brazil, one of the tasks of formal education is to develop citizenship, with a curriculum that envisages contextualized, multidisciplinary teaching. In the first

nine years of education, citizenship-related topics (environment, ethics, cultural diversity, sexuality) are taught across disciplines. The environment is also included in the national curriculum parameters with the objective of “contributing towards developing informed citizens capable of taking decisions and actions in their socioenvironmental reality in a way that demonstrates commitment to life, the wellbeing of everyone and local and global society” (Ministerio de Educação, 1998). According to the curriculum guidelines for science education set by the Rio de Janeiro municipal department of education, environmental education is presented to pupils during the first years of primary education, with air pollution being prioritized in the sixth year, especially the relationship between air pollution and damage to human health and the environment (Secretaria Municipal de Educação, 2010).

Environmental education needs to be reinforced in response to the degradation of the environment and related social problems. In this complex context, teachers must be prepared to take on board new information, including environmental information, so

*Corresponding Author E-mail: uerj.felzen@gmail.com

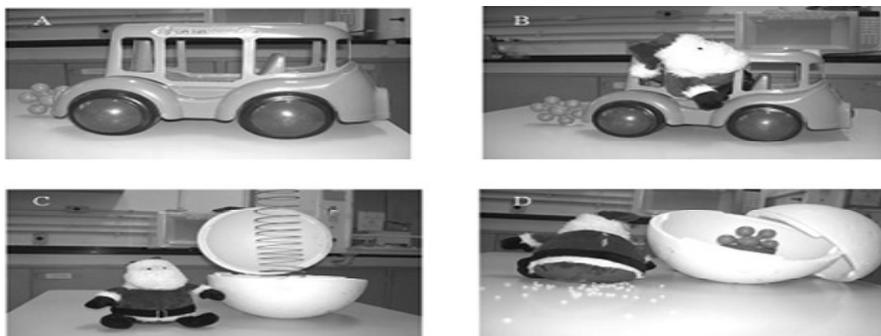


Figure 1. The materials below were used to represent the problem: a story about Santa Claus that needs to cross along a road with heavy traffic and pollution, was told to the students (A - plastic star, behind the car). A polystyrene puppet (B) was used in telling story – each polystyrene sphere represented the cells in his body, a big polystyrene ball (C), represented the enlarged cell, a spring (C) inside the ball represented the DNA, and a “star” linked to the DNA, the DNA lesions induced by the pollutants (D).

they can then pass on to the pupils what its implications are for the environment (Santos, 2006). Emphasis should be placed on building the capacity to perceive interdisciplinary relationships, resulting in a local and global education that highlights the environmental problems arising from disorganization and the degradation of the quality of life in different cities and regions (Jacobi, 2003; Santos, 2006).

The Environmental Mutagenesis Laboratory (Laboratório de Mutagênese Ambiental, LABMUT) at the Roberto Alcântara Gomes Institute of Biology, State University of Rio de Janeiro (Rede UERJ, 2010), has a project entitled the “Study of Mutagenic Agents in Atmospheric Air in Rebouças tunnel and Avenida Brasil”, funded by Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ) and published in notices # 23/2008 and FAPERJ # 12/2009, which has mediated the communication of information on atmospheric pollution. The overall goal of this project is to monitor the air quality in Rebouças tunnel and on Avenida Brasil (Rio de Janeiro), assessing its clastogenicity and genotoxicity by means of cytogenetic tests using *Tradescantia pallida* var. *purpurea*. One of its specific aims is to develop environmental education initiatives with students from CIEP Leonel de Moura Brizola, a public school in Rio de Janeiro (Avenida Brasil, 8666, Ramos, Rio de Janeiro).

Avenida Brasil is a very busy multiple-lane highway that receives a major influx of pollutants because of the heavy traffic (average of 150,000 vehicles a day). It is 58 km long and provides an important connection between the west zone and downtown area of the city (CET Rio, 2008). Along this highway, there are many schools, hospitals and houses. CIEP Leonel de Moura Brizola is one such school. It is run by the Rio de Janeiro local authority and its pupils study there full-time, which is not the norm in Brazil, where pupils either study in the morning or the afternoon. It has about 500 pupils studying the first nine years of formal education and classes of youths and adults (Secretaria Municipal de

Educação, R.J., 2010).

In this study, we aimed to raise the awareness of the students from CIEP Leonel de Moura Brizola as to the harm caused to human health and the environment by air pollution, and also communicate the work done in laboratory research and build bridges between it and the school classroom.

METHOD

In order to communicate and draw ties between the research and the school environment, we took a large-volume sampler (AGV MP 2, 5) and a plant, *Tradescantia pallida* var. *purpurea*, used to monitor mutagenic pollutants, to the school to show to the primary and youth/adult students.

The primary school pupils that took part in the activity were aged 7 to 10. They were split into six groups of 30 and the activity with each group lasted 90 minutes.

We told a story we had written and dramatized with the aim of expounding the concept of air pollution and relating it to the harm caused to human health. The presentation was split into three stages: 1 – Motivating Activity – we asked the students about the air pollution around the school and whether they or their relatives ever had respiratory problems; 2 – Presentation of the Problem – a story was told that presented a character who had to go along a road with heavy traffic every day, and who after some time started to develop health problems (respiratory, skin and eye complaints, and damage to genetic material). A doll made of polystyrene was used to tell the story – each polystyrene sphere represented the cells in his body, a big polystyrene ball represented the enlarged cell, a spring inside the ball represented the DNA, and a “star” represented the pollutants – as well as a toy car, which represented the moving vehicle (Figure 1); 3 – Closing Activity – after the story, we showed the pupils an optical microscope so they could see real cells, and then we asked them to



Figure 2. Pictures from the young students after the story: (A) observing the mutations present in the pollen from the plants living near the high traffic avenues, (B-D) coloring in accordance with the presented problem, (E-F) presenting solutions to decrease the pollutants in the surrounded area.

make posters about the topic, including recommendations for addressing the problem.

For the youths and adults (60 in all, split into five groups), lectures were given on the harm caused by atmospheric pollution, emphasizing the respiratory diseases and mutations that can be induced by exposure to them. After the presentation, a debate was conducted involving the students and their teachers.

RESULTS AND DISCUSSION

In towns and cities, atmospheric air quality is often compromised by different factors that have a direct impact on their inhabitants' quality of life. One of the factors that can significantly compromise air quality in big cities is the emission of gases by vehicle exhausts, which contain pollutants such as sulfur dioxide, carbon monoxide, nitrogen oxide and different hydrocarbons. This last group of pollutants becomes effective carcinogens and/or mutagenic agents after metabolic transformation (Lopes and Andrade, 1996).

The primary school pupils were engaged and enthusiastic throughout the activity, and demonstrated a high level of interaction with our team of educators. When they were asked questions, around 70% were willing to answer, raising their hands and asking for a chance to speak, which is a good measure of how motivated they were by the activity. According to Bareicha (2006), this is the time when knowledge of the world surrounding the students' lives is acquired and merges with them. The results obtained are illustrated in Figure 2.

Figures 2 C and 2D demonstrate that the pupils understood the information presented to them. Figures 2 E and 2 F show that the pupils managed to think of some ways of reducing the emission of pollutants, such as the idea of using other forms of transport like bicycles and skateboards, and they also drew trees, showing that they made a connection between reforestation and clean air. The pupils did not do drawings of cells, DNA or lungs, which may indicate that their primary concern was about the impacts air pollution had on their environment, not considering

“man” part of the environment.

The groups of youths and adults did not interact much with the team of educators. When they did ask questions, they were about the direct, immediate impacts of exposure to air pollution and how city- and country-dwelling people were exposed to different levels of pollution. The teachers actively asked questions and encouraged the students to ask their own questions so they would understand the topic better.

The presentation of the air sampler and the plants of the species *Tradescantia pallida* var. *purpurea* mainly interested the primary school pupils. They asked questions like: “How does the equipment work?”, “How are the plants used in the study?” and expressed ideas like “Avenida Brasil is polluted!” The youths and adults did not participate in this way.

This study was the outcome of our first contact with the students from the school in question. The inappropriateness of the motivation activity may have been responsible for the limited participation on the part of the youths and adults. New approaches will be studied and tested in the future that is geared specifically towards these older students.

CONCLUDING REMARKS

Environmental education is fundamental for raising awareness and preparing the citizens of the future. It must be given consistently throughout the curriculum and cross disciplinary boundaries; it cannot be effective if given only on an ad hoc basis. The educational project started at CIEP Leonel de Moura Brizola School will be carried on in the future, with new activities designed to take the world of laboratory research into the school classroom.

The environmental education activity undertaken was of great value, since the aim of raising the pupils' awareness was attained. The depiction of the information in the form of drawings, especially by the primary school children, as well as their spoken comments and questions, showed the beginnings of a critical awareness of the environmental problem addressed.

The presentation of the problems caused by air pollution and the opportunity to have contact with activities from the scientific world offered a new

perspective for the students on the issue of air pollution.

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