Science in a changing Education

The contribution of the Hands-on Science network to the improvement of Science Education

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SCIENCE EDUCATION

and

SCIENTIFIC LITERACY

"HSCI'2005 - Science in a changing Education", Rethymno, Crete, July 2005.

In these times of enlargement consolidation and global affirmation of the European Union in the world, Education and particularly Science and Technology education play a role of major importance.

If Europe is to grow socially and economically it has to ensure that it is on the forefront of scientific research, and Science Education has a decisive impact on the improvement of Science and Technology.

A sound Science Education beginning as earlier as at pre-school level is fundamental to a good development of fundamental skills the new generations will definitely need in order to cope with the requirements of a new Knowledge based economy and Society.

SCIENCE EDUCATION

Education reforms have been effectuated or are under way in most of the European and other countries during the last years. Although the extent and the kind of the reforms vary significantly from one country to another, they all share as a common factor the increased significance of Science Education which becomes a major constituent of school curriculum, comparable to language and literature.

Particularly in what concerns primary school the teaching/learning of Science is fortunately gaining a fast increasing importance. Politicians educators and parents are realizing the importance of this topics on view of the developments needs of our society. If studied in an active hands-on experimental or investigative way the students themselves enjoy particularly these subjects.

Studying Science

Training to

observe and think

…

Fundamental competencies

Critical reasoning

Method

Responsibility

Active commitment

Self confidence

"HSCI'2005 - Science in a changing Education", Rethymno, Crete, July 2005.

Work related to Science teaching which constitutes a major part of the contents of Science education has also attracted educators and researchers extending also into more general aspects such as the teaching approaches adopted, the underlying learning theories, the teaching means and the use of new technologies (especially informatics), and also, other parameters that may affect the effectiveness of Science Teaching.

Effectiveness however depends strongly on the objectives attributed to Science education an issue directly related to the reasons (cultural, utilitarian, personal development, social) Science is included in the school curriculum. Whatever the main emphasis may be, Science education is greatly based on practice work experimentation, construction, innovative application of 'known theory', inquiry, etc).

In this sense, practice work is essential to the understanding of Science and thus fundamental to Science and Technology literacy.

As an increasing number of decisions is dependent upon Science and Technology developments, in order for the citizen of a democratic society to be able to participate on his (her) own he (she) not only should be S&T literate but also he (she) must have cognitive skills permitting decisions on incomplete knowledge, i.e. also in areas he (she) is not an expert. Science education provides a natural framework towards the development of such skills.

SCIENTIFIC LITERACY

-familiarity with both scientific content knowledge and scientific ways of thinking and understanding

-valued as part of an individual's intellectual ability and for its value in building socially responsible and competent citizenship in a democratic society.

…critical scientific literacy is a crucial aspect of responsible citizenship and sound social an environmental behaviour…

In 1898 Ernst Mach in his book "*Popular Scientific Lectures*" stated (p. 359-360):

"...without at least an elementary mathematical and scientific education a man remains a total stranger in the world in which he lives, a stranger in the civilisation of the time that bears him. Whatever he meets in nature, or in the industrial world, either does not appeal to him at all, from his having neither eye nor ear for it, or it speaks to him in a totally unintelligible language."

"One inclined to be uncharitable might say that our gymnasiums and classical academies turn out men who can speak and write, but, unfortunately, have little to write or speak about."

…

Nobel Prize Millikan back in 1917 wrote:

"Our national *(USA)* **prosperity**, yes, our national life itself, **depends** upon our further success in stimulating and rendering **effective** scientific and industrial research, and this in turn depends upon the **appreciation and fostering of science** by the king of our great land - the **common people**. *And where are they going to get that appreciation and that willingness to foster, save in the public schools*?"

Formal, non-formal and informal education

In 1995 Carl Sagan pointed out a rather important issue:

"Science arouses a soaring sense of wonder, but so does pseudoscience. Sparse and poor popularizations of science abandon ecological niches that pseudoscience promptly fills. If it were widely understood that claims to knowledge require adequate evidence before they can be accepted, there would be no room for pseudoscience.

But a kind of Gresham's Law prevails in popular culture by which bad science drives out good."

The problem of scientific illiteracy in developed countries is becoming to affect significantely and objectively the economical and social development perspectives.

The United Nations launched the Literacy decade (2003-2012), and more recentely the decade "Education for a Sustainable Development"(2005-2014)

In Europe…

Lisbon agenda

Scientific and technology Literacy

Uppsala

increasing recruitment

Barcelona

increased investment on research (GDP: 1.9 → 3%)

MST benchmark

15% increase in graduates by 2010

gender imbalance
career attractiveness
lifelong education

THE ACCESS OF WOMEN TO SCIENCE

In Education, over last couple decades, women outnumber men in secondary and higher education and represent the majority of graduates (55% on average). The scenario changes on post-graduations were the percentage of women falls down to the 39%. But, by far, the worst situation happens in the fields of Science and Technologies where the percentage of graduations drop to between 21 and 36%.

In what concerns employment the situation is extremely negative. In general women's employment rates increased on last years (yet clearly below the 60% Lisbon target). But it is rather "unusual" to find women employed in Science or Technology business. In industry the situation is even worst in spite the recognised quality of the women graduates and the efforts of some governments, women rights organisations and even some industrial companies. The situation is common all over Europe and it's not a fact that in countries with higher standards of living the situation is better…!

THE ACCESS OF WOMEN TO SCIENCE

On the latest report on equality between women and men of February last year, the European Commission refer as most significant progress achieved by the EU' strategic policy initiative to promote gender equality, the important number of amended treaties and Directives issued. If its true that EU' legislation greatly improved in the direction delineated by the Lisbon agenda, its incorporation on national legislation is far from finalized and its application do not yet generated the practical positive impact that was expected.

LIFELONG LEARNING

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…experimental work…

HANDS-ON

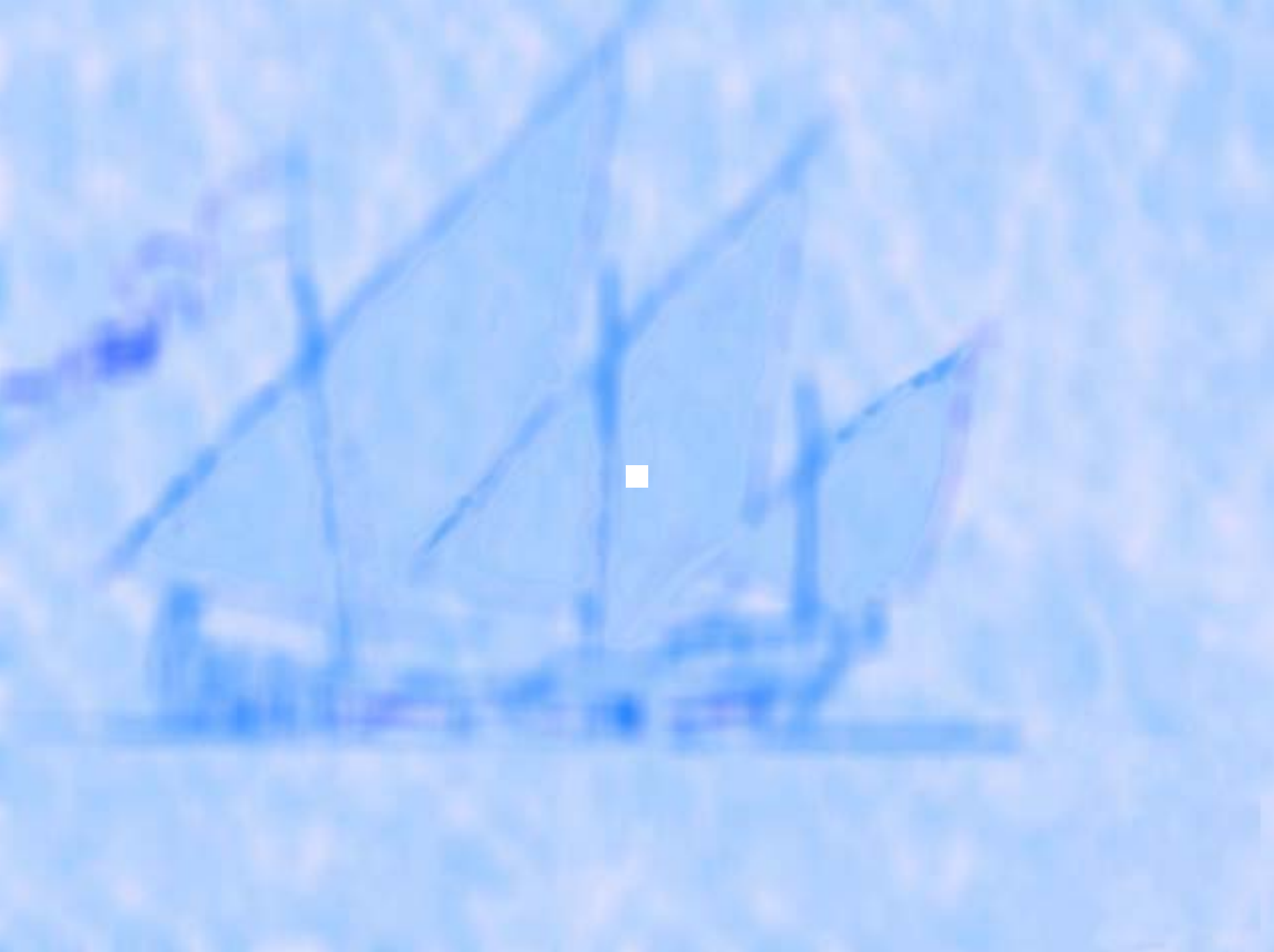
...

MINDS-ON

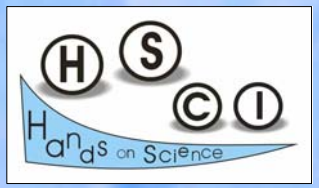
"HSCI'2005 - Science in a changing Education", Rethymno, Crete, July 2005.

THE "HANDS-ON SCIENCE" PROJECT

"HSCI'2005 - Science in a changing Education", Rethymno, Crete, July 2005.




Education and Culture
Socrates
Comenius


H S C I
Hands on Science

Obrigado