

# Science education for pupils with special needs in a non formal environment

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**Abstract.** *Apart from what critical literature says about the importance of a science education for pupils' development, one of the points of departure of this communication was done by collecting information at Aveiro (Portugal) schools in which it was noticed that the curriculum of the pupils with educative special necessities (nee) does not include, generally, any sciences discipline. We will describe a project that tries to promote science education for pupils with nee in a context of teaching not formally.*

**Keywords.** Non-formal environment, Pupils with special needs, Science education.

## 1. Introduction

The development of the different scientific disciplines, the growing specialization, as well as the notion of applicability of his knowledge, made science apprenticeship a subject of basic importance for the functioning of the society. Science education seeks to provide situations of learning that promote the understanding of the natural world, and it's (inter)relations with the social world. It will also contribute for the development of the pupils' skills and attitudes that allows them to act in the future like explained consumers and able citizens, of intervening, in a responsible form, in the resolution of day by day problems.

Martins [10] defends that science education must pass with a social framing so that all the pupils can realize science contribution for the citizenship.

A recommendation of the *Declaration on Science and the Use of Scientific Knowledge* of written at *World Conference on Science for the Twenty-first Century: A New Commitment*

carried out in the day 1 of July of 1999, reinforces these convictions:

“Governments should accord the highest priority to improving science education at all levels, with particular attention to the elimination of the effects of gender bias and bias against disadvantaged groups, raising public awareness of science and fostering its popularization.” (UNESCO and ICSU, 1999).

## 2. Legal framework of students with special needs in Portugal

In Portugal the education system is compulsory for all children and young people, for 9 years, corresponding to basic education, according to Table 1:

		Average of ages
1st cycle	4 years	6-9
2nd cycle	2 years	10-11
3rd cycle	3 years	12-14

**Table 1. Portugal education system**

Over those years of schooling, science education is presented at Table 2:

		Physical and Natural Sciences
1st cycle		(generalist)
2nd cycle		Sciences of the Nature
3rd cycle		Natural Sciences Physics and Chemistry

**Table 2. Science education at compulsory education.**

To promote a democratic and inclusive school, looking for responding to the diversity of characteristics of all students, including children and young people with special educational needs, there is legislation which sets out to provide

specialist support and educational measures to be applied, updated in Law 3/2008. The most restrictive is the Individual Specific Curriculum (previous Alternative Curriculum, according to Law 319/91). This replaces the skills defined for each level of education and training. This curriculum is designed from the identification of strengths and weaknesses of each student.

### **3. Science in individual specific curriculum**

Was done a collecting information at Aveiro (Portugal) schools, between May and June 2007, that showed that the pupils, of the 2nd and 3rd cycle of basic education with special needs with an Alternative Curriculum, do not have Physics and Chemistry and only 34.7% have Natural Science.

The data collected by interview to the teachers responsible for the construction of curricula for students, allow concluding that the reasons why students do not have the science disciplines were:

- characteristics of the content (complexity, abstraction ...);
- characteristics of students (cognitive difficulties, ...);
- other (lack of appropriate materials, lack of preparation of teachers, ...).

However, all the teachers interviewed believed that is important or very important to include science in pupil's curricula.

### **4. Science education in a non formal environment**

The concept of education supported by the "World Declaration on Education for All" (UNESCO, 1990) beyond the limits of formal education and includes non-formal environments. As above, "Supplementary alternative programmes can help meet the basic learning needs of children with limited or no access to formal schooling ...." It also says that "Other needs can be served by: skills training, apprenticeships, and formal and non-formal education programmes in health, nutrition, population, agricultural techniques, the environment, science, technology, family life (...) and other societal issues."

Seeks to clarify the meaning of these names we can say that formal education is developing in its own institutions (schools) and is characterized

by being highly structured, following pre-defined programs. The non-formal education is an organized and systematic educational activity that happens outside the formal system (Hamadache, 1993; Bianconi and Caruso, 2005; Gadotti, 2005) and is conveyed in the museums, science centres, media or other counterparts.

According to Gadotti [6] the non-formal education should not be seen as opposed to formal education, arguing for the complementarity and coordination between the two. Know their potential bring them to the benefit of all. To Ávila [2] we can not conceive education isolated from society or accept that the formal school is the sole locus of expression of educational intentional processes.

Non-formal education characteristics, such as flexibility concerning time and space, reinforcing the relevance of the role that a less formal environment - outside school - can have on education for pupils with special needs that have a particular rhythm and development. It permits to respect differences and capacities of each one. According to Gadotti [6], non-formal education programs don't need a sequential and hierarchical progression. Gohn [7] states that non-formal education gives conditions for individuals to develop feelings of self-recovery, the rejection of prejudice that they are addressed, the desire to be recognized as equals in their differences which reinforces the idea behind this project, increasing the environmental non-formal education in science for students with special needs. The environments of non-formal learning enabled by museums and science centres, according Chagas [4], are very rich and diverse that approximates the natural environments where the child spontaneously, creates its own knowledge. Some studies (Rodrigues, 2005; Bianconi and Caruso, 2005) emphasize the role of a non-formal environmental education in science. They believe that it have a huge potential to be exploited, especially to motivate pupils, to develop their creativity and, above of awakening the interest of the young in science.

The current movement of museums and centres that are dedicated to the spread and communication of science and technology is highlighted by his enormous public acceptance. Such acceptance is due, fundamentally to the appellative form as they show up, as well as the dynamic ones of exploration that stimulate the participation and interactivity, not forgetting the scientific correction. His structure invites the visitor to explore and to lift questions to all the

public. According to Chagas [4] science centres assume so a clearly educative function using interactive techniques of exhibition and it stimulate curiosity and pupils participation.

In this sense, in Portugal, the program *Ciência Viva*, was created like one unity of the Ministry of the Science and Technology (Law 6/MCT/96), with the principal objective to produce spaces for the spread of science and technology, corresponding to new social practices, like non-formal interactive institutions.

Visit interactive science exhibitions is one of the processes that can be used in the science education that has been showing sign of quite elevated levels of implication and apprenticeship. That happens, because in these visits the experimental situations are of essentially playful nature, where the pupils explore / observe, not having certainly or wrong and where the rhythm is established by owns them. So, all the pupils, even that have learning problems, have possibility to develop several competences and capacities such as attention, cooperation, critical spirit or creativity.

So, the development of interactions between science centres and schools must not be restricted to punctual situations but be translated to a deeper collaboration.

## **5. Proposed project**

Considering the previously presented (3.), we can note that we were before a population that in spite of frequenting the school will be illiterate scientifically.

Assuming the relevance of science education for all, it has to be put in a multidisciplinary and multidimensional perspective, with community implication. To Ferreira [5], pupils with special needs problems must not be discussed or solved like an isolated reality.

It is necessary to think about a cooperative proposal, looking for new methodologies that provide pupils development, in the society, in a process of autonomy and inclusion. This idea is reinforced by Latas (1990 quoted by Sousa [15]), what suggests the use of alternative resources to provide experiences of apprenticeship that are adapted to the different necessities of the individual pupils.

Only an included education in a social context will allow enjoying the full right of citizenship. So, the true inclusion implicates to understand the concept of education as a whole, implicating a school restructuring, passing by a

fusion between the formal and non-formal education.

In this sense a proposal project was developed, in a partnership between *Fábrica Centro Ciência Viva* of Aveiro (a science centre), the Department of Education and Educative Technology of the University of Aveiro and the schools that were making part. The great mark of this project was to develop competences (capacities and attitudes), through science education, contributing to the educative inclusion of pupils with specific individual curriculum.

The implementation of this project implicated to include in the curriculum of the pupils, a science area, with a weekly periodicity (during 90 minutes), what was happening in *Fábrica Centro Ciência Viva*.

## **6. Why *Fábrica Centro Ciência viva***

*Fábrica Centro Ciência Viva* is a non-formal science education environment, in constant growth, which gives him a set of own characteristics that potentiate it and allow pupils a rich, diversified and differentiated experience.

Is a centre with a multiple offer capacity, making possible the exploration of different spaces with opportunity to carry out activities of different levels (interactive, thoughtful, reflexive,...) and with different communication ways (sound, light, image, writing, ...). This plurality stimulates the curiosity and interest of the pupils, allowing them to explore, to question, to manipulate, to try,..., while they interact with other visitors.

## **7. The implementation of the project**

### **7.1. Participants**

There were wrapped 18 pupils of two Aveiro schools, divided in three groups (Tuesday group: 6 pupils of the 3rd cycle of the basic teaching; Thursday group: 6 pupils of the 2nd cycle of the basic teaching; Friday group: 6 pupils of the 2nd and 3rd cycle).

Besides the investigator himself, that had an active paper, they were also implicated Special Education teachers, responsible for the pupils, who supplied information on the pupils and of the impact of the implemented dynamic ones in them development. This information were also supplied for persons in charge of education of the

pupils and of elements of the Executive Councils of the Schools.

## 7.2. Dynamic

During the academic year 2007/08, the pupils wrapped in the project carried out, once weekly, several activities proposed in the Fábrica Centro Ciência Viva. The pupils of the School João Afonso were moving accompanied by an educative assistant, and stay there alone. Those of School Aradas were accompanied by the respective teacher of Special Education.

For the School EB João Afonso, the project had beginning in the 1st period, being extended up to end of the academic year:

- Group of the 3rd cycle (Tuesday) – total of 31 sessions:
  - first session: 02 / October / 2007
  - last session: 17 / June / 2008
- Group of the 2nd cycle (Thursday) – total of 29 sessions:
  - first session: 04 of October of 2007
  - last session: 19 of June of 2008

For School Aradas, for reasons foreign to the persons in charge and project promoters, like the late placing of the teacher of Special Education in the School and pupils dislocation, project had beginning only in the 2nd period, being extended up to end of the academic year, to Friday, having carried out a total of 16 sessions:

- first session: 11 / January / 2008;
- last the session: 20 / June / 2008.

Each group developed sessions of activities, organized at three moments:

- 1st moment (orientated by the investigator): preparation / motivation of the pupils for the activity to develop, where different strategies were used, such as the placing of a question problem, resolution of an enigma, ...;
- 2nd moment: realization of the activity. When the activity was belonging to one of Fábrica it orientated by his monitors. Before the session to happen there was always a prior approach to monitors, by the investigator, of how to potentiate the session dynamic, attending to pupil's characteristics. The sessions boarded quite diversified themes, trying to attend to pupil's ages, development, interests and motivations. Someone sessions were prepared and / or adapted for the effect.

- 3rd moment (orientated by investigator): systematization of the activity; reflection; resolution of the question problem...

## 7.3. Gathering information

The instruments of gathering of data of the observation were: notes, photos, registers of the meetings carried out with the schools and wrapped teachers, materials produced for and on the pupils, such as graphic different registers of descriptive and reflexive character.

They were done interviews to the different intervenient in the study (pupils, teachers, parents).

## 7.4. Articulation with the schools

Along the whole academic year straight contact was maintained between the investigator and pupils Special Education teachers. In the end of each period there were formal moments, when interviews were carried out. Of these contacts agreements were born to the implementation of the project, such as:

- the development of activities in the School, continuing sessions carried out in the Fábrica;
- the presentation by pupils of the activities developed in the Fábrica, in their own schools.

In the end of each period there was carried out, by the investigator, a global evaluation of each pupil who consists of his school registers.

## 8. Conclusions

On basis of the collected data, we can say that pupils benefited, with pleasure, the proportionate activities. Besides to go out from the routine of the school, the sessions corresponded to his curiosity and interest, surpassing expectations. There was a global development, in all the pupils, at several levels, such as: social behaviour, relation with others, language. Besides these aspects highlights still the knowledge built through the individual discovery. Along the academic year there were carried out several activities that provided to the pupils different experiences, the contact with " things " what they would never have access if it was not this project, which led to the development of general competences and of capacities and attitudes.

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