

Hands-on Science Network. Improving Science Education towards a Sustainable Development

M.F.M. Costa

Universidade do Minho, Dep. de Física
Campus de Gualtar, 4710-057 Braga, Portugal.
mfcosta@fisica.uminho.pt

Abstract. The developmental needs of our modern societies demand a strong yet sustainable development of Science and its Technological applications. In most countries it is being registered a striving lack of scientists technicians and engineers but also, and probably most dramatically, science and technology teachers¹. Driven by this fact science should and is gaining an increasing importance in school education. Hopefully also recognizing the importance of the study and training in Science in the building up of our youngsters' personality and abilities, both professional and social, changes in school curricula are being implemented in most countries being giving to Science a clearly higher importance.

However the improvement in the levels of quality and effectiveness in school science education can hardly be achieved in a non supporting environment, provided by societies with a low level of Scientific Literacy, and without an effective change in the way Science Education is traditionally approached in our schools. The method that drives the pursuit of scientific knowledge should be the starting driving and guiding basis of all process of in-school teaching/learning of science. Leading the students to a pro-active posture and an active volunteer commitment in hands-on experimental activities: by observing, analyzing critically, deducing, reasoning, defining, discussing, experimenting... "making" (learning) science as scientists do...

This was the driven idea that leads to the establishment of the "Hands-on Science" Network back in 2003 with support of the European Commission under the Socrates Program. It was clearly confirmed along these years of exciting and rewarding work and will be the motto of the International Association "Hands-on Science Network" established in October 2006 and now open to a word wide enlarged membership.

Keywords. Hands-on Science, Network, Association.

1. Improving Science Education towards a Sustainable Development

Established in October 2003 in the frames of the Comenius 3 action of the Socrates program of the European Commission, the European Network "Hands-on Science" developed since then a vast range of activities towards a better Science Education in European Schools².

Our main goal is the promotion and development of Science Education and scientific literacy in Europe. We aim to generalise innovate and improve Science & Technology teaching at basic vocational training and secondary schools by hands-on experimental practice in the classroom. *Bringing hands-on active learning of Science into the classroom and into the soul and spirit of the school.*

The network, established now as an International Association, enrolls as institutional or individual members, over two hundreds schools, several universities, national and international associations, governmental bodies, science centres and museums, NGO's and companies of practically all countries of the European Union and from all over the world.

About a thousand teachers and educators from kindergarten to high and vocational training schools including special education institutions and well over 20000 pupils are or had been directly and actively involved in our activities.

Several dozens of lectures, countless experimental activities in the classroom, experiments demonstrations plays festivals and science fairs were organised. Several science clubs were established are working actively and passionately... discovering Science.

Training seminars and courses for teachers and pupils had been developed at national and European level. Over four hundred pedagogical and scientific papers were published in conference proceedings and journals. Several books and experiments guides and support texts had been published in different languages. Multimedia CDROMs and DVDs were produced as well as fourteen websites in different languages:

<http://www.hsci.info>,
<http://hsci.no.sapo.pt>,
<http://www.hsci-pt.com>,
<http://colos.fcu.um.es/comenius/>,
<http://webs.uvigo.es/eventos/h-sci/>,
<http://ptcl.chem.ox.ac.uk/%7Ehmc/hsci/>,
<http://www.emg-huerth.de/comenius/index1.htm>,
http://www.hsci.info/hsci_si/,
<http://education.inflpr.ro/ro/hsci.htm>,
<http://users.skynet.be/fb738062/>,
<http://micro-kosmos.uoa.gr/Hands-on-Science/>

http://www.hsci.info/hsci_mt/,
<http://www.clab.edc.uoc.gr/hsci/>,
<http://lsg.ucy.ac.cy/other/hsci/>.

Most of the websites establish links to many other websites offering an enormous amount of resources (including remote laboratories like the site <http://colos.fcu.um.es/r/lab/>) that can be used freely by teachers, students, and all interested persons in general.

Various press-conferences news and reports were organised disseminating the results of our work in our communities.

A major public relations campaign stating and illustrating the importance and the absolute need of a generalized use of practical hands-on experiments at the classroom as basis the education in Science at all school levels was developed aiming EU' schools, decision makers governments and politicians, universities, networks and national and transnational associations, science museums and other institutions involved with non-formal or informal education, the industry, local communities and the citizens in general.

Several successful Comenius 1 and Comenius 2 cooperation projects between dozens European schools and other institutions had been promoted in different subjects: robotics, renewable energies, optics, in-service science' teachers training, sociology and European identity, arts and science, and sustainable development. Other types of cooperation resulted also from the three Socrates/Comenius Contact Seminars we organized as part of our annual conferences in Ljubljana, Slovenia in 2004, in Crete in 2005 and in Braga in September 2006. The 2007' conference in Ponta Delgada, Azores, in this European year for "Equality" will focus on "Developed Diversity and Inclusion in Science Education.

Three international workshops were organized in Cologne, Malta and Bucharest to discuss issues of utmost importance as the Access of Women to Science, Scientific Literacy the Development of Europe and the Challenges of EU' Enlargement, and the increasing importance of Life Long Learning and Scientific Literacy in our Societies.

The "1st International Conference on Hands-on Science. Teaching and Learning Science in the XXI Century" held in 2004 in Ljubljana, was an excellent forum where 120 participants from 13 EU' countries presented 52 works and discussed the main aspects of modern Science Education establishing the basis for the work the network developed thereafter towards the

generalization of hands-on experimental work in science education at our schools.

In Crete, July 2005, the HSCI2005 conference, "2nd International Conference on "Hands-on Science. Science in changing Education", gathered nearly 200 participants from 27 countries of the five continents that presented 81 communications discussing the changes education is facing these days in our schools. An interesting science fair was the preferred meeting point for informal contacts and friendly exchange of experiences and good practices.

In September 2006, 4 to 9, at the University of Minho in Braga, Portugal, our "3rd International Conference on Hands-on Science. Science Education and Sustainable Development", HSCI2006, proved the importance and prestige our organizations reached among the EU', and world's, educational and scientific community (a web search for the phrase 'Hands-on Science International Conference' gave more than 1 million hits most of them referring to our annual conferences and over 1/3 of all hits on hands-on science refer to activities of our network³).

Over 450 persons registered to the conference and the 314 effective participants from 41 countries presented 270 works, involving 432 co-authors, apart of 137 hands-on experiments presentations (many including several different experiments) at the 1st European Science Fair we organised from the 5 to the 8 of September that was visited, apart from the conference participants, by more than 500 students teachers and interested citizens in the most active and enthusiastic way.

In the overall over 790 scientists teachers students heads of school politicians ministers and other national and local governments representatives, NGO and media from 43 country (mostly from the EU) actively participated in our six major meetings presenting their ideas in 403 works, published and freely available in our websites in electronic format, and established a set of major recommendations and work' support material that, we truly believe, will positively influence the way Science Education is approached in our schools.

2. The future of Hands-on Science

With the active contribution of all network members and individuals and institutions committed to the improvement of science education, the Hands-on Science network will continue growing and contributing to the improvement of scientific literacy and to the quality of science education and thus to a sustainable development of our societies.

The Hands-on Science Network⁴ will be maintained in the form of an International Association (www.hsci.info) and will keep growing enlarging its membership and the impact of its activities and proposals in our schools and societies...

inducing a better science education ...
in favour of a sustainable development ...
... towards a brighter future of humankind ...

3. Conclusion

World' sustainable development both in economical and social terms strengthening the democracy and social cohesion in our societies with high levels of human development in respect to the United Nations chart of human rights should be a goal of all countries and of each one of us.

The importance of Science, both the pursuit of knowledge and the search for practical uses of scientific knowledge, is widely recognised at all levels in modern societies. A strong and enlarged scientific literacy is fundamental to the development of science and technology but also to a democratic citizenship.

4. Acknowledgements

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5. References

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