

EUROPEAN PROJECT OF SCIENTIFIC EDUCATION

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Abstract: In 2016 the final report of Operative National Program (“Competences for the development”), promoted by the General Direction for International Affairs of Italian Ministry of Education, University and Research, has been presented. Such a program has involved about 4000 schools from Calabria, Puglia, Campania and Sicily regions in which several training activities for teachers aimed to improve the teaching quality (especially of mathematics and sciences) took place: in total, 1125 secondary school science teachers have been educated. The management of the program have been entrusted to INDIRE Institute of Florence (National Institute for Information, Innovation and Educational Research), which could rely on European structural funds (PON funds). In order to manage to improve the learning quality of scientific subjects, the educational syllabus has been split in 4 different disciplinary thematic units (reading the environment, earth and universe, transformations, energy and its transformations) and 3 transversal units (history of science, education to sustainable development, learning evaluation). A total of 209 didactic materials have been published, both in paper and multimedia format (containing 25 clips made by the students), mainly addressed to secondary schools (during the last phase of the project some “vertical modules” have been added, in order to propose itineraries going through primary school and the first two years of middle school).

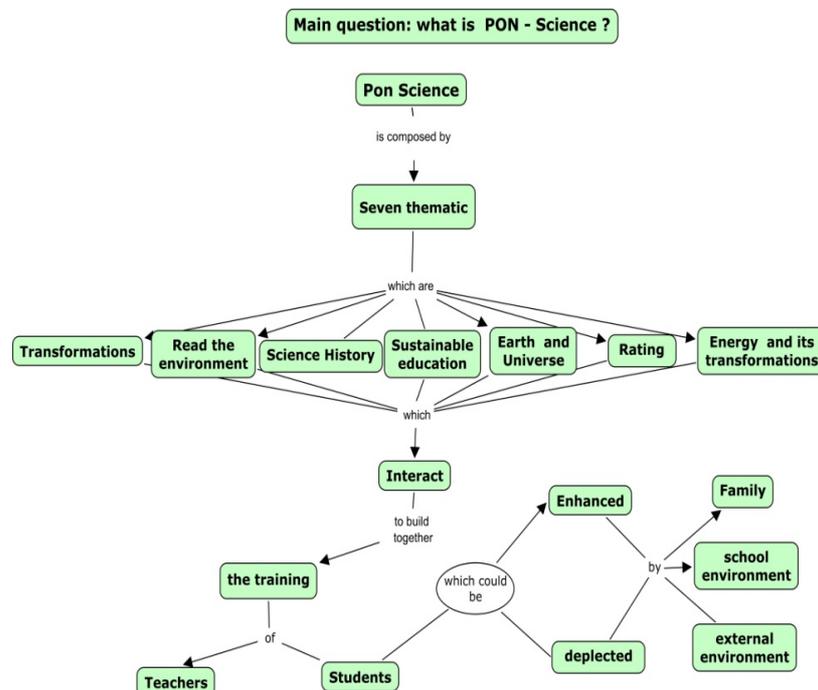


Figure 1. Map of European project educational units.

1. Introduction

The first results coming out from the program highlight encouraging signals, even though the main and the most ambitious goal (didactic improvement and shift to a student-focused teaching) requires a long-term perspective. The project makes the 209 didactic materials and the 25 clips available to the primary and secondary school Italian and European teachers. Workshop and laboratory approach is the strategic choice of the program: laboratories cease to be a physical place confined inside four walls and opens to internal and external problems of the school. The efficiency of this approach is witnessed by the control that scholars have upon the different aspects of learning experience: something from the outside (observations) and something from within (critical thought and meta-cognitive reflection on what observed) melt together and form what we call “Phenomenon” (Wagenschein, 2000). Meta-cognition act is a reflection, based on an experience or a personal thought already fixed inside us, which becomes significant after the concept map construction. If we want the students to build up a real scientific competence, we need to let them the necessary amount of time for continuous and repetitive meta-cognitive reflections, developed through the use of concept maps with CmapTools, realized in collaboration with their classmates both in primary and secondary school. New programs and new investigating activity based approaches to learning require making multiple connections between all that is known and its applications. That is the new

idea of class: dividing students in cooperating and interacting groups (with the teacher as well), providing them any kind of problem, for whose solution concept maps represent a valid tool.

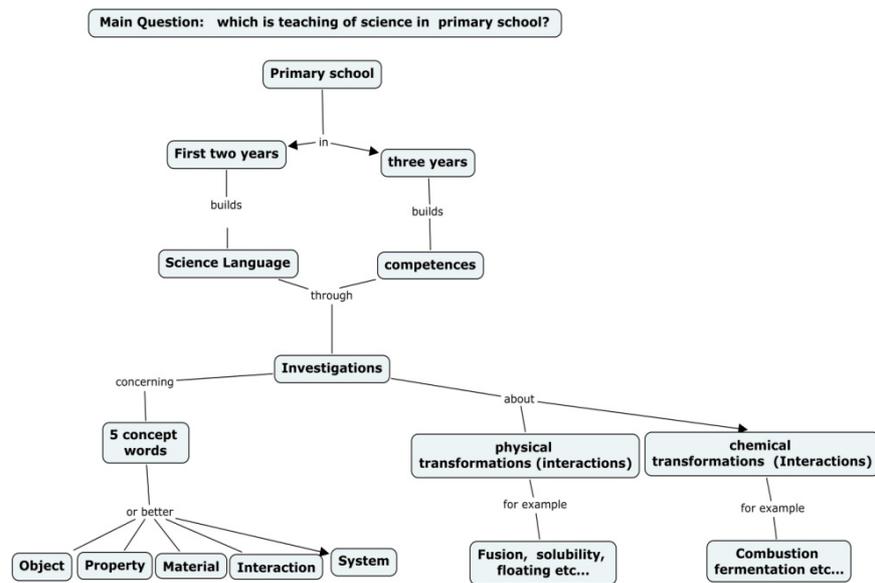


Figure 2. Map of scientific teaching in primary school.

2 Learning Environment Design

Teacher designs and manages science learning in a workshop-like didactic, using cheap and common materials, procedures and contexts in order to put students in a position to “learning by doing”. In particular, activities will take place according with the 3 stages of Learning Cycle, theorized by Robert Karplus: exploration, invention and discovery. The European Scientific Educational Program recommends a wide use of investigations and Cmaps in every Italian school grade. Investigations allow ruling abilities to develop ideas and concepts, such as classification ability (Why am I classifying? Which are the properties of the objects I am observing?) or comparing ability (Why do objects look similar? Why do they look different?).

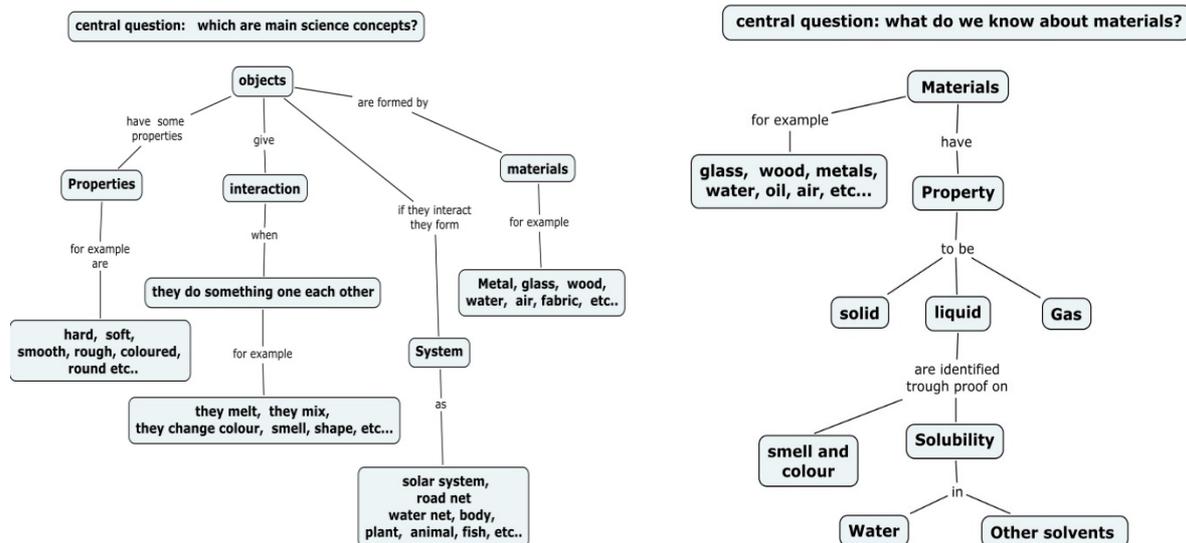


Figure 3-4. Maps regarding the key-concepts of “objects” and “materials”.

3 Learning Laboratory

The construction of a basic scientific language always starts from a simple question (or a game), which students are asked to answer after investigating throughout building their own concept maps. This didactic strategy stimulates their curiosity and develops long lasting scientific attitudes. Classroom investigations start with

physical objects manipulation, which are thought to help students to realise that the correct scientific language is built thanks to a linking of consecutive investigative processes. Investigating on objects and their properties

In these activities, several examples of investigations will be proposed, lead with different strategies born from the analysis of different objects, in order to determine which is the material carrying the necessary properties for a certain goal.

3.1 Investigating on chalks to discover their properties



Figure 5. Use of chalks and discovery of their properties.

Kids discover that different chalks are made of the same material, but differently coloured, the teacher defines the name of the ideas developed during the activity, putting the meaning into evidence



Figure 6

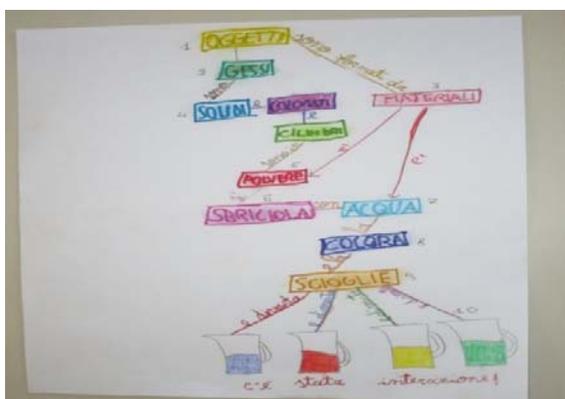


Figure 7

Investigations allow to apply the formerly “invented” concepts and to start exploring new ones. This kind of activities promote the oral, written and iconic language development, ensuring the communication and linguistic ability strengthening

4 Construction of Concept Maps

The teacher’s role is essential, since he/she is required to establish the adequate atmosphere, encouraging kids in order to strengthen and address procedures and strategies. Students build their own concept map and connections are described and narrated. Different maps come out, allowing to evaluate the knowledge that learning activity has yield in everyone.



1. Objects
2. Chalks...
- 3...are made of:
- 4...are solid, coloured and cylindrical
- 5...dusty material
6. Interaction
7. Water takes chalks' color
8. Water is a liquid
9. Water melts chalks

Figure 8. Children explaining the map.

Concept maps, built in cooperative groups both in primary and secondary school, play an important social role, since the educative context becomes location of dialogue, comparison, debate and sharing of meanings.



Figure 9



Figure 10

Group maps in primary school are realised in a wide space with movable sheets and labels, in order to facilitate the research of logical and coherent solutions and explanations. Some examples of group maps are reported below.



Figure 11. "Object-Property-Material" map.

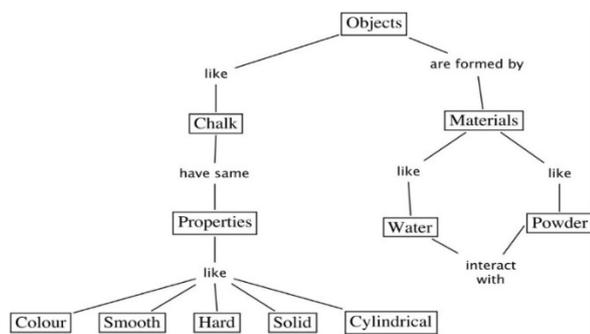


Figure 12. Map realized with software "Cmap".

5 Conclusions

PON project has been founded by European Union and has enrolled about 4000 schools in four different regions (Calabria, Puglia, Campania, Sicilia), promoting formation seminars for teacher aimed at improving the teaching and education of sciences, math and Italian language. In particular, PON Scientific Education Project, which has trained 1125 science secondary school teachers, will be extended to the remaining 16 Italian regions, aiming at improving the quality of teaching in secondary school, considered the most fragile school grade.

209 didactic materials have been published both in printed and multimedia version (containing 25 clips realized by students). The project also recommends the wide use of investigations and concept maps in every school grade, useful to evaluate the improvement of the conceptual structure of both single and group of students. Since the map can be compared to a filter through which students observe the real world, it can also be used as an evaluation tool.

6 References

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