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Developing Environmental and Scientific Education in School

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Abstract. Initiatives involving notions of environmental education and scientific education were stimulated in a state secondary school (Niterói, Rio de Janeiro, Brazil), using practical and dynamic activities undertaken with pupils aged from 15 to 17 years old during an entire academic year. Each activity had a specific organization, with its own goals, targets, and a schedule for completing tasks, as well as staggered participation by the pupils involved. The variety of activities allowed pupils to be assigned according to their specific skills and interests. The aim of the project was to foster commitment in pupils in their day-to-day performance of activities, thereby helping create habits in accordance with an environmental and scientific education. The implementation of this project afforded the pupils the opportunity to plan actions which would allow ideas to be put into practice, turning them into reality. As well as teaching them subject matter from the curriculum, the actions undertaken also enable the teaching of auxiliary strategies to promote better eating habits and minimize the amount of organic waste discarded. Cultivating vegetable gardens in crates only requires small spaces, and raw vegetable peelings thrown in the bin were used to create organic compost for the garden itself. Activities such as these contribute towards making the school not just a place for formal education, but also a centre for teaching and disseminating measures that could yield immediate results in terms of raising the quality of life of the school community.

Keywords. Environmental education, scientific education, formal education, vegetable garden, composting.

1 Introduction

In Brazil, law no. 9.795/99 (Brazil, 1999) makes provisions for Environmental Education, by establishing the National Environmental Education Policy; according to which,

Article 1: Environmental education is deemed to be the processes whereby an individual and the community build social values, knowledge, training, attitudes and skills geared towards preserving the environment, a resource for communal use by the population, which is vital to a healthy quality of life and the sustainability thereof.

Article 2: Environmental education is an essential and permanent component of national education, and should be coordinated to form part of all levels and modalities of the education process, both formally and informally.

From this standpoint, developing environmental education in schools assumes that practical and dynamic activities will

be undertaken to make pupils proactive participants responsible for their own actions.

Within the context of scientific education, Santos (2007) believes that thoughts in this field “*evoke school processes which seek ways of contextualising scientific knowledge where pupils incorporate it as a cultural resource which is implemented in their social practice*”. Zancan (2000) discusses the need for scientific education to be implemented in schools so that youngsters are stimulated to work as a team and to learn for themselves how to solve problems, have confidence in their own skills, and develop personal integrity, initiative and an ability to make innovations.

The “Cultivate Project” was developed by the Biology department at Colégio Pedro II Campus of Niterói (Rio de Janeiro), a state-owned federal education institution in Brazil. This project sought to integrate perspectives from environmental education and scientific education via practical and collaborative activities undertaken by the pupils themselves. According to Araújo (2006), the pedagogical strategy of projects is vital to transversal education, since it enables a certain

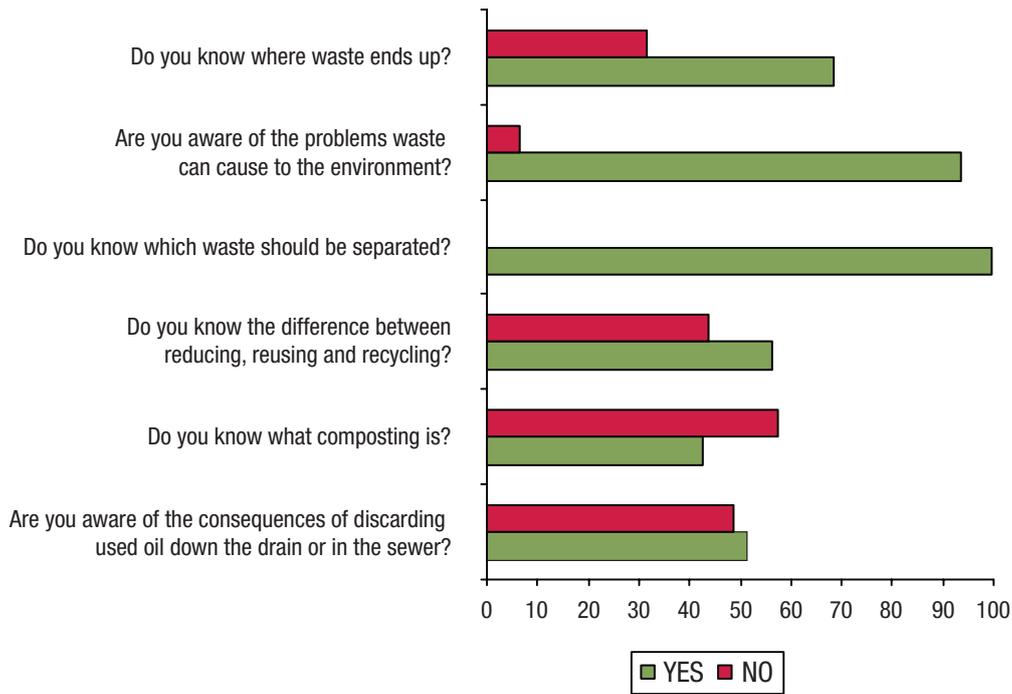


Figure 1. Graph showing the percentage of “Yes” and “No” answers to questions aimed at determining what pupils know about issues relating to environmental education.

subject to be taught involving the concomitant participation of pupils from different grades and, as stated by Perrenoud (1999), it encourages the cognitive skills of those involved.

According to Jacobi (1997), since the majority of the Brazilian population lives in cities, it is notable that living conditions are increasingly deteriorating, reflecting an environmental crisis, which leads us to reflect on the need to change our way of thinking and act in line with the environmental issue, with a modern vision. Schools play a crucial role in this process of change, since in educated societies, schools are responsible for formally educating future citizens. The integration of the principles of environmental education and scientific education was stimulated by the development of biology contents via practical activities adopted in pupils’ daily lives. This project sought to be an incentive for pupils to perform actions every day aimed at improving the quality of life, both for themselves as individuals and for the wider society. Cultivating vegetable gardens in crates, depending on the context of the school community, could provide an alternative for obtaining healthy foods, thereby contributing towards improving the health of pupils’ families. This strategy for cultivating vegetables, in conjunction with the production of compost using raw vegetable peelings which would normally be discarded, is in line with the assumptions of environmental education and scientific education and, if added to school studies, can be replicated by the pupils themselves, resulting in social and environmental gains.

2 Methodology

The Cultivate Project commenced with a questionnaire for all the pupils ($n = 443$) at the Colégio Pedro II–Unidade Niterói

in order to diagnose their habits and attitudes towards issues specific to environmental education.

Second grade pupils were chosen to participate systematically in the project activities as per the contents of that grade’s Biology curriculum, and according to their age range. It was felt that these pupils would be more prepared to perform the tasks envisaged. The Cultivate Project activities therefore formed part of the pedagogical planning of 2nd grade Biology at Niterói’s Colégio Pedro II. All six 2nd grade classes took part in the project, with an average of 27 pupils per class, totalling 164 pupils aged between 15 and 17 years old, and were involved in the work for one academic year (from February to November in the Southern hemisphere). First and 3rd grade pupils took part on a voluntary basis; therefore, only some pupils from these grades were involved in performing project activities. The activities were organized and led by four teachers from the school.

The 2nd year pupils were divided into groups, who were given the responsibility of sowing a vegetable garden in wooden crates and arranging the composting. It was decided to sow vegetables in wooden crates in order to facilitate the maintenance of the vegetable garden by the pupil working groups. Thus, each group was in charge of cultivating one crate of vegetables.

The more fragile vegetables were sown in egg boxes, and the shoots were later transplanted to the crates, where plant development proceeded.

After the first planting, the groups of pupils performed research into the biological classification, morphological description, geographical origin and nutritional value of the tubers and vegetables cultivated. Files were produced defining the characteristics of the vegetables grown, which were

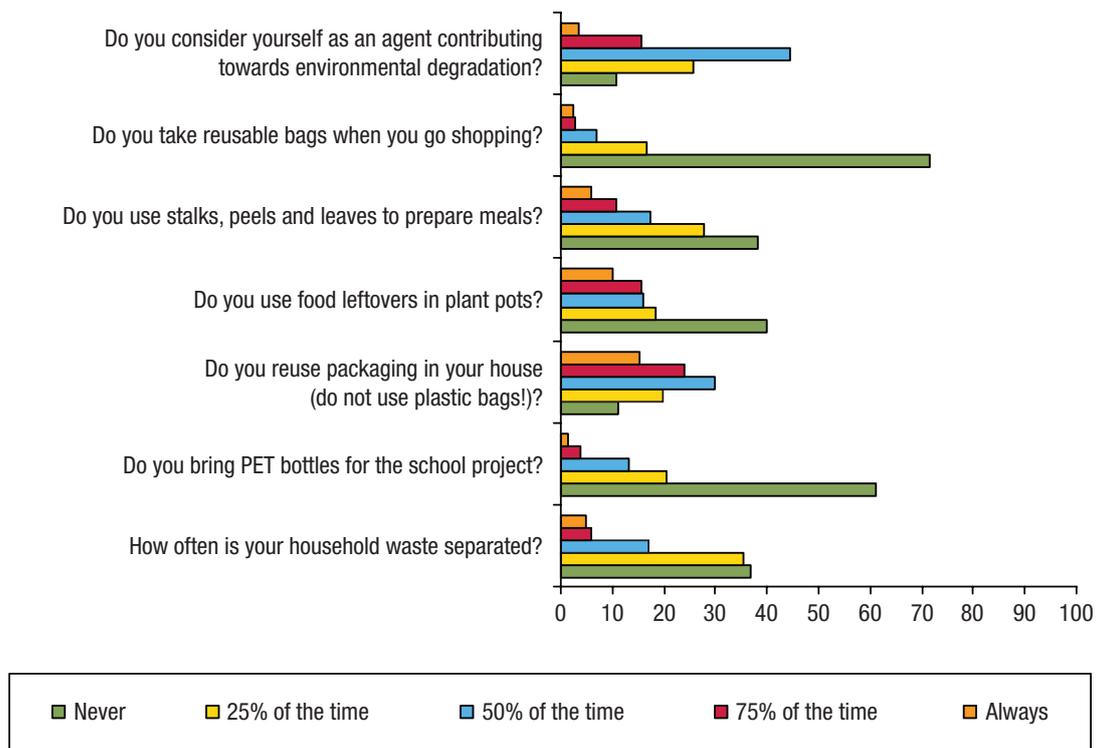


Figure 2. Graph showing how often attitudes relating to issues specific to environmental education are used.issues relating to environmental education.

then used to monitor the vegetable garden. New seeds were sown every two weeks, in order to maintain the productivity of the vegetable garden throughout the entire academic year. All weekly activities, including watering, selection and transplanting of shoots to the crates, weeding (removing weeds growing near the cultivated plants in each crate), earthing up (periodically placing more earth close to the roots of the growing vegetables), thinning (manual removal of dead leaves), and checking for and controlling pests, were all carried out by the pupils. Arranged into groups, the pupils shared the daily tasks for taking care of the vegetable garden and composting, and also drew up reports which were periodically analyzed by the teachers in charge.

Dry leaves, grass trimmings and twigs removed from the school garden were placed in composting crates, also maintained by the pupils. Pupils also brought organic leftovers (peels, leaves and stalks) from home to add to this slowly-decomposing material. The resulting compost was used in the organic vegetable garden crates to improve the fertility of the soil.

Activities were also undertaken to make use of parts of vegetables usually discarded—such as the stalks, leaves and peels of some legumes and fruits—in cooking. Foods such as cakes, desserts and quiches were prepared using these vegetable parts, which the pupils tasted during their afternoon break. The recipes for these foods were disseminated among the pupils participating in the project.

Voluntary 1st and 3rd grade pupils took part by organizing and collecting used PET bottles and cooking oil, brought to school by the school community itself. The volunteers received and

stored this material in suitable sites. PET bottles were sent to cooperatives of collectors of recyclable material, and the cooking oil was taken to a waste oil recycling company, which exchanged the oil collected for cleaning products.

Throughout the work, the 2nd year pupils were assessed on how well they completed their tasks and produced activity reports, and records were kept of the positive and negative aspects of the activities. This educational assessment formed part of the Biology score of 2nd year pupils.

3 Results and discussion

The results of the questionnaires (n= 443), quantifying the knowledge (Figure 1) and habits (Figure 2) of pupils from all three grades, showed a discrepancy between “what pupils know” and “what pupils do” with respect to issues relating specifically to environmental education.

With regards to knowledge, all pupils stated that they know waste should be separated, although almost 40% affirmed that they never separate waste at home and fewer than 12% of pupils said that they do this 75% of the time or more often. Neto, Moraes and Fernandes (1998) and other authors discuss how educational actions can encourage the learning of new knowledge without necessarily leading to changes in behavior and attitude. If the aim of education is to change pupils’ habits and raise awareness, pedagogical plans must be designed to stimulate and encourage the development of correct behavior and attitudes, and pupils therefore need to be given opportunities to practice and perform actions which they can incorporate into their daily lives, which will depend



Figure 3. Pupils cultivate the school vegetable garden in crates and employees participate in the harvest.

on how they accept the relevance of such actions to their lives. Despite the contradiction identified by the questionnaire, the pupils did not readily see themselves as contributing towards environmental degradation. This probably relates to the difficulty in changing habits, since usually we only change if we acknowledge the need to change our attitudes, unless we are forced to do so. These findings also suggest that individuals also find it difficult to identify themselves as agents of environmental degradation. There is still resistance towards recognizing the importance of individual actions in achieving collective results, thereby contributing towards improving environmental conditions. For Jacobi (1997), it is necessary to create new attitudes and behavior given our society's consumption and to stimulate changing individual and collective values. This is reinforced by Sorrentino (1998), who sees the major challenges facing environmental educators as, on one hand, restoring and developing values and behavior (trust, mutual respect, responsibility, commitment, solidarity and initiative), and on the other hand, stimulating an overall and critical vision of environmental issues and promoting an interdisciplinary focus on restoring and building knowledge.

Environmental education, in the context of formal education, should enable the development of attitudes which are likely to be adopted by pupils, demonstrating the importance of collective participation so that these actions bring forth positive consequences for the environment. It is easier to form habits in childhood and adolescence than later in life; therefore, schools should stimulate activities which create attitudes which are compatible with the premises of environmental education. With adequate planning and support from teachers, the aims of the biology curriculum were reconciled with the behavioral aims of environmental education, promoting scientific education as proposed by Santos (2007).

Performing activities in the areas outside of the classrooms allowed pupils to work spontaneously during breaks. Generally in groups, or in collaboration with each other,

the pupils monitored the development of the vegetables (Figure 3–A, B) and took part in harvesting, together with employees from different sectors of the school's organization (Figure 3–C).

The physical space outside the school building was modified, thus improving the atmosphere for the pupils (Figure 4) and demonstrating the feasibility of using urban spaces to grow vegetables practically and economically.

The composting activities allowed a fruitful discussion about the issue of urban waste, by promoting considerations about how each citizen can contribute towards the mitigation of this problem with the separation of the domestic waste and the possibility of recycling different materials in their own homes.

The students were receptive to trying out food prepared from parts of vegetables that are usually discarded. At first, they resisted trying the dishes, but after the first few tastings the group began to like these new foods. Some participants even searched for new recipes and brought them to be tried at school events, such as environment week (taking place in June) and cultivation week (in October). The activity reports contain accounts of pupils whose families also started making use of the parts of vegetables that they used to discard, to make soups and follow some of the recipes tried in the school.

The "Cultivate Project" activities fostered different relationships with the contents of the Biology curriculum. Subjects such as ecological relations, systematics, plant physiology, food chains and recycling of material were discussed by observing the living creatures in the vegetable garden and in the composting area. In this way, the planned curriculum became more pleasant for the pupils, since their participation in the learning process took them beyond the classroom and was related to the practical activities carried out in collaboration with other pupils. Generally speaking, this allows pupils to develop their abilities to gather, select, sort, analyze and interpret information (Hernandez, 1997).



A



B

Figure 4. The area outside the school building modified by establishing the school vegetable garden. Space before setting up the crate garden (A), and the same space occupied by cultivation (B).

Declarations from pupils who participated in the Cultivate Project indicated an interest in and awareness of the need for actions within this context. Examples are given as follows:

“It is very rare to see mobilizations such as this one in urban areas, where there is waste and pollution and where manufactured products are used. Developing this project with pupils is very important, because in the future we will be adults who are aware of what we do with the environment.”

“With the expansion of the project, the school environment (area) will be much more pleasant and people will see the results and be motivated to plant vegetables in their homes and encourage others to do the same, enriching the environment.”

“The aim of the Cultivate Project is for us to do practical work on the subjects studied in the classroom.”

“The aim of the Cultivate Project is to produce the school’s own vegetable garden, so that the pupils can eat healthily. The subject of Biology is brought closer to pupils through this project, since it makes the class more practical and therefore brings us into contact with the subject studied.”

“By bringing PET bottles into school and collecting organic waste, we help to avoid wasting materials which can be reused.”

“This project is important to raise people’s awareness of their responsibility to look after the environment and show that even in an urban area it is possible to “cultivate”.”

These declarations reinforce the ideas espoused by Reigota (1998) regarding the importance of implementing environmental education by raising pupils’ awareness, changing their behavior and developing their skills and ability to assess and participate.

According to Pelicioni (1998), “*environmental education aims to raise the citizens’ awareness and to become a philosophy of life, leading to the adoption of environmentally appropriate behavior; it must be transformed into action.*”

4 Final considerations

With this project, the school commenced work acting also as a centre not only as a forum for debate on environmental issues, but also for promoting more conscious actions which can contribute towards improving the quality of life in urban areas. Cultivating a vegetable garden in crates meets the need to implement pedagogical projects based on scientific education and contributes towards disseminating the idea of making use of small spaces to produce healthier food for society. These activities show the school extending its spheres of action and divulging scientific knowledge in a practical and proactive manner to the benefit of society.

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