## Hands-on Science in Prison!

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Abstract. Is it possible to introduce hands-on science in a prison? Yes, it is! In this presentation an annual hands-on educational programme of Astronomy will be described which has been conducted during 2008-2009 scholar year, once a week, in the Second Chance School of Korydallos Prison of Athens. The programme was aimed at adults prisonerlearners aged 20 to 65 years. The methodology was based on "project method" and a variety of didactic approaches has been experimented such as workshops of Astronomy using New Technologies, hands-on experiments, constructions, laboratories of art theater, painting and body expression. The enrichment of the educational programme with hands-on activities and interactive workshops helped a lot to make prisoner-students more social, creative and active and to increase the self-estimation of their abilities & capacities.

**Keywords:** Adult Education, Astronomy, Hands-on Science, Museum Education, Prison Education, Science and Society.

#### Introduction

2008-2009 During scholar year an educational programme of Astronomy has been organized in the Second Chance School of Korydallos Prison of Athens in Greece by Hellenic Physical Society, a scientific association with an intensive action in the field of education that represents the Greek scientists of Physics. The project, has been realized in occasion of the International Year of Astronomy 2009 and it has been approved by the National Academy of Athens as a greek national action of the Astronomical International Year. The astronomy project, titled "Touching the stars...!", was an educational activity of the European Programme Exploring "Science as Culture through the European Science Museums", a Grundtvig Lifelong Learning partnership (numbered 07GRC01-GR04-00025-1), conducted from October 2007 to July 2009, that connected Science Museum with Adult Education. The European Lifelong Grundtvig Project (www.anakalypto.eu) aimed to the creation of teaching procedures of distance learning with the use of New Technologies as didactic tools and to the promotion of innovative pedagogical lifelong procedures of informal and non formal forms of Science and Museum Education. It was addressed to museum visitors and museum educators, to adult school students and teachers involved in adult education, to financially and socially inferior groups, such as prisoners. The programme "Touching the stars...!" was aimed at men adults prisoner-learners aged 20 to 65 years and it was conducted, once a week, in the Second Chance School of Korydallos Prison in collaboration with the teachers of the school. The basic group of work was composed of 10 students, but a lot of activities have been proposed to all 75 prisoner-students of the school.

#### **Educational scenario**

The pedagogical action was based on an interdisciplinary approach of study and it was composed of a variety of didactic approaches [1], such as research on Scientific Museology, use of Technologies, laboratories. lectures. New interactive workshops, constructions and performances. The educational scenario covered an extended range of astronomical issues: history of Astronomy, differences between satellites, stars and planets, basic constellations of northern hemisphere with specific references to the constellations of Hunter and Scorpion, orientation using the Polar Star, comprehension of astronomical maps, study of the Planet Earth, the moon, the sun, the solar system and of our galaxy.

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<u>Use of New Technologies and hands-on</u> experiments

During the project elements of Science Museum Education have been introduced and prisoner-students had the opportunity to realize the importance of hands-on exhibits and interactive exhibitions [8]. Because of the impossibility of the learners to visit museums the most important European Science Museums and Planetariums have been visited virtually. The educational material was based on the use of New Technologies [9]: special softwares such as Crazy Talk and Crocodile Physics have been utilized. Using Crazy Talk, a computer program for generating talking characters from an image or photo and facial animation for video, the participants created an artefact 'talk' of the solar system lending their voices to each celestial body. Using Crocodile Physics, a simulator that lets model a range of physics experiments, they practiced physics simulations. An interactive *board*, a whiteboard capable of interacting with a computer and projecting images in a screen, has been used constantly and students learned how to use it. 3D films of astronomy have been also watched using special 3D glasses.



Figure 1. Experiments on waves

For a better comprehension of the astronomical issues, lessons on physics notions have been activated and physics experiments have been realized. A small laboratory of physics has been created for the first time inside the prison school, in order to promote the scientific knowledge of the students in combination with hands-on activities. All 75 students of the school practiced experiments on motion, forces, optics and waves. All spaces of the school have been used, even the corridors were converted to laboratories for the realization of experiments with very long springs.

#### Lectures, workshops of art and body expression, theater performance, creation of an exhibition of astronomy

Lectures related to the theme of the project have been also organized for all 75 prisonerstudents. The basic issues of the lectures were on Museum Education, on the use of New Technologies, on Astronomy and Cosmology. Our efforts have been supported by European experts and University Professors of Physics who came inside the prison to explain complicated scientific notions in a simple way.



# Figure 2. Construction of the solar system using newspapers and glue

The educational programme has been enriched not only with hands-on experiments but also with a variety of interactive workshops. The movements of celestial bodies in the solar system, such as the rotation and the revolution of the earth and the rotation and revolution of the moon, were understood through specific workshops of body expression.





Art theater workshops have been also organized and a theater performance, an abstract of the book of Brecht's "Life of Galileo", has been presented to public. At the same time prisoner-students attended labs of painting and created constructions of the solar system from different kinds of materials, such as alfa-block, newspapers, glue and even bread crumbs and sugar! The painting and construction creations implemented an art exhibition of astronomy which took part to the Art & Science Symposium "Meeting in the Early Universe" that Hellenic Physical Society organized at Harokopeio University in October 2009. Thanks to the exhibition of astronomy the prison school partecipated also and won an award to the Panhellenic Competition of Astronomy 2009.



# Figure 4. Painting of the sky and constellations

#### Methodology

The methodology used was based on "project method", that means in-depth and indisciplinary study of a subject [7] in which ideas, questions and interests of students direct the course of research and shape the experiences among learners [2]. The project has prompted us to develop applications of «interactive experience model» according to Falk and Dierking [4]. In we focused on activities of addition, «discovering learning» following the didactic approach of Freeman [5] that includes: i) guided discovery, ii) resolution of the problematic, iii) student action.

Particular emphasis was placed on assessing students' ideas. The educational programme focused in a particular way on the correction of misconceptions and on the reconstruction of previous knowledge, for a right understanding of scientific concepts [3]. The encouragement of curiosity and motivation, a systematic nonpassive attitude of students and their active involvement through observation and partecipation in hands-on activities were main objectives of the educational process [6]. The encouragement of group discussion was also an important methodological key in order to facilitate the socialization of students [10].

#### Results

The results of the project were very encouraging:

- All students were strongly motivated and they would like to repeat this experience.
- The variety of interactive cross-curricular teaching activities from the area of non-formal education has led to the sharp increase of interest for astronomy and physics science and improved the apparent astronomical knowledge of learners.
- The encouraged student action and the enrichment of the educational programme with parallel interactive workshops contributed to make prisoner-learners more social and creative.
- The integration of non formal and hands-on activities in a formal environment promoted the group work and the interaction among students.
- The use of New Technologies as teaching tools is very useful to the the creation of innovative learning teaching procedures.
- The long duration educational programmes offer substantial and specialized pedagogical results.
- Prisoners are often depressed and have low self-esteem. Such educational actions provoke the augmentation of the self-estimation of their abilities & capacities.

### Conclusions

These extremely encouraging results demonstrate that:

- The interdisciplinary teaching methods incorporating actions of non formal learning and hands-on activities "refresh" the formal educational system and contribute to science and society approach.
- Scientists and teachers of science should be governed by the philosophy that the

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- Hands-on science can be introduced even in socially disadvantaged environments such as prisons.

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