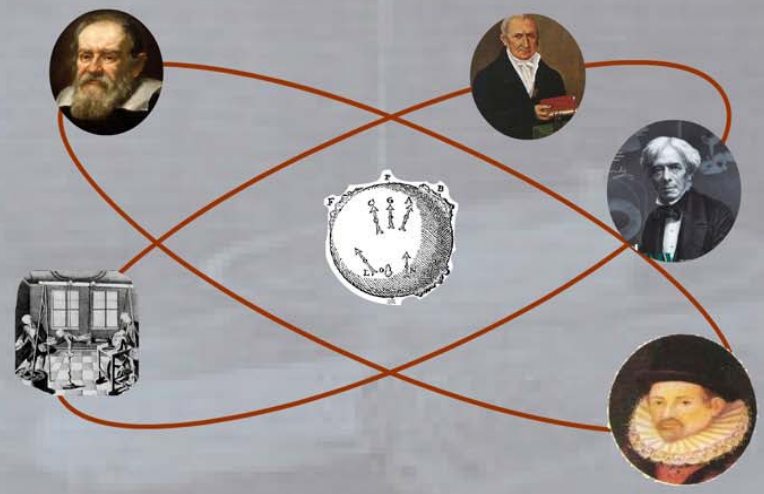
7th International Conference for History of Science in Science Education



"Nothing is too wonderful to be true if it be consistent with the laws of nature."

"Adapting Historical Knowledge Production to the Classroom"

Monday July 7th to Friday July 11th 2008

National and Kapodistrian University of Athens

Athens Greece

http://www.primedu.uoa.gr/sciedu/7ICHSSE/
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created by E. Stamoulis

7th International Conference for History of Science in Science Education

(Workshop of experts)

"Adapting Historical Knowledge Production to the Classroom"
National and Kapodistrian University of Athens,
Athens Greece
From Monday July 7th to Friday July 11th, 2008.

Under the auspices of the Greek Ministry of National Education and Religious Affairs

The International Conference for the History of Science in Science Education is developing a tradition (for information about the recent conferences see http://www.sci-ed.ca/conferences.htm).

The conference will be located at the National and Kapodistrian University of Athens Central Building, 30 Panepistimiou Ave, Athens, Greece.

The idea of the conference is experts to exchange views on establishing the history of science in science education. In particular, the discussions of the participants should play a central role in the conference; consequently the number of papers as well as the number of participants is limited. Therefore, participation in the conference is desired, but interested parties have to register.

The language of the conference will be English.

7th International Conference on History of Science and Science Education-Workshop of Experts		
CONFERENCE PROGRAM		
Monday	**7/7/2008**	
18:30-19:15	**Opening Session**	
19:15-20:00	Panagiotis Kokkotas, Emeritus Professor, National and Kapodistrian University of Athens	The contribution of Greek scientists to the development of contemporary science: The case of Constantine Caratheodory
20:00-20:45	Michael Matthews, School of Education at the University of New South Wales	Teaching the Philosophical and Worldview Components of Science
20:45	**Dinner**	
Tuesday	**8/7/2008**	
Pannel of the session:	**Arthur Stinner, Kostas Gavroglou, Agustin Aduriz Bravo**	
09:00-09:45	William McComas,University of Arkansas, U.S.A.	Should the History of Science be the Future of Science Education?
09:45-10:30	Kostas Gavroglou, National and Kapodistrian University of Athens	The teaching of the physical sciences /versus/ the teaching of history of science: an impossible coexistence
10:30-11:15	Stathis Psillos, National and Kapodistrian University of Athens	Is the history of science the wasteland of false theories?
11:15-11:45	**Coffee Break**	
Pannel of the session:	**William McComas, Peter Heering**	
11:45-12:30	Elizabeth Cavicchi, Edgerton Center, Massachusetts Institute of Technology, U.S.A.	Classroom Explorations with Pendulums, Mirrors, and Galileo's Drama
12:30-13:15	Peter Heering, Institute of Physics, Carl-von-Ossietzky Universitaet Oldenburg, Germany - Stephen Klassen, University of Winnipeg, Canada	Troublesome droplets: Evaluating students' experiences with the Millikan oil drop experiment
13:15-14:00	Cibelle Celestino Silva, Institute of Physics of Sao Carlos, University of Sao Paulo, Brazil	Which HPS do/should textbooks refer to? The historical debate on the nature of electrical fluids
14:00-16:00	**Break**	

Pannel of the session:	**Cibelle Celestino Silva, Ian Winchester, Dimitris Koliopoulos**	
16:00-16:45	Ian Winchester,Professor, University of Calgary, Canada	The relevance of Collingwood's "The Idea of Nature" for contemporary history of science in relation to science education
16:45-17:30	Juraj Sebesta, Department of Theoretical Physics at Comenius University in Bratislava	History and philosophy of physics in physics education: case study of Slovakia
17:30-17:45	**Coffee Break**	
Pannel of the session:	**Juraj Sebesta, Antoni Roca Rossel**	
17:45-18:30	Antoni Roca Rossel, Polytechnical University of Catalonia, Barcelona, Spain	Integration of science education and history of science: The Catalan Experience
18:30-19:15	Ricardo Lopes Coelho and Ricardo Guardado, Faculty of Sciences of the University of Lisbon	On the Concept of Energy: How Understanding its History can Improve Physics Teaching
Wednesday	**9/7/2008**	
Pannel of the session:	**Panagiotis Kokkotas, Michael Matthews, Aristides Baltas**	
09:00-09:45	Dimosthenis Assimakopoulos, Professor, Vice Rector, National and Kapodistrian University of Athens	Historic Review on the Atmospheric Environment and Climate Change Issues
09: 45- 10:30	Aristides Baltas, National Technical University of Athens	Science Education and the Grammar of Scientific Change
10:30-11:15	Gabor Zemplen, Budapest University of Technology and Economics Department of Philosophy and History of Science	History of science and argumentation in science education: joining forces?
11:15-11:45	**Coffee Break**	
Pannel of the session:	**Fabio Bevillacqua, Elizabeth Cavicchi, Gabor Zemplen**	
11: 45- 12:30	Fabio Bevillacqua, Pavia University	History of Science and the digital revolution: the challenge of participatory media
12:30- 13:15	Xenophon Moussas, Associate Professor in Space Physics, Astrophysics Laboratory, National and Kapodistrian University of Athens	The Antikythera Mechanism: The oldest astronomical instrument and computer
13:15-14:00	Muriel Guedj, Montpellier University	History of science and technology in the French system for teacher training: about a recent initiative
14:00-16:00	**Break**	

Pannel of the session:	**Brigitte Van Tiggelen, Muriel Guedj**	
16:00-16:45	Brigitte Van Tiggelen, Universite catholique de Louvain, Louvain-la-neuve, and Memosciences asbl, Belgium	Gases: a nebulous concept. Can historical accounts help?
16:45-17:30	Dimitris Koliopoulos, Assistant Professor, University of Patras	The problem of measuring time with the help of the simple pendulum: The use of texts from the history of physics as tools for the investigation of pupils' conceptions
Thursday 10/7/2008	**Visit to sightseeings**	
Friday	**11/7/2008**	
Pannel of the session:	**Stephen Klassen, Xenophon Moussas, Fanny Seroglou**	
09:00-09:45	Arthur Stinner, Professor of Science Education, Faculty of Education University of Manitoba, Canada	Using selected Nobel lectures in physics to teach the history of early modern physics to future physics teachers
09:45-10:30	Agustin Aduriz Bravo, Assistant Professor, CEFIEC, Universidad de Buenos Aires, Ciudad Autonoma de Buenos Aires, Argentina	Use of the history of science in the design of research-informed NOS materials for teacher education
10:30-11:15	Fanny Seroglou, Lecturer, School of Primary Education, Faculty Of Education, Aristotle University of Thessaloniki	History of science and culture in science teaching: From the Manhattan project to the space race
11:15-12:00	Dietmar Hottecke, Institute for Science Education, Dep. of Physics, University of Bremen & Falk Riess, Institute of Physics, Carl-von-Ossietzky Universitaet, Germany	Developing the Culture of School Science Practice – A European Approach for the Inclusion of History and Philosophy in School Science Teaching
12:00-12:30	**Coffee Break**	
12:30-13:30	Symposium for STeT Project: Kokkotas Panagiotis, Bevilacqua Fabio, Heering Peter, Seroglou Fanny The project is funded by the EU	
13:30-14:00	**Closing remarks**	

7th International Conference on History of Science and Science Education- Workshop of Experts

ABSTRACTS

Panagiotis Kokkotas,
Emeritus Professor, National and Kapodistrian University of Athens

The contribution of Greek scientists to the development of contemporary science: The case of Constantine Caratheodory

Abstract: From ancient years Greeks contributed to development of scientific knowledge being referents for next eras' scientists. This paper concerns one of the most prominent and contemporary Greek scientists with acknowledged contribution to scientific community, Constantine Caratheodory, a man of unusually extensive education who substantially enriched and vitally influenced science. We particularly focus on his work on science, how this influenced development of contemporary science and gave the opportunity to other scientists (e.g. Einstein) to extend his ideas and discover new knowledge.

Michael Matthews,
School of Education at the University of New South Wales

Teaching the Philosophical and Worldview Components of Science

Abstract: A common feature of contemporary science education curricula is the expectation that as well as learning science content, students will learn something about science – its nature, its history, how it differs from non-scientific endeavours, and its interactions with culture and society. These curricular pronouncements provide an 'open cheque' for the inclusion of history and philosophy of science in science teacher education programmes, and for their utilisation in classrooms. Unfortunately this open cheque is too often not cashed. This paper will discuss an important aspect of the contribution of science to culture, namely its role in the development of worldviews in society. A case study of the adjustments to a central Roman Catholic doctrine occasioned by the metaphysics of Atomism which was embraced at the Scientific Revolution will be presented. Options for the reconciliation of seemingly conflicting scientific and religious worldviews are laid out, and it is claimed that as far as liberal education is concerned, the important thing is to have students first recognise what are the options, and then carefully examine them to come to their own conclusions about reconciliation or otherwise.

William McComas,
University of Arkansas, U.S.A.

Should the History of Science be the Future of Science Education?

Abstract: Science educators have embraced the recommendation that high quality science teaching includes both relevant science content and rich discussions of how science knowledge is created in science and how truth claims are evaluated -- typically called the Nature of Science (NOS). There is also increasing agreement on which specific aspects of NOS should be taught. Therefore, the time has come to consider the equally important but much less defined task of how to teach NOS. This presentation will examine the role to be played by incorporating the history of science though a "socio-historical instructional" approach to the teaching of NOS by discussing the rationale, reviewing prior related strategies and considering some examples.

Kostas Gavroglou,
National and Kapodistrian University of Athens

The teaching of the physical sciences /versus/ the teaching of history of science: an impossible coexistence

Abstract: The aim of the paper is to show that it may, perhaps, be impossible to teach history of science as an integral part of the teaching of the physical sciences. This is neither to underestimate the many historical details which could be incorporated in the teaching of the physical sciences nor to minimize the efforts to give a new perspective to the teaching of the physical sciences through the help from history science. Nevertheless, the teaching of the physical sciences is fundamentally dictated by a positivist approach, and the reconstruction of their own history has the objective to make teaching more effective. But such characteristics come into a direct clash with the methods and objectives of history of science.

Stathis Psillos,
National and Kapodistrian University of Athens

Is the history of science the wasteland of false theories?

Abstract: The pessimistic induction is a well-known argument against scientific realism. It capitalises on the history of radical theory-change in science in order to remove any kind of warrant for taking current theories to be truthlike (or closer to the truth than their predecessors). Over the last two decades, realists have tried to block this argument by looking into the history of science and trying to identify ways to restore some substantive and truth-oriented continuity in theory change. What can there be the relevance of this kind of philosophical debate over the history of science to science education? This paper will focus on this question and will examine the prospects of a philosophical narrative of the history of science that presents it as a mixed story of change and truth-oriented continuity.

Elizabeth Cavicchi,
Edgerton Center, Massachusetts Institute of Technology, U.S.A.

Classroom Explorations with Pendulums, Mirrors, and Galileo's Drama

Abstract: What do you see in a mirror when not looking at yourself? What goes on as a pendulum swings? Undergraduates in a science class supposed that these behaviors were obvious until their explorations exposed questions with no quick answers. While exploring materials, students researched Galileo, his trial, and its aftermath. Galileo came to life both in their presentations about him, and in the context of lab investigations by the emerging class community. Questions and experiments evolved continually; differing perspectives on science and authority were exchanged respectfully. In rediscovering their own capacity for wonder, students developed as critical explorers of the world.

Peter Heering,
Institute of Physics, Carl-von-Ossietzky Universitaet Oldenburg, Germany
Stephen Klassen,
University of Winnipeg, Canada

Troublesome droplets: Evaluating students' experiences with the Millikan oil drop experiment

Abstract: Millikan's oil drop experiment is among the classic experiments from modern physics; moreover, it is considered to be one of the 'most beautiful' experiments of all time (Crease, 2002). These classifications, however, contrast with the laboratory experience of students and instructors in performing the experiment, for "… as a teaching-lab experiment it does not enjoy a good reputation for three principal reasons: eyestrain, tedium, and poor, unconvincing results" (Jones, 1995). The existing concerns, resulting in questioning its educational value, led us to start a research project on the Millikan experiment in order to improve its educational potential.

In the project, we have been producing and using instructional materials that reflect how the experiment has developed historically. At the same time, we have evaluated the responses of students working with the various instructional versions of the Millikan experiment. In the paper, we will first compare the design and use of two didactic experimental set-ups with the original account of Millikan's experiment. In the second part, we will present the results of an evaluation of the responses of Canadian students. This evaluation is based on three questionnaires that the students were asked to answer before, during, and after their activities with the Millikan experiment. The questionnaires were supplemented with structured interviews, carried out several weeks after the lab period, in order to evaluate the students' understanding of the experiment after they had submitted reports and to provide clarity for the questionnaire results. Finally, we present some tentative proposals and recommendations to ameliorate the current situation.

Crease, Robert P.: The most beautiful experiment. In Physics World, Sept. 2002, http://physicsworld.com/cws/article/print/9746 (last access Jan. 11th, 2008)
Jones, Ray C.: The Millikan oil-drop experiment: Making it worthwile. In: American Journal of Physics 63 (1995), S. 970-977

Cibelle Celestino Silva,
Institute of Physics of Sao Carlos, University of Sao Paulo, Brazil

Which HPS do/should textbooks refer to? The historical debate on the nature of electrical fluids

Abstract: This paper analyzes how history of electricity is presented in textbooks for fundamental and secondary schools in Brazil. In particular it focuses on the 18th century debate on the nature of electrical fluids with a special regard of Benjamin Franklin's studies on electricity. It will be analyzed how textbooks address these issues. This study takes into account the quality of historical information and ideas on the nature of science conveyed by these historical narratives. Usually these narratives have a pseudo historical character, which reinforces the idea of ingenious minds in science, a strong whiggish character and transmit an empirical-inductivist view on the dynamics of science. Such a representation of science and its history is hardly appropriate to develop teachers' and students' understanding of the nature of science towards more sophisticated views. In previous research we have found that this sort of problem is recurrent in physics textbooks. The lack of adequate representations of scientific discourse in textbooks leads us to important questions of research and development which I would like to pose to the audience: What contents and which aspects of HPS should be stressed and included in textbooks in order to support the development of a more sophisticated understanding of science?

Ian Winchester,
Professor, University of Calgary, Canada

The relevance of Collingwood's "The Idea of Nature" for contemporary history of science in relation to science education

Abstract: Collingwood's "The Idea of Nature" is a major work in the history of scientific ideas. In it he points out that we live in the third great era in which the notion of "nature" has been centrally important. Our present notion of nature is quite different from that of the early Greek thinkers of the 6th and 5th centuries B.C. Nor is it the same notion as that of the 16th and 17th century thinkers dominated by the work of Descartes, Galileo and Newton. It is important for science students to know that the presuppositional structure of natural science depends in part on what we take "nature" to be at any era and within any given discipline.

Juraj Sebesta,
Department of Theoretical Physics at Comenius University in Bratislava

History and philosophy of physics in physics education: case study of Slovakia

Abstract: Research on history and philosophy of physics in physics education (HPPPE) started in Slovakia at early 1990´s. Firstly, lectures on history and philosophy of physics have been included in the curriculum for future physics teachers in our faculty. Secondly, lectures and seminars on HPPPE started there at later 1990´s. At the turn of centuries two PhD students have started their researches on methods of using history of physics in secondary school physics education and introduced them into classes. Results of these efforts will be presented and discussed in contribution.

Antoni Roca Rossel,
Polytechnical University of Catalonia, Barcelona, Spain

Integration of science education and history of science: The Catalan Experience

Abstract: History of science offers an interesting perspective on the world of science in order to better understand the cognitive challenges of humanity and the social roots of science and technology. These issues could be contrasted with science education that is usually structured along rigid ideas and procedures beyond historical contingencies. The role of history of science in education ought to provide an alternative view of science and technology, placing them in a human context. To achieve this objective is not easy. There are a number of groups working on this objective in Barcelona. These groups have two main orientations. First, dissemination of historical content in science education, highlighting the educational value of case studies. In certain topics, history is a good way to teach science, involving an active participation of the students. This option is currently being developed by a number of groups in secondary education. Second, special courses on history of science and technology. This option exists at the university level and, in general, the syllabuses of these courses undertake the historical analysis of disciplines and professions with the aim of placing university studies in their historical and social context. In the case of engineering education, increasing specialisation of the syllabus must be balanced to give a general view of technology, which would embrace sustainable development and the commitment of engineers to society. In the two options, there is a pressing need for historical research to minimize risks such as anecdotal accounts or misplaced internalism and externalism. The education of historians of science constitutes a challenge. In this regard, doctorate courses and a master programme are available in Barcelona.

Ricardo Lopes Coelho and Magda Isabel Goncalves,
Faculty of Sciences of the University of Lisbon

On the Concept of Energy: How Understanding its History can Improve Physics Teaching

Abstract: Some physicists have pointed out that we do not know what energy is. Many studies have shown that the concept of energy is a problem for teaching. A study of the history of the concept shows that the discoverers of energy did not find anything which is indestructible and transformable but rather that the concept of energy underwent a change of meaning. In distinguishing between the treatment of phenomena and the theories carried out by Mayer and Joule, it can be concluded that they established equivalences between different domains.

Dimosthenis Assimakopoulos,
Professor, Vice Rector, National and Kapodistrian University of Athens

Historic Review on the Atmospheric Environment and Climate Change Issues

Abstract: Historic revision on atmospheric environment issues indicates that, human attitude and teaching approach on scientific developments follow almost the same pattern.
Examination of the most important historic turning points on scientific developments in this field is very revealing uncovering interesting issues on the human achievements. In this respect reference is made on the most important figures and philosophers who created the fundamental scientific background on environmental instrumentation development. Further more special attention is made on the last 150 years of environmental records during which most quantitative data is collected.
Typical examples of scientific records on atmospheric environment observations are also presented. Finally the case of the last Inter-governmental Program on Climate Change 2007 report will be used as platform to discuss how scientific decisions are taken and what will be the future developments on the earth climate following the recent international agreements.

Aristides Baltas,
National Technical University of Athens

Science Education and the Grammar of Scientific Change

Abstract: Paradigm change in Physics (for example the passage from Classical Mechanics to the Special Theory of Relativity) challenges what we might call the “grammar” of the old paradigm. “Grammar” in this sense determines from the background the syntactic as well as the semantic aspects of the old concepts and particularly those the passage in question bears directly upon. Studying “grammar” in this sense can lead to interesting results in respect to the effective teaching of the novel theory, for it can manifest the conditions of its understanding. We will try explaining the notion of “grammar” at issue here and we will give examples of how our employing this notion might assist our student’s understanding the novel theory.

Gabor Zemplen,
Budapest University of Technology and Economics Department of Philosophy and History of Science

History of science and argumentation in science education: joining forces?

Abstract: Science education can benefit in numerous ways from the insights of history of science. Apart from the 'body' of the scientific disciplines, studying historical knowledge production can also help the introduction of the 'nucleus' and the 'periphery' of science subjects (to use the terminology of Tseitlin & Galili 2005). As opposed to the curricular efforts focusing on 'body' of scientific disciplines, the paper tries to map how history of science can be utilized to develop a) knowledge and skills on the 'nature of science', b) citizenship (including 'socio-scientific issues' and 'public understanding of science') and c) reflective, critical thinking via argumentation. The paper argues that in these areas recent curricular efforts that incorporate historical aspects can be linked with those that stress the role of argumentation in science education (Erduran and Jiménez-Aleixandre 2008).

Erduran, Sibel, Jiménez-Aleixandre, María Pilar (2008) Argumentation in Science Education - Perspectives from Classroom-Based Research. Springer.

Tseitlin, M. and Galili I. (2005). 'Teaching physics in looking for its self: from a physics-discipline to a physics-culture', Science and Education, 14 (3-5), 235-261.

Fabio Bevillacqua,
Pavia University

History of Science and the digital revolution: the challenge of participatory media

Abstract: In the last sixty years we have seen the emergence and the development of not only "big science" but also modern history of science, digital technologies and science education studies. A number of interactions and debates have connected these four fields. Today a new scientific and technical revolution is underway: it might allow a new, more participative and democratic approach to the recurrent "two cultures" debate. The present and the future offer plenty of opportunities. Will we be able to make good use of them?

Xenophon Moussas,
Associate Professor in Space Physics, Astrophysics Laboratory, National and Kapodistrian University of Athens

The Antikythera Mechanism:
The oldest astronomical instrument and computer

Abstract: The Antikythera Mechanism is an excellent attractor of pupil and young people to Science, Mathematics, Engineering and Technology. This old astronomical instrument of the 2nd century BC found in an ancient shipwreck of the 1st century BC, looks like an oxidized grand mother's clock made of bronze gears. It is the oldest known analogue computer that calculates the position of the Sun, the Moon (its phases), the eclipses of the Sun and the Moon, several calendars, based on the Saros, Exeligmos, Meton's and Callippus cycles of 18 years, 54 years, 19 years and 76 years respectively.

The Antikythera Mechanism rewrites the history of science and technology, and it is an excellent device to teach many subjects to children, astronomy, mathematics and physics, mainly modelling of physical phenomena, and computing as well with analogue methods (gears that multiply for example).

The interest concerning the Antikythera Mechanism in Greece and worldwide is enormous. We organize and participate to conferences, general public lectures, exhibitions, and we construct and contribute to models and replicas. The collaboration with amateur astronomer groups and physics and mathematics teachers, as well as with museums is very fruitful. We have a successful collaboration with the Children's Museum of Manhattan and we participate to their exhibitions Gods, Myths & Mortals: Discover Ancient Greece (www.cmom.org) with great success.

Muriel Guedj,
Montpellier University

History of science and technology in the French system for teacher training: about a recent initiative

Abstract: Recently, the french education ministry showed a real interest by introducing history of sciences in education (secondary schools but also primary school and university) The desire to develop scientific culture and the disaffection for scientific studies are at the root of this fact. But, because of the lack of practical instructions and training, the teachers have some difficulties to insert this point of view in their lessons :
Which history of sciences should be taught, why should it be taught?
Which school subject matters could be concerned and what are the connexions with sciences education?

Three years ago, the ReForEHST (Recherche et Formation en Epistémologie et Histoire des Sciences et des Techniques/Research and Training in Epistemology and History of Sciences and Technology) group was constituted between several IUFM (Institut Universitaire des Maîtres-university departments). The main ambitions of the group were, and still are, the following : first, to create and/or sustain a community of teachers, teacher trainers and professional historians working on,

using, or simply interested in, the history and epistemology of sciences and techniques; second, to promote research and training activities within this community; third, to produce historical resources that may be useful and accessible to teachers as well as to teacher trainers; finally, to obtain some official recognition for these activities.
Since its establishment, the group, has taken several concrete steps to promote its aims. A first meeting; consisting of lectures and working groups, was organized in Montpellier in May 2005[1] The same year, the group planned a website[2] a mailing list and a new meeting. The latter was organized in Jan 2006 in Antony (near Paris), and included the possibility to present in thematic workshops teacher training activities[3] Finally, the last ReForEHST meeting was recently organized in Caen on a more particular theme (history of science and active pedagogy) and offered the possibility to present either research papers or teacher training activities[4].

If we take for granted, that history of science should be taught to students and teachers, there are still thorny questions we will discuss : (1) In which way should the history of science be taught? Is it always as successful as we find it described in enthusiastic reports of actual teaching experiences? Or are there failures and for what reasons? Who should study these issues? (2) What concrete opportunities exist for teaching or using history of science (or both)? Indeed while they are opportunities that are clearly indicated in official curricula[5], there are many others (in fact, the majority of them) which are not officially indicated but which are, in fact, excellent opportunities to introduce a historical perspective. What are these opportunities and how do they come to be recognized as such?

Therefore, the general line of argumentation and action we suggest is, in outline, the following:

- The first step is to establish as our point of departure the analysis of official instructions as well as the present state of teachers' needs;
- The second step is to show that, given a problem or request, history of science is or should be part of the answer;
- The third step is to show, through the analysis and diffusion of actual examples and experience, that history of science indeed helps to confront the difficulties analyzed in the first place;
- The last, complementary step is to demonstrate the necessity of time, experimentation, reflection and, therefore, of research.

1. *The detailed conclusions are available in French in (ReForEHST 2006); see http://www.montpellier.iufm.fr/internet/site/recherche/revuetrema/modele/index.php?f=paruti ons .*
2. *See http://plates-formes.iufm.fr/ehst*
3. *See the program on http://plates-formes.iufm.fr/ehst/article.php3?id_article=9*
4. *A summary of the interventions is available (in French) on http://plates-formes.iufm.fr/ehst/article.php3?id_article=37 and the proceedings should be published soon in a special issue of the Cahiers du Centre François Viète.*
5. *The tarte à la crème example is the study of the law of free fall, for which it is rare not to see some encouragement to study Galileo's writings, or at least experiences.*

Brigitte Van Tiggelen,
Universite catholique de Louvain, Louvain-la-neuve, and Memosciences asbl, Belgium

Gases: a nebulous concept. Can historical accounts help?

Abstract: Very early in the school curriculum, children are taught that there are three states of matter: solid, liquid and gas. Whereas the solid and liquid states are very easy to illustrate, the gaseous state is tricky and the examples often chosen (clouds, steam, scent...) do often confuse more, and even distort later understanding.
Drawing on pre-conceptions that can be inferred from students' drawing and "errors", it seems natural to go back to the historical development of the concept, taken both from the history of physics and the history of chemistry, and use some turning points and historical experiments to clarify the concept.

Pre- and in-service teachers highly appreciate science teaching with a strong cultural perspective as it offers them motive and inspiration to learn and teach science in a way that encourages all students to participate in science learning. This is the main aim of a teacher training course titled “Science and Culture in Education”. The course is attended by pre-service teachers at the School of Primary Education at the Aristotle University of Thessaloniki. One of the three parts of the course is focused on presenting scientific events that have been influenced by and have influenced culture. In this paper two case studies concerning the Manhattan project during the Second World War and the space race during the cold war are presented. Pre-service teachers attend films presenting aspects of these events, participate in face-to-face as well as by distance discussions concerning science and culture interrelations and produce final projects going on at an in-depth analysis of the effect of research concerning the atom bomb and space rockets on culture, society and education.

Dimitris Koliopoulos,
Assistant Professor, University of Patras

The problem of measuring time with the help of the simple pendulum: The use of texts from the history of physics as tools for the investigation of pupils’ conceptions

Abstract: The subject of this paper is linked to a broader empirical research study regarding how 13-14-year-old Greek pupils understand whether, why and how it is possible to measure time with the help of a simple pendulum. The purpose of the study is to ascertain whether and in what ways children of this age a) conceive the pendulum as a mechanism for the precise measuring of time, and b) conceive why it is possible to measure time with the help of a simple pendulum. The first question is related to the cultural dimension of scientific knowledge, i.e., to whether one knows what a pendulum clock is and how historically it has replaced all other forms of clocks, while the second question is related to the conceptual and methodological dimension of scientific knowledge and, mainly, to whether one perceives the

isochrony of pendulum motion as well as the way in which we control its existence. Two complementary methods are used in order to trace the pupils' conceptions: the review, with the help of a pertinent questionnaire, and the group observation technique. In this paper we will be presenting data related to the conceptual and methodological dimension of scientific knowledge which originate in group observation technique. This technique consists in the documentation of a discussion between pupils and researchers in the context of "situations/problems" posed to the pupils on the occasion of the pupils' commentary of two texts of historical content. The first text contains extracts from Galileo's book Dialogue Concerning Two New Sciences and is related to the paradox of the isochronous motion of the simple pendulum. The second one refers to a description of the discovery by the astronomer J. Richer concerning the delay of a pendulum clock as a consequence of its being moved from Paris to the city of Cayenne in French Guyana, on the Equator. An initial analysis of the data that resulted from this method led to the following basic conclusions:

(a) in the conceptual domain, most pupils cannot perceive the pendulum's isochronal motion, while the discussions reveal that when they try to study that problem (reproducing, in a way, the historic dialogue between Salviati and Sagredo on the same topic!), in their effort to explain the paradoxical result of isochronal motion, they formulate Aristotelian-type conceptions,

(b) in the methodological domain, it is a basic methodological problem for the pupils to recognize and select the proper variables in the investigation of the relationship between the period, the length of the string and gravity. This seems to be due to the fact that, during the discussion, they construct the concept of the period which is not pre-existing in them as implied in traditional teaching.

The rich conclusions produced by the aforementioned method, show that the use of texts that originate in the history of physics can constitute, in addition to other things, the proper methodological tool for the investigation of the conceptions expressed by students of the concepts and methodology of physics.

Arthur Stinner,
Professor of Science Education, Faculty of Education University of Manitoba, Canada

Using selected Nobel lectures in physics to teach the history of early modern physics to future physics teachers

Abstract: More than two decades ago, Clifford Schwartz wrote an editorial in the "Physics Teacher" entitled: "On the teaching of Newtonian physics to Aristotelian minds in the days of quantum operators". Schwartz challenged physics teachers to keep abreast of contemporary physics for their own development and then urged them to introduce physics using ideas that allowed students to connect to modern physics more easily.
In this presentation I will describe the course I am teaching to "teacher-candidates", using a selected number of Nobel lectures, from Roentgen (X-rays, 1901) to James Chadwick (discovery of the neutron, 1936). The concepts and foundational experiments contained in these lectures cover the basic ideas of modern physics. Presenting these ideas and experimental confirmation in this manner provides a richer context and a more sophisticated level of learning, which in turn leads to a more self-confident approach to the teaching of modern physics to young students.

Agustin Aduriz Bravo,
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Use of the history of science in the design of research-informed NOS materials for teacher education

Abstract: Nature of science has been recognised as a major component of science teacher education. Consequently, several programmes, recommendations and materials have been issued. It is currently of utmost importance to design, implement and evaluate instructional units, or teaching-learning sequences, that draw from NOS research and aim at changing prospective and in-service teachers' ideas on what science is and how it works. Within this kind of materials, the use of history of science is often recommended; nevertheless, there are several ways to integrate historical knowledge with other meta-scientific content in NOS instruction. In this presentation, I will present one possible rationale of integration, which uses the history of science as a set (in the theatrical sense) to learn key-ideas from 20th century philosophy of science.

Fanny Seroglou,
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History of science and culture in science teaching: From the Manhattan project to the space race

Abstract: Science and culture are interrelated and interact influencing one another. History of science offers the background to bring forward, discuss and reflect on a variety of science and culture interrelations. As science evolves and changes in time, also offers an evolutionary and innovative momentum to culture and society, providing to the new generations the field not only to seek for new answers to the old questions but furthermore to redefine some of the fundamental questions. Science is a social activity driven by the visions and values of society, while scientific concepts and theories reflect the social, political, ethical, financial and environmental conditions of their times.

Pre- and in-service teachers highly appreciate science teaching with a strong cultural perspective as it offers them motive and inspiration to learn and teach science in a way that encourages all students to participate in science learning. This is the main aim of a teacher training course titled “Science and Culture in Education”. The course is attended by pre-service teachers at the School of Primary Education at the Aristotle University of Thessaloniki. One of the three parts of the course is focused on presenting scientific events that have been influenced by and have influenced culture. In this paper two case studies concerning the Manhattan project during the Second World War and the space race during the cold war are presented. Pre-service teachers attend films presenting aspects of these events, participate in face-to-face as well as by distance discussions concerning science and culture interrelations and produce final projects going on at an in-depth analysis of the effect of research concerning the atom bomb and space rockets on culture, society and education.

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Developing the Culture of School Science Practice – A European Approach for the Inclusion of History and Philosophy in School Science Teaching

Abstract: History and philosophy of science (HPS) are hardly implemented into school science practice. Even if teachers have a scientific background in HPS they rarely include HPS into their daily teaching. On the other hand official documents all over the world stress the important role HPS has to play for a general scientific education and the development of functional scientific literacy. Within a European project we aim to close this gap between objectives and practice. HIPST – History and Philosophy in Science Teaching – is funded by the European Commission and brings together 10 partners from all over Europe. They collaborate in order to develop and refine case studies for teaching and learning with and about HPS. Project outcomes will provide an enriched basis for an effective implementation of HPS. The developmental process is strongly routed in school science practice from the very beginning. Researchers collaborate with school science teachers and

experts from science museums. An advisory board provides expertise of history of science, school science administration and educational studies to the project. Next to HPS inquiry learning based on historical replicas will be a central method to foster learning about nature of science. Accompanying empirical research broadens our knowledge about the effectiveness of the approach regarding both, the students' learning and teachers' pedagogical content knowledge.

Symposium for STeT Project:
Kokkotas Panagiotis, Bevilacqua Fabio, Heering Peter, Seroglou Fanny
The project is funded by the EU

Abstract: The project seeks to widen the training opportunities of science teachers by using important cases from the History of Science and investing on ICT technologies.
The main objective is to design and develop an interactive distance-learning website where science teacher advisors and in-service science teachers can locate guidelines and exemplary materials/ strategies conducive to effectively teaching and learning science (electricity and electromagnetism). The project will focus on developing exemplary/pilot training modules (a course), in the form of a Resource Kit for science teaching based on case studies from the History of Science. The Resource Kit or training modules/materials will be made available to groups of prospective stakeholders via a web-site that can help teachers to design and develop materials for their own students. Intended users of this website will have access to tele-mentoring and will be invited to upload on the website their own materials, so that these can be used and evaluated by other users.
A variety of activities will be employed for the attainment of the objectives of the project and the diffusion of its outcomes, including online resources, an interactive distance learning, a dissemination workshop, a CD-ROM documenting the project, and a network of prospective users at the European level.

The conference is organized by

“Greek Association for Science Education”- (EDIFE)

National and Kapodistrian University of Athens

University of Patras

Aristotle University of Thessaloniki, Faculty of Education, School of Primary Education

under the auspices of the Greek Ministry of Education.

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