

Promoting citizenship in schools through a European environmental study and using new technologies: The PEOPLE-Citizenship project

Tânia FONSECA 1, Pedro FERRAZ DE ABREU 2, Domingos COSTA 3, Conceição LIQUÍTO 4, Isabel MEDINA 5

1Teacher, ES Açores, CITIDEP, tania_fonseca@hotmail.com

2DUSP PhD Fellow, MIT, CITIDEP, pfa@mit.edu

3Teacher, ESE-IPVC, dbelo@ese.ipvc.pt

4Teacher,EB1 Monserrate, cfl@vodafone.pt

5Faculty,U. Catolica, CITIDEP, isabelmedina@netcabo.pt

Abstract:

The process of decision-making about scientific issues in social contexts involves a critical examination of the relevant scientific knowledge. When citizens are required to take an active role in social life with respect to science, they are expected to be scientific literates.

However, scientific literacy process involves explicit methodologies in order to facilitate a compromise between learning and action and between education and society.

The project here presented, PEOPLE-Citizenship, is a large educational project promoting citizenship in schools through a European environmental (EU) study about benzene air pollution. Its purpose was to promote an integrated approach to science, technology and social education, raising the awareness of citizens about air quality and the impact of personal behavior on pollution.

It enhanced the participation on scientific data gathering and promoted new forms of public participation in the discussion about science, human behaviour and social responsibility. The project led policy makers in EU to recognize the central role of school in such projects were it is essential to promote society changes, and that path to learning citizenship is to improve the capacities of students to both understand and criticize the challenge of techno-scientific advances.

INTRODUCTION

To teach democracy through chemistry and environment to young students, a network was created between students, teachers, scientists and experts in air quality, CITIDEP developed a large educational project here presented named PEOPLE-Citizenship. Supported by the European Joint Research Center and by PEOPLE-team that made the environmental study about benzene air pollution, this educational project brought investigation to secondary and elementary Portuguese schools, involving them in a real-world environmental issue.

The PEOPLE (Population Exposure to Air Pollutants in Europe) project is an assessment of outdoor, indoor and exposure levels of/to air pollutants in European capitals.

This article proposes to be a reflection how the project was developed in the perspective of teachers from high-school, teachers from rural elementary schools and a scientist involved on the project. We will try to demonstrate the reasons, dimension and the effects of developing the critical thinking and decision-making skills through interacting a real scientific study and students.

WHY WE DID IT

The exercise of citizenship involves a conciseness' and constructive civic intervention, related with the educative process that the citizen lives among their life, not only during their youth.

Starting from the idea that students are forced to spend most of their youth time in the school atmosphere, emerge the necessity to understand how much schools are important in this field; we must briefly characterize several dimensions in contemporary schools:

- Curriculum
- Methodologies
- Relationship between learning and action
- Relationship between education and society

The curriculum must privilege learning based on the development of competence to reflect, observe, experiment, inquire, relate and decide.

It's important to approach scientific research and scientific education together, not only because children and young people have a spontaneous curiosity about scientific subjects that we must stimulate, but also because science itself can be participated by almost everyone and they younger are, indeed, the best partners of scientists.

Therefore, schools are capable to promote activities based on problem solving and hands on, Learning Citizenship by practice and Participative Science, it's contributing to a dynamic and constructive environment that will empower their citizens and improve individual decision-making process.

The scientific data shows that some critical situations detected are the consequences of bad environmental policies.

PEOPLE project proposes a roadmap to solve some of those problems through the application of scientific knowledge to urban planning.

However, public participation in democratic decisions about those policies demands a higher level of environmental education in the population. When citizens are required to take an active role in social life with respect to science, they are demanded to be scientific literates.

But how can they become literates? And how can the relevant information be communicated, concisely and clearly, to the population, in order to promote citizenship and to allow their public participation in those policies?

Besides, a school not divorced from scientific investigation on the must integrate harmoniously social and cognitive skills, and scientific community can help this purpose.

The role of sciences education is very important and should be taken in a perspective of relating the study of sciences, technology and society problems not only by rhetorical approach.

Emphasising the role of school and sciences education, we are capable to promote the reflective exercise and improve the critical thinking competences developing sciences projects that go beyond the school walls and penetrates the scientific world.

With PEOPLE's science-technology-society approach, we:

- Promoted environmental education and citizenship
- Promoted the construction of the knowledge not memorising and the reproduction of theories.
- Promoted investigative ways to learn instead of the written concepts.
- Privileged real contexts using their scientific knowledge instead imaginary contexts.
- Propitiated the learning by doing.
- Propitiated the leaning of the meaning of concepts.
- Propitiated multiple representations of the same reality.
- Stimulated a collaborative and constructive knowledge thought social negotiation instead of individual competitiveness to a grade.
- Privileged a self regulated learning and self-evaluation.
- Imputed the students's responsibility on their own learning process.
- Promoted learning with and to creativity.
- Promoted learning with and to liberty.
- Promoted the reflection about the need of changing urban policies
- Promoted the awareness of citizens about air quality
- Promoted the reflection of the impact of personal behaviour on pollution

WHAT WE DID:

The Activities where:

- Activity 1: Research on Benzene as a pollutant. (Before 15/ October)

This activity consisted of research performed by the students on Benzene as a pollutant. The students performed general research over this topic, using the Internet as its primary research, complimented by several articles and/or a bibliography provided by their teachers.

The primary objective of this activity was to raise the awareness of the dangers associated with the use of products containing benzene and the need of stronger legislation to regulate the quantities that a human being can be exposed to without endangering their health and a lesson on the quality of the air that we breathe and its importance.

- Activity 2: Learning Session (15/October)

The main objective of this activity was an interchange between environmental specialists and the students involved in the project. It was held in the format of a videoconference to allow all interested parties to take active participation in the discussion with their questions and opinions.

- Activity 3: Environmental game: “Learn with the environment, playing!” (January)

This activity was a learning exercise for elementary school students, developed and implemented by high-school students in order to teach the younger kids about environmental issues in the form of a game.

The game consisted of a board with various “houses”, some data and cards with questions about the air pollution and the environmental issues.

The game was conceived during class time and allowed the older students a greater level of involvement in their own learning as well as responsibility for the understanding of others.

- Activity 4: Particles on the paper/Elastics and pollution (10 February)

This activity was a learning exercise about sciences. The 7^o and 8^o grade students had to choose a place to put the paper and the elastics to study the level of pollution that existed on their school and houses.

From a simple experience of observing if the papers were dirty and the elastics were cut, they could explain way and discuss with the colleagues about their assumptions.

- Activity 5: Videoconference and broadcasting II with chat for students from the 2nd and 3rd grade (18 March)

This activity was conducted with elementary school students in the first grade in the form of a dialogue between students in various schools and experts involved in the project. The activity was divided into two parts. The first part was learning sessions in the form of a videoconference with Viana do Castelo and transmission over the Internet.

The second part was a demonstration of work developed by the students and an interactive game between the students that were in booth schools and the others students by “chat” over the Internet. They were approximately 30 schools.

This activity gave the opportunity to break not only the walls between students and sciences makers but also the distance between the Portuguese students. It was possible to integrate students from isolated regions of the country, contributing to

- Activity 6: The air exists, although we, can't see it” (April)

This experimental activity was conducted with students in the 1st, 2nd and third grades of elementary school and monitored by the high school students. It consisted of an experimental activity in the chemistry lab in the schools with the objective of demonstrating the primary levels of scientific teaching and allowing them to experiment observe and reflect over an experimental work.

- Activity 7: Speaker about air-quality and tobacco & Role-Play Summit “PEOPLE’S Future”. (12 June)

A Clinical Psychologist, Carla Carina Quaresma, gave this presentation with 10th and 12th grade students involved in the PEOPLE project. The aim was to prevent and teach about the problems that tobacco brings to our health, relating the knowledge about Benzene that they had been studying with the rest common problems.

After the presentation, another activity took place: Summit “PEOPLE’S Future” This activity, involved the participation of high-school students in a role-playing activity dealing with the environmental issues addressed with the PEOPLE project. The objectives were to describe, demonstrate and reflect on their knowledge of the social and scientific implications of science and represent it in a synthetic work over this activity.

The activity involved the use of real data collected by the monitors used in the PEOPLE project. The students in the role-play had chosen a real player in the debate over the environment and, using the knowledge that they had acquired of that entity, debated the social and environmental issues from the perspective of their character. The students’ teachers were responsible for assisting the students with documentation and articles as informational resources covering their chosen character. The role-play had also a group of observers and a group of evaluators.

HOW WE DID IT

During 9 months, a network of students, teachers and PEOPLE experts in air quality, engaged together in the research, at multiple levels of learning.

The pilot schools with students between 6 and 16, which participated directly in PEOPLE-citizenship project cooperated with scientist’s team gathering the data and participated in the discussion of the results.

The PEOPLE project aims to support health impact assessment. An important facet of the project is awareness-raising campaigns in participating cities organised with the involvement of citizens, scientists, decision makers and the media. The study focuses on carcinogenic pollutants presenting long-term effects on human health. Benzene has been selected as a first indicator to be measured with priority in the pilot phase of the project.

This project brought to the classroom the air pollution by BENZENE issues and was integrated in the high-school curriculum of chemistry and the pollutions issues on the elementary school curriculum for the first time in Europe.

This network enhanced the participation on scientific data gathering and promoted new forms of public participation in the discussion about science, human behaviour and social responsibility.

The network:

PEOPLE (Population Exposure to Air Pollutants in Europe):

- Joint Research Center – European Commission)
- Institute for the Consumer, Presidency of the Council of Ministers [Lisbon Project Coordination],
- Regional Administration of Environment and Land Use Planning for Lisbon and Tagus Valley,
- Ministry of Cities, Land Use Planning and Environment,
- Department of Environmental Sciences and Engineering College of Science and Technology, New University of Lisbon,
- Public Health Regional Center for Lisbon and Tagus Valley, Ministry of Health,

- *Quercus* — National Association for the Conservation of Nature,
- City Department for Environment and Green Spaces, Lisbon Municipality,
- CITIDEP – Research Center on Information Technology and Participatory Democracy

Schools:

- High School Pedro Nunes, Lisboa
- Colégio São João de Brito, Lisboa
- High School Camões, Lisboa
- High School de Sta. Maria Maior, Viana do Castelo
- Elementary School n.º 29, Lisboa
- Elementary School 2+3 de Miraflores
- Viana do Castelo Superior School of Education I.P.V.C
- Elementary School 1 de Monserrate, Viana do Castelo
- Elementary School 1 Eirado-Eiras, Viana do Castelo

Others:

- Viana do Castelo Superior School of Education
- High School Department-Ministry of Education
- UARTE – Ministry of Science and Technology (Internet in Schools)

The project was developed in several activities during a school year each one with an aim.

The Benzene issues were brought to the school although it could not be learned easily.

The first step was to think how we would synchronize the PEOPLE timetable with the student's year school, than the methodologies to apply. A school was responsible to organize and coordinate the network between teachers and scientist.

Teachers of different schools and environment specialist draw the activities plan after some meetings.

In high school:

10º grade students

Their teachers presented the project to all students. In this presentation, students were elucidated about the aim of the project, why they were doing it, with whom they would work, the activities they would be asked to develop and how they were going to be evaluated.

The methodologies adopted included the integration of benzene issues in to their chemical classes. In each class a problem had to be solved using resources given by their teachers. These resources could be the Internet, literature, films, public information or their own information on the subject. These teaching techniques used included individual and group projects, which were determined by students and teachers for each step.

Common environment problems:

- When 10º grade students were asked to think about some environmental issues of their concern, air pollution was not one of them. They presented problems related to recycle, ozone layer, the garbage their families did, but they didn't talk a lot about the use of cars instead of walking, riding a bike or skating.

A chemical called benzene:

- It was asked to form groups and search for chemical danger products, one of them, the BENZENE. Documentation was given on the known and potential effects of air pollution on human health, weather conditions, and biosphere. In their research, they pointed practical applications of benzene, the kind of chemical it is and the hazards associated.

After this research, they started to be much more touched to the problematic: the air pollution provoked by the use of benzene.

Students were perplexed by the use of benzene in tobacco and gasoline. Practical applications of this information were discussed and standards of air quality were discussed. After some arguments between them, they started thinking about the economical consequences and the social problems involved.

They wrote a report and presented to younger high school students.

Asking scientists:

- After this report, they established the first contact with environment specialists. Arguments were prepared by students to refute some environment policies. They were excited to face them, and clear up their questions and worries.

This took place, in the first videoconference of the project.

Helping scientist:

- A week after the first contact, the schools resaved the samplers.

They had the chance to do what they had learnt on the session with scientists. They were the ones putting the samplers in their schools.

One of the students' used one all day.

How to consciousness young people:

- Following the gathering data with a scientific team, 10^o grade students were asked to think how they could help to pass the message to the elementary students involved on the project.

They presented strategies, the disadvantages and the advantages of each strategy, the effort involved, if it would work or not, etc. After some debates and a lot of argumentation, at the end of the week, they made a purpose. Students agreed with an environmental game, because it would be the best way to get to a child.

They designed the game, asked for the material and they putted their hands one.

High school students in some elementary schools in the country implemented this activity, monitored the youngest, by playing the game and explaining the scientific-social issues related.

Teaching air chemistry to young students

After the first contact with young people, high school students prepared a day in their schools to teach some chemistry.

They study elementary chemistry and prepared some "hands-on" activities that would help the young people to understand the existences of the air. These activities helped destroying some of the misconceptions in sciences, improving their scientific knowledge.

Discussing the results:

Before the role-play activity, students had to reflect who the social intervenient were in this kind of social issues. They decide and prepared the characterization of each one.

The characters chosen were:

- Oncologist doctor
- Smoker's association
- Environmentalist
- Gas bomb worker
- Owner gas bomb
- Car industrial association

During the role-play, students debated the social, scientific, environmental and ethics problems involved in the use of benzene and the individual behaviour contribution in air pollution. They also presented some alternatives and some new policies that should be recognized.

7^o and 8^o grade students

- After their colleagues explain to them the consequences of the benzene use, they started doing some activities.
- The activities developed by these grade students were basically a experimental study in their own school about air pollution.
- These activities involved the reflection on the individual behaviour, the places more polluted and the way to observe the pollution.
- After defining the places they started their investigation on air pollution.
- Following the gathering data, they discussed the results in their classes and presented a map with their conclusions.

In the rural elementary schools:

In this project participated two schools of elementary schools in Viana do Castelo. The invitation to the participation came from CITIDEP and UARTE. Within the ambit of the PEOPLE project CITIDEP and UARTE promoted the realization of a videoconference between ELEMENTARY schools of Viana and Lisboa. In Viana do Castelo this resulted in the development of a number of activities involving teachers from two schools in the district (EB1 of Monserrate and EB1 from Eiras). The EB1 school of Monserrate is located in Viana do Castelo and has around 200 pupils and the EB1 of Eiras is located in Arcos de Valdevez a smaller rural and less-developed council of the district and only has 9 pupils. The latter is an

isolated school with only one class and one teacher. Three classes participated in the videoconference, a total of around 70 pupils, from the school of Monserrate.

In the preparation of the videoconference, some of the classes valued above all the work they had already been carrying out in the field of environmental and ecological education because all of the teachers already had pedagogical experience in this area. In one class, they dedicated all of their work to the issue of benzene and the pollution of the sea waters through a case study of the sinking of the “Prestige” tanker near the Portuguese coast.

Despite the distance and isolation of the school of Eiras, the teacher and the pupils carried out a number of very interesting activities linked to environmental education and through the use of computer technologies they were able to share their experience and to make contact with the reality of other schools. The inequalities that exist in the periphery were consequently overcome.

With regard to the work carried out by the elementary school pupils in the classroom in relation to benzene and air pollution, in general, we select for our presentation the work carried out by one of the classes of EBI (elementary school) Monserrate with the teacher Conceição Líquito.

Starting from the problem of “Prestige” directly related to the professional activity of some of the pupil’s fishing families; the class was able to work on a very large number of issues in the different disciplines.

The main objective was to involve them in researching, selecting information, producing texts, using questionnaires and divulging data based on a theme with they were very motivated about.

In the discipline of the Study of the Environment (Geography, History and Sciences) they administered questionnaires to their family members about smoking and they themselves decided, after becoming more acquainted with the harmful consequences of tobacco, to encourage their smoking relatives to give up smoking. They presented various arguments such as: “my dad smells and the cigarette smoke makes me cough”, “they could die of cancer”.

Pollution remained a constant theme throughout, beginning with the pollution of the sea, going on to look at the pollution of the air, and taking up the problem of the forest fires which comes up every summer in the forests and mountains of the area. They were shocked with the issue of the ozone layer and decided that they would change the behaviour of some of their family members with regard to the problem of pollution.

The pupils produced texts based on specific terminology used in what concerns to air pollution (carbon dioxide, greenhouse effect, benzene and others). This activity allowed the acquisition of vocabulary in a playful way. The study of “Prestige” also provided the opportunity to study the oceans, the rivers of Portugal, the cardinal points, the marine biodiversity, etc.

In the Portuguese Language they searched for information on the internet and in newspapers, they read literary works such as “Ulysses” of Homer, they widened their vocabulary in various areas, they wrote texts, made summaries, talked and listened. They also told stories about people’s fears in the Fishing Quarters of the town when the weather is bad and the sea knocks at their door. They then went on to tell imaginary stories thus developing their imagination.

In the discipline of “Arts” they made paper boats in order to decorate a poster on the “Prestige”. One pupil remembered how his grandfather had taught him to make paper boats out of sweet papers. The poster was the result of the collective work that the pupils had carried out for two months with all of the research that they had done on the case of the “Prestige”.

In mathematics they invented and resolved problems that involved live beings whose lives were in danger because of the forest fires. The making of the poster about the “Prestige” allowed them to resolve the problems based on the calculation of areas and perimeters, systematizing the measures of length.

All of this work enabled the teacher to work with the curriculum in an integrated way and to develop skills in a transversal way.

In the final stage the pupils went to the ESEVC (School of Education of Viana do Castelo) to participate in the videoconference. They were excited about this visit. On the eve of the visit one of the pupils said: “I’m going to ask my mum to give me a bath”. It is evident that the participation of these pupils in these events has consequences that are often unforeseeable yet just as important as the academic and technologic learning which appears to be the ELEMENTARY objective.

After participating in the videoconference on 18 March nearly all of the pupils gave their own critical account in which they expressed their most memorable sensations and emotions. They wrote small texts which they all sent individually by email.

In the school of Monserrate in the afternoon of the 18 March the classes involved in the project asked questions via internet, chat and video diffusion in the second half of the videoconference.

During the videoconference about the air in Viana the pupils were not able to understand anything due to the quality of the sound received by videoconference. The problem was where technicians put the

reception of the videoconference via Internet which only happened at the end. The pupils lost their motivation because they did not understand what had been said.

The high point of the videoconference in Viana was the game. The pupils participated actively and became involved in the search for adequate answers to the questions.

The participation of various schools resulted in the sharing of experiences between pupils and teachers which contributed towards improving the quality of teaching and learning with the use of IT in a pedagogical context. The pupils of the participating classes were highly motivated which contributed towards the developing of skills related to researching themes, selecting information, reading and the capacity for oral and written expression.

In a world which is in constant metamorphosis, in which technological innovations are sprouting up all the time and where we feel good or bad surrounded by machines, it is of paramount importance to develop the capacity in each child to act in a participative manner. Schools can now offer more work tools, making the lessons more dynamic. However, all of this is only possible if the teacher has been given adequate training in computing. But it would make no sense to work in this way without also developing the need in the children to be participative and to act in a critical and responsible way in society.

There is certainly a technological revolution taking place in education and we are constantly bombarded by acronyms, names, brands, etc. and it is for this reason that schools must create the conditions to be able to give to the children what their families are frequently unable to give.

Material resources are scarce. Teachers have proved to have lots of difficulties in the use of IT in an educational context. Contents with good pedagogical quality produced in Portuguese are also scarce. The project that was carried out during the school year 2002-2003 may be seen as one of the first steps towards engaging with the information society taken by pupils in obligatory schooling. It seems to us that this constitutes a mega turn which, fortunately, relegates the traditional teaching method to a secondary place.

The information society must be an inclusive society. Future plans must envisage providing the means and resources which will enable every citizen to develop a participative attitude towards society and the challenges that it poses. It is imperative that the generation that is currently at school graduate with reinforced skills in the use of information and communication technologies. These skills must not be translated into an uncritical or passive usage, but on the contrary, they should result in the exercise of a fully engaged citizenship.

We don't think that many people share our views however we do believe that the introduction of IT in the classroom may serve to motivate pupils and contribute towards their development as critical and participative citizens.

CONCLUSIONS AND FURTHER PERSPECTIVES

The PEOPLE project clearly identified higher levels of exposure to benzene with tobacco smoking and emissions from automotive traffic.

European Air Quality legislation can only be successful if understood and endorsed by the individual citizen. Raising the awareness of the public can lead to environmentally friendly behaviour. The active support of citizens to pollutant issues is important for the success of environmental policy. The development of local abatement strategies is an effective step in the quest for better air quality in our cities. The enthusiastic participation of the volunteers and schools in Lisbon through the PEOPLE project clearly shows that improved environmental quality is a common goal for children, citizens and policy makers.

Further PEOPLE campaigns were recently conducted in Brussels (22 October 2002), Bucharest and Ljubljana (27 May 2003), and will follow soon in Madrid and Rome (end of 2003). The study will be extended to other cities 2004. A number of cities have already expressed their interest to be associated in the project: Belgrade; Dublin; Paris; and Budapest. The project will be extended to other toxic pollutants in the longer term, with emphasis on particulate matter.

Is it possible to learn participatory democracy through Chemistry?

Yes, was their answer.

This learning/investigative process contributed, as much as possible, to help students to be active with their environment and materials of their learning issues, researchers when exploring the material and the environment of their learning issues, intentional- searching spontaneously and with good will to achieve the proposed aims, dialogist involving them in dialogues with each other and the teachers, reflective when relating their learning and reflecting on the process and the decision making process and extensive when they generated judgments and assertions, tributes and implications based on their learning's.

Inside and outside the school curriculum, technology and creative methods were used to break barriers. Students from isolated small villages could ask questions to scientists and interact with their colleagues in Lisbon, through videoconference and Internet broadcasts. Older and younger students visited each other, playing educational environmental games designed by them and doing lab experiments together. All these activities allowed children and youngsters to learn the negative effects of air pollutants, at the same time that they were discovering their personal and social responsibilities towards the risks of damaging environment.

After this educational experiment we believe that these children and young people are, indeed, the best messengers of the PEOPLE results, and the best guardians of environment and public health.

REFERENCES

ACEDOVEDO, J.A., Vazquez, A., y, Manassero, M.A. (2002b). *Evaluación de actitudes y creencias C.T.S. diferencias entre alumnos y professors*. Revista de Educación, 328.

APPLE, M.W. (1989). *Educação e Poder*. Porto Alegre: Artmed

DEWEY, J., *Democracy and education*, Nova york, The Free Press, 1966.

Giordan, A. & Souchon, C., *Uma Educação para o ambiente*, Instituto de Inovação Educacional/ Instituto de Promoção Ambiental, Julho 1997.

GASPAR, Maria Ivone, (Coord.) [2001], *Três dimensões básicas do Currículo*, Lisboa, ME/IEE: "Reflexões sobre Programas de ensino", p.87-95.

UNESCO- Tayler, J- *Guide de la simulation et des jeux pour l'éducation relative à l'environnement*- Paris: Unesco, 1985

UZZEL, D., Fontes, P., Jensen, B., Vognsen, C., Uhrenholdt, G., Gottsradiener, H., Davallon, J & Kofoed, J., *As Crianças Como Agentes de Mudança ambiental*, Porto: Campos das Letras, 1998.

Web pages

"PEOPLE-Citizenship ", project: <http://www.citidep.pt/act/peoplecitidep.html>

"Cidadania e Novas Tecnologias" Project: <http://www.citidep.pt/act/progcid.html>

"PEOPLE" project, <http://www.people-pt.net/>

CITIDEP <http://www.citidep.pt/>

UARTE <http://www.uarte.mct.pt/>