

## Annex 2. Networks and practice communities for improving motivation and learning in science & technological education

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### Introduction

The vertiginous scientific and technological advances have a special force in developing the knowledge society, permeating our daily life and raising challenges for citizens and in the world of work (Roberts, 2007). Consequently, scientific and technological literacy *for all* constitutes an essential purpose for scientific and technological education, especially in basic education systems. Paradoxically we are witnesses of science decline in the education context (Castaño *et al.*, 2006). On worldwide scale and mainly in the West, there is a worrying trend of declining student interested in science studies and science education. Statistics indicate that the majority of students opt out of scientific careers (OECD 2006).

In Spain, the results of a recent survey on the social perception of science carried out by the Spanish Foundation for Science and Technology (FECYT) show the indifference of a wide range of social sectors. Practically 50% of the sample considers that «science is difficult» and “science does not stimulate interest”. There is a drastic and progressive reduction in secondary students' choices related to scientific options (Castaño *et al.*, 2006). On the other hand, it is obvious that science teachers play an essential role in the scientific education quality and the improvement of the students' motivation and learning. New strategies and plans for initial and in-service teacher training improvement are necessary (Glynn & Koballa, 2006).

## A coursework design for improving motivation and in-service science teachers training

In 2007, a training project of 70 hours was implemented for in-service science teachers and focused on the design of classroom activities for improving motivation towards scientific and technological education (Llopis et al., 2009; García Gregorio et al., 2009). A network between members of the Principe Felipe Museum staff, Valencia, teachers of the Universidad Politécnica de Valencia, teachers of the German School and French School and the Centre for Teachers training (Centro de Formación de Profesores CEFIRE) was created to work for a committed, enjoyable and engaging science. The group constituted a practice community in order to collaborate with science teachers sharing experiments, activities with toys and devices, science in daily life, Science-Technology-Society-Environment (STSE) texts, drawing on didactic experiences of other European countries (Germany, France and the United Kingdom).

### *Project Objectives*

- Sharing an environment for enriching the teachers' motivation in a practice community.
- Communicating science and technological issues, igniting motivation of the teachers and students through a vision of an enjoyable and creative science, committed to sustainable human development and the students' interests
- Generating and applying projects in the classroom, analyzing its impact on the improvement of students' learning.

The principal characteristics in the coursework design are:

- a) *Integration of multidisciplinary contents specially in STSE perspectives.*
- b) *Applicability to the classroom.* The course includes the elaboration of an individual school Project by the teachers, presenting the outcomes and the results of its implementation with students in a workshop (videos, power point presentations, artifacts and experiment designed, etc.).
- c) *Improvement the practice of action research as professional development,* promoting the self-reflection about the teachers own motivation, styles and learning environments.
- d) *Multiplicity of actors,* including formal, in-formal and non-formal education agents such as museum staff, teachers, teacher educators and university staff.

- e) *Different education culture collaboration*, throughout the meeting between teachers from Spain, France and Germany, with their own didactic background and their own educational experiences.
- f) *Active methodologies and multiple didactic strategies*. The coursework is based on constructivist orientation, promoting models as the Inquiry-Based Science Education (IBSE), Project Based Learning (PBL), problem solving and, in general, the *learning by doing or hands-on learning*). In addition, teamwork, creativity and use of Information and Communication Technologies (ICT) are used to promote learning.
- e) *Diversification of activities and didactic resources*, combining discipline and inter-discipline perspectives and a wide variety of resources (toys, scientific and technological devices and artifacts, articles, press and magazines, Internet resources, etc.)

## Results



The course was implemented for three consecutive years with the application of a set of evaluation indicators (pre and post-questionnaires, a general survey and observation during the course development). Aspects that were considered as important by teachers have been: novelty (98%), applicability to the classroom (98%), links with daily life (97%) and improvement in student motivation (95%). These results re-affirm the consistency in the course design (Llopis et al., 2009). There are more than one hundred projects developed between 2007 and 2009. One of them, called “El Blog: una herramienta

de motivación para el estudio de las Ciencias” (The blog: a useful instrument for science study), has been distinguished in 2009 with the 1st National Award by the Ministerio de Educación (<http://cienciaalucinante.blogspot.com>, “amazing science”) and Project “Digital pen for the Wii” has been recently distinguished with other award (Premio Manises Innova). Of the elaborated projects, 15% corresponds to technological applications, 44% to problems in daily life and 56% focused on curricular themes. Other project titles include: Love thermometer, *Truffles with Hazelnuts*, *Eating Cells*, *Does the laboratory’s air fit in a matchbox?*, *Gummysciences*, *Genetics of the bitter flavor*, *The infernal catapult...*

The results show the importance of achieving the creation of multiple actor networks, constituting a new approach to the educational innovation through the generation of a true community of

practice. It is also an especially effective tool to stimulate students' interest through science with personal and social relevance, that is simultaneously creative and enjoyable.

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