European Association for Research
on Learning and Instruction

4th European Symposium

Conceptual Change: Philosophical, Historical, Psychological, and Educational Approaches

ABSTRACTS

May 19-23, 2004
Delphi, Greece

European Association for Research
on Learning and Instruction

4th European Symposium
Conceptual Change: Philosophical, Historical, Psychological, and Educational Approaches

May 19-23, 2004
Delphi, Greece

ABSTRACTS

Edited by:
Stella Vosniadou, Christina Stathopoulou,
Xenia Vamvakoussi & Nektarios Mamalougos

Sponsors:
Olympic Airways, Commercial Bank of Greece, Greek Centre of Educational Research, Greek Ministry of Culture, Local Union of Municipalities and Communities in Fokis Prefecture, Gutenberg Publications

4th European Symposium on Conceptual Change
Philosophical, Historical, Psychological and Educational Approaches
Delphi, Greece. May 19-23, 2004

Web Site: http://cs.phs.uoa.gr/delphi2004
E-mail: delphi2004@phs.uoa.gr

Book of Abstracts

Laboratory of Basic and Applied Cognitive Science and Educational Technology
Department of Philosophy and History of Science,
National and Kapodistrian University of Athens, Greece
University Campus, Ano Ilissia, 15771, Athens, GREECE
Tel. Voice: +30 210 727 5506; Fax: +30 210 727 5504

Publication: The book of abstracts is published by Gutenberg Press.

Front Cover: The Charioteer (Heniochos). The bronze statue was found at Delphi and originally belonged to a larger group, which represented a chariot with four horses. Its height is 1.8m and is made up from six separate cast parts. It was dedicated to Apollo by Polyzalos, tyrant of Gela, in 478 BC, after he won the chariot-race at the Pythian Games (Archaeological Museum Delphi).

Back Cover: Remains of the Dome, ancient Rotunda Temple, dedicated to Athena, Goddess, of Wisdom (located in Delphi, Archaeological Site).

Contents

Preface & acknowledgements

On behalf of the International and Local Program Committees I would like to welcome you to the 4th European Symposium on Conceptual Change: Philosophical, Historical, Psychological and Educational Approaches, in Delphi, Greece, May 19-23, 2004. This meeting was organized and supported by the Cognitive Science Laboratory and the Cognitive Science Division of the Department of Philosophy and History of Science, National and Kapodistrian University of Athens. It became possible also through the support of the Greek Ministry of Culture, Olympic Airways, Commercial Bank of Greece, Greek Centre of Educational Research, Local Union of Municipalities and Communities in Fokis Prefecture, and Gutenberg Publications.

This volume brings together the abstracts of the keynote lectures, the invited symposia, the papers and the posters of the symposium. They include contributions from leading researchers investigating conceptual change from philosophical, historical, psychological, and educational perspectives. Special emphasis has been given to issues on conceptual change in physics and mathematics as well as the influence of epistemological beliefs and motivational factors on conceptual change.

The organization of this meeting would not have been possible without the expert help of many people. To the members of the local and scientific committees to the organizers of invited symposia, to the many members of the SIG and particularly its coordinators Kaarina Merenluoto and Gunilla Petersson, I would like to express my sincere thanks. I would like to especially acknowledge the help of my colleagues Ola Halldén, Erno Lehtinen, Margarita Limon, Lucia Mason, Aristides Baltas and Bill Brewer. Warm thanks also go to Giorgos Dardanos and Christos Stavropoulos from Gutenberg Publications and to a special crew of students from the University of Athens: Irini Skopeliti, Antonis Koukoutsakis, Athanassios Mol, Katerina Ligovanli, Maria Koulianou, Natassa Kyriakopoulou, Kalliopi Ikospentaki, and Vassiliki Siereki.

Scientific Programme and the book of abstracts owe their existence to the expertise and many hours of work of Xenia Vamvakoussi, Christina Stathopoulou, and Nektarios Mamalougos; my deepest thanks to every one of them.

Stella Vosniadou

Chair of the
4th European Symposium
on Conceptual Change

Commitees of the Conference

Chair of the Conference

Stella Vosniadou	Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece

International Scientific Committee

Aristides Baltas	National and Technical University of Athens, Greece
Ola Halldén	Stockholm University, Sweden
Erno Lehtinen	University of Turku, Finland
Margarita Limón	Universidad Autónoma de Madrid, Spain
Lucia Mason	University of Padova, Italy
Marianne Wiser	Clark University, USA

SIG Coordinators

Kaarina Merenluoto	University of Turku, Finland
Gunilla Petersson	Karolinska Institutet Stockholm, Sweden

Local Organising Committee (University of Athens)

Christina Stathopoulou, Xenia Vamvakoussi	Scientific Programme, Book of abstracts
Nektarios Mamalougos	Web Site, Book of abstracts
Antonis Koukoutsakis	Web updates, Communication
Irini Skopeliti, Erifylli Tsirempolou, Natassa Kyriakopoulou Rania Gikopoulou	Secretariat, Hotels
Athanassios Mol, Katerina Ligovanli	Fund Raising and Catering
Kalliopi Ikospentaki, Maria Koulianou, Vassiliki Siereki	Cultural Activities, Transportation

attention was given to the same exactly subjects, within the same curriculum and timetable, by the teachers and their students. This indicates that the CSCL environment is more successful in producing conceptual change.

References

Bereiter, C. (2002). *Education and Mind in the Knowledge Age*. Mahwah NJ: Lawrence Erlbaum Associates

Brown, A. L. & Campione, J. C. (1994). Guided discovery in a community of learners. *In K. McGilly (Ed.) Classroom lessons: Integrating cognitive theory and class-room practice*. Cambridge, MA: MIT Press / Bradford Books

Scardamalia M. and Bereiter C. (1996), Chapter 10: "Computer Support for Knowledge-Building Communities", *in book "CSCL: Theory and Practice of an Emerging Paradigm*", edited by Timothy Koschmann, Southern Illinois University, 1996, Lawrence Erlbaum Associates Inc. Mahwah, New Jersey

Vosniadou, S., Kollias, V., Mamalougos, N., Vlassa, M. (1999): "Computer Supported Collaborative Learning and Conceptual Change in Science", CSCL 1999 Conference, Stanford University, USA

Vosniadou S. (2001), "How children learn", *Booklet, International Academy of Education*, International bureau of Education, UNESCO, 2001

Vosniadou, S., Ioannides, C., Dimitrakopoulou, A., & Papademetriou, E., (2001) Designing learning environments to promote conceptual change in science. *Learning and Instruction*, Vol. 11, pp. 381–419.

B. Science Learning and Instruction

Chair: George Tsaparlis, University of Ioannina, Greece

Discussant: Lia Halkia , University of Athens, Greece

Conceptual Change in the Teaching and Learning of Solar Energy with 6th Grade Primary School Children in Greece

Nektarios Tsagliotis, University of Crete, Greece

Review of literature

Over the last twenty five years, many theoretical approaches on learners' conceptual change in science education have been developed (cf. Duit, 2002). In general terms, it appears that *"conceptual change denotes learning pathways from students' pre-instructional conceptions to the science conceptions to be learned"* (Duit, 1999). The classical approach of Posner *et al.* (1982) and its revised version (cf. Strike & Posner, 1992) is considered to support *a radical form* of conceptual change. Science educators faced several difficulties when they attempted to put

into practice the four proposed conditions (*dissatisfaction, intelligibility, plausibility* and *fruitfulness*) in order to promote successful conceptual change. Strike & Posner (1992) criticise their theory for being too linear and overly rational, based on the assumption that learners have well-articulated conceptions or misconceptions for most science concepts.

Hewson & Hewson (1992) suggest that conceptual change can be seen through a change of *status,* which can be attributed to a particular conception and they distinguish between *conceptual capture* and *conceptual exchange* or *replacement*. Carey (1991) and Vosniadou (1994) appear to be considering a form of *weak restructuring* with elements of *enrichment* of pre-existing knowledge and *strong* or *radical restructuring* with elements of *revision* of prior knowledge and explanatory "framework theories" with the formation of "mental models" (Vosniadou, 1994), involving ontological and epistemological changes.

A radical notion of conceptual change is often related to restructuring, revision or accommodation of new conceptions to the learners existing systems of beliefs or knowledge. Nevertheless, as Duit & Treagust (2003) contend, there is no documentation of a case where a learner's conception could be completely extinguished or even replaced by a new idea. In this sense, conceptual change may not always be a radical, revolutionary shift in a learner's conceptions of a phenomenon. It can also be a gradual, evolutionary change in the way learners continuously enrich and reconstruct their conceptions, in an attempt to interpret the world in more advanced ways, within a context that includes situational and cultural factors facilitating this process (Vosniadou & Ioannides, 1998; Vosniadou *et al.*, 2001). Moreover, affective factors, such as the learners' goals, intentions, purposes, needs and expectations, appear to be equally important in a process of conceptual change (Sinatra & Pintrich, 2003).

Methodology and research design

From a practitioner-researcher's standpoint, aiming to provide an in-depth view of a particular situation (Schön, 1983), research has been carried out in an educational setting of a 6th grade of primary school with 35 children, divided into two classes. Two research episodes are involved in a broader inquiry framework, the first focusing on the study of aspects of conceptual change on teaching and learning about *mechanical energy* and the second about *solar energy*, whereas the latter has been extended to include *a science fair project*. Only the second research episode on solar energy is being reported here. Sixteen (16) children from the above mentioned educational setting, selected to be of mixed ability, have been interviewed before and after a teaching intervention, with the *Interview-About-Instances* technique (Gilbert *et al.*, 1985), using the same set of six interview cards. Follow up interviews were conducted three months after the completion of the research episode using another set of 4 interview cards, which depicted both similar but also differentiated instances from those of the first set.

In an attempt to achieve methodological triangulation, additional research methods have been used, within the same context. Thus, *concept cartoons* (Naylor & Keogh, 2000) have been used as a tool of formative assessment during the teaching interventions. *Concept maps* (Novak, 1998) on solar energy have been constructed by children, in an evolving, dynamic approach throughout the teaching intervention, whereas a total map was put together at the end of the teaching intervention, enhancing reflection in action (cf. MacAleese, 1998). Moreover, *children's written work* (Harlen, 2000) from particular question items and from report documents has been collected and is to be analysed accordingly.

Analysis and preliminary findings

The interviews have been fully transcribed and are being analysed in three levels. At first level the *Pre-Intervention Interviews* and the *Post-Intervention Interviews* are analysed separately, in order to elicit a variety of qualitatively different conceptions about the depicted instances before and after the teaching intervention on solar energy. At second level the elicited conceptions are to be compared within the context of each depicted instance, in order to identify conceptualisation differences, in an attempt to reveal the dynamics of conceptual change. At third level the conceptions of particular children-cases are considered across the interview cards, both in pre and post intervention interviews, in an attempt to obtain deeper insights in children's evolution of conceptions and conceptual change. The post-interviews, conducted 3 months later, will be considered separately and in combination with the 2nd and 3rd levels of analysis.

Preliminary findings indicate that *before the teaching intervention* solar energy appears to be conceived as "the energy coming from the sun", which "can do things for us". It can "give light" and "heat up things like water", or make "black things very hot" and perhaps "it can even cook food" or it can somehow "give electricity" or "electrical energy" with the solar cells. These appear to be seen initially as "properties" of solar energy, which happen or could happen anyhow due to "normal" every day processes (e.g. solar heaters *do* heat up water using the energy from the sun) or material properties (e.g. black things heat up very fast because that is what black things do or green houses are "hot boxes" because they heat up from the sun or "gain" high temperature), without discerning characteristics of *energy change* or *energy degradation*, within the context of depicted instances of the interview cards. *After the teaching intervention* conceptions about "energy change" appear to be discerned in the card-instances as solar-heat or solar-heat-kinetic (e.g. in the case of water heating up in the solar heaters) or solar-electric-kinetic-heat (e.g. in the case of the toy car moving with the solar cell). Furthermore, *energy degradation* is seen though "energy change to heat" conceptions due to "friction" and "crashes" or "fading" of energy, which "is put out of use" or is "incapacitated" (e.g. in the moving solar toys), but also as "heat that escapes" out of solar heaters, or solar cookers (e.g. pizza box solar cookers or more

advanced box solar cookers), which "needs to be taken care of", in order to construct more effective devices.

References

Carey, S. (1991) Knowledge acquisition: Enrichment or conceptual change? In Carey, S. & Gelman, E. (Eds.) *The epigenesis of mind*, Hillsdale, NJ, Erlbaum, pp. 257-291.

Duit, R. & Treagust D.F. (2003) Conceptual change: a powerful framework for improving science teaching and learning, *International Journal of Science Education*, Vol. 25(6), pp. 671-688.

Duit, R. (1999) Conceptual change approaches in science education. In W. Schnotz, S. Vosniadou, & M. Carretero (Eds.), *New perspectives on conceptual change* (pp. 263–282). Amsterdam, NL: Pergamon.

Duit, R. (2002) *Bibliography STCSE: Students' and teachers' conceptions and science education*. Kiel, Germany: IPN – Leibniz Institute for Science Education (URL: < http: //www.ipn.uni-kiel.de/ >).

Gilbert, J.K., Watts, D.M. & Osborne, R.J. (1985) Eliciting Student Views using the Interview-About-Instances Technique. In West, L.H.T & Pines, A.L. (Eds.) *Cognitive Structure and Conceptual Change*, London: Academic Press, pp. 11-27.

Harlen, W. (2000) *The teaching of science in primary schools*, London: David Fulton Publishers.

Hewson, P. & Hewson, M. (1992) The status of students conceptions. In Duit, R., Goldberg, F. & Niedderer (Eds.) *Research in Physics Learning: Theoretical issues and empirical studies*, Kiel, Germany: Institute of Science Education, pp 59-73.

McAleese, R. (1998) The Knowledge Arena as an Extension to the Concept Map: Reflection in Action, *Interactive Learning Environments*, Vol.6(3), pp.251-272.

Naylor, S. & Keogh, B. (2000) *Concept cartoons in science education*. Sandbach: Millgate House Publishers.

Novak, J.D. (1998) Learning, Creating and Using Knowledge: Concept Maps™ as Facilitative Tools in Schools and Corporations, London: LEA Publishers.

Posner, G.J., Strike, K.A., Hewson, P.W. & Gertzog, W.A. (1982) Accommodation of a scientific conception: Toward a theory of conceptual change, *Science Education*, Vol. 66, No. 2, pp. 211-227.

Schön, D. (1983) *The reflective practitioner*, New York: Basic Books.

Sinatra, G. M., & Pintrich, P. R. (Eds.) (2003) *Intentional conceptual change*. Mahwah, NJ: Erlbaum.

Strike, K.A. & Posner, G.J. (1992) A revisionist theory of conceptual change. In Duschl, R. & Hamiltonn, R. (Eds.) *Philosophy of Science, Cognitive Psychology* *and Educational Theory and Practice*, Albany, N.Y., State University of New York Press, pp. 147-176.

Vosniadou, S. (1994) Capturing and modelling the process of conceptual change. *Learning and Instruction*, Vol. 4, pp. 45–69.

Vosniadou, S., & Ioannides, C. (1998) From conceptual change to science education: a psychological point of view. *International Journal of Science Education*, 20, 1213–1230.

Vosniadou, S., Ioannides, C., Dimitrakopoulou, A., & Papademetriou, E. (2001) Designing learning environments to promote conceptual change in science. *Learning and Instruction*, Vol. 11, pp. 381–419.

Promoting Conceptual Change in Acid-Base Concept

Eren Ceylan*, Ömer Geban and Hamide Ertepinar, Middle East Technical University, Turkey

In this study, one of our aims was to determine high school students' misconceptions about acid-base chemistry.

For better understanding and meaningful learning, there is a need for finding ways to overcome misconceptions. One of the instructional methods can be used for this purpose is conceptual change approach. Posner et al. (1982) proposed two types of conceptual change, assimilation and accommodation. Assimilation describes the process where students use existing concepts to deal with new phenomena and accommodation describes when the student must replace or reorganize his concepts. They proposed four conditions necessary for conceptual change to occur: 1)There must be dissatisfaction with existing conceptions. 2) A new conception must be intelligible. 3) A new conception must appear initially plausible. 4)A new conception should suggest the possibility of a fruitful research program.

Many techniques based on the conceptual change approach help students to change their misconceptions. One of the most successful techniques to overcome students' misconceptions is the conceptual change texts or refutational texts (Dole & Niederhauser, 1990; Hydn & Alverman, 1986; Maria & Macginite, 1987). Conceptual change texts are texts that refuse commonly held naive concepts. They directly state that commonly held intuitive ideas do not explain certain phenomena, they explain the target scientific concept (Hydn et al., 1994).

Many researchers and educators have accepted that the students bring to classes their backgrounds, attitudes, abilities and experiences. These naive descriptive and explanatory preconceptions are often different in significant ways from scientists' views and they are remarkably resistant to change by traditional instructional methods. Therefore, in this study, researcher determined the effectiveness of a teaching strategy based on conceptual change approach (Posner et al., 1982) to dispel students' misconceptions about acid-base chemistry. The main aim of this

study is to investigate the contribution of conceptual change oriented lesson to high school students' understanding of acid-base concept.

In this study, the aim was to investigate the effect of conceptual change oriented lesson in understanding of acid- base concept.

Methodoly

Subject: In this study, 63 tenth grade students from two classes of a chemistry course taught by the same teacher were enrolled.

Instruments: Acid-Base Concepts Test developed by researchers was administered to all students in the study.

Treatment: In the study, there were two groups of students: Experimental group and control group. Experimental group was instructed by conceptual change texts through teacher lecture. Control group received traditionally designed chemistry instruction. Both groups were given Acid-Base Concepts Test as pre-test at the beginning of the study to determine whether there would be a significant difference between two groups. In the control group, the students were instructed only with traditionally designed chemistry instruction. During the classroom instruction, the teacher used lecture and discussion methods and solved algorithmic problems to teach acid-base concepts. Also, the students were provided with the worksheets. Each worksheet included mathematical and conceptual chemistry questions. The teacher acted as a facilitator and answered some questions and make suggestions when needed. Worksheets were corrected and scored and the students reviewed their responses after correction. Students in experimental group work with the conceptual change texts. Conceptual change texts were prepared by the researchers. They identified common misconceptions about subject matter and directly informed students that may posses such kind of misconceptions. They activated students' misconceptions by presenting simple qualitative examples that allow the misconceptions to be used to make a prediction about the situation and they presented the evidence that typical misconceptions are incorrect and provided a scientifically correct explanation of the situation. Six conceptual change texts were written concerning the following topics; the concept of acid-base, the properties of acid-base, the concept of pH and pOH, the strength of acid-base, hydrolysis, the neutralization reaction. At the end of the treatment, all students were administered Acid-Base Concepts Test.

Analysis

ANOVA was used to identify the effects of treatment on students' understanding of acid- base concepts.

Results

The results have indicated that there was a significant difference between two groups in terms of students' achievement in Acid-Base Concepts.). In the light of this result, it can be concluded that instruction based on conceptual change action. Neuroscientific evidence supports the existence of a "weak" nonsemantic kind of object representation that precedes other semantic representations of the same object. There is evidence that there exist in the cortex two or three visual streams, which serve roughly two different functions. The first is the dorsal system that utilizes visual information for guidance of action in one's environment. For that it needs information about the dimensions of objects in body–centered terms. It uses viewer–centered structured representations of surfaces of objects, and employs them to individuate, index, and track objects. The second is the ventral system that uses visual information for knowing one's environment, that is, for identifying, and recognizing objects.

The dorsal system processes spatial and motion information, information regarding size and shape, and information regarding the affordances of objects in a body–centered frame of reference. The information is retrieved from the scene directly by the low and mid–level vision, without recourse to any higher processing. Semantics do not affect these processes and they do not affect the on–line control of action.

The representations of objects that are used by the ventral system are richer. In addition to spatial information and information about size and shape, which is now cast in an object–centered reference framework, they also contain nonspatial and semantic information (about fragility, temperature, function, color, weight, etc.) This requires reference to previously stored knowledge about specific objects. The representations are conceptually mediated, since they are influenced by top–down semantic inferences.

There is independent evidence that the weak representations precede the semantic representations. Research on object–centered attention suggests that the representations of objects based on spatiotemporal, size, and viewer–centered shape information, precede and often override those based on featural information. Spatial, size and shape information is computed faster than the nonspatial information and the representations built in the dorsal system precede those of the ventral system.

The studies on vision for action and the studies of object–centered attention suggest that when viewing a scene, one builds first an object representation that contains only spatiotemporal, size, and viewer-centered shape information, which is used to individuate and index objects. This content is retrieved in conceptually unmediated ways from a scene; it is the outcome of a cognitively impenetrable perceptual mechanism.

Participants' Index

Participants' List

Ahtee, Maija; Department of Teacher Education, University of Helsinki, Finland. ahtee@edu.jyu.fi

Aidinis, Athanasios; Department of Primary Education, School of Education, Aristotle University of Thessaloniki, Greece. aaidinis@eled.auth.gr

Akpinar, Ercan; Department of Primary Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Alexander, Patricia; University of Maryland, USA. pa34@umail.umd.edu

Anapolitanos, Dionysios; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. danapol@phs.uoa.gr

Antonopoulos, Ioannis; Historical Researcher, Greece.

Arabatzis, Theodoros; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. tarabatz@phs.uoa.gr

Avraamidou, Lucy; Department of Education and Professional Studies, King's College London, UK. lucy.avraamidou@kcl.ac.uk

Balim, Gunay; Department of Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey. agunay.balim@deu.edu.tr

Baltas, Aristides; National Technical University of Athens, Greece. abaltas@central.ntua.gr

Biza, Irene; Department of Mathematics, National and Kapodistrian University of Athens, Greece. empiza@sch.gr

Blown, Eric; Faculty of Education, University of Strathclyde, Scotland, UK. eric.blown@strath.ac.uk

Brewer, William; University of Illinois at Urbana-Champaign, USA. wbrewer@uiuc.edu

Brodeur, Monique; Pavillon de l'Éducation, Université du Québec à Montréal, Canada. brodeur.monique@uqam.ca

Bryce, Tom; Faculty of Education, University of Strathclyde, Scotland, UK. t.g.k.bryce@strath.ac.uk

Butler, Jim; School of Education, The University of Queensland, Australia. j.butler@uq.edu.au

Caravita, Silvia; Instituto di Scienze e Technologie della Cognizione, CNR, Rome, Italy. caravita@www.ip.rm.cnr.it

Carretero, Mario; Department of Psicología Basica, Universidad Autónoma de Madrid, Spain. mario.carretero@uam.es

Çetin, Gülcan; Department of Secondary Science and Mathematics Education, Faculty of Education, Middle East Technical University, Ankara and Department of Biology Education, Necatibey Education Faculty, Balıkesir University,Turkey. gcetin@metu.edu.tr, gulcan_cetin@hotmail.com

Ceylan, Eren; Middle East Technical University, Ankara, Turkey. eceylan@metu.edu.tr

Christiannides, Ioannis; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. ichrist@cc.uoa.gr

Christodoulou, Spyros; School of Pedagogical and Technological Education, Athens, Greece.

Christou, Konstantinos; Graduate Program in Cognitive Science, National and Kapodistrian University of Athens. kochrist@phs.uoa.gr

Chronaki, Anna; Department of Early Childhood Education, School of Human Sciences, University of Thessaly, Greece. chronaki@uth.gr

Chryssanthopoulou, Katerina; Graduate Program in Cognitive Science, National and Kapodistrian University of Athens. katerina_chr@yahoo.com

Clement, John; Scientific Reasoning Research Institute and School of Education, University of Massachusetts, Amherst, USA. clement@srri.umass.edu

De Bock, Dirk ; European Institute for Higher Education, Brussels, Belgium and Center for Instructional Psychology and Technology, University of Leuven, Belgium.

Deaudelin, Colette; Université de Sherbrooke, Canada. colette.deaudelin@sympatico.ca

Delikanis, Panagiotis; Department of Mathematics, National and Kapodistrian University of Athens, Greece. pdelkan@math.uoa.gr

Demerouti, Margarita; National and Kapodistrian University of Athens, Greece.

Demetriou, Andreas; University of Cyprus, Cyprus. ademetriou@ucy.ac.cy

Desli, Despina; School of Education Sciences in Pre-School Age, Faculty of Education Sciences, Democritus University of Thrace, Greece. ddesli@psed.duth.gr

Di Nur, Nirit; Department of Education in Technology and Science, Technion – IIT, Haifa, Israel.

Dimitriadi, Kyriaki ; Department of Primary Education, National and Kapodistrian University of Athens, Greece. kdimitr@primedu.uoa.gr

Duschl, Richard; Graduate School of Education, Department of Learning & Teaching, Rutgers University, New Jersey, USA. rduschl@rci.rutgers.edu

Dussault, Marc; Université du Québec à Trois-Rivières, Canada.

Ehrlen, Karin; Department of Education, Stockholm University, Sweden. karin.ehrlen@ped.su.se

Ekici, Celil; Middle East Technical University, Ankara, Turkey.

Entwistle, Noel; University of Edinburgh, UK. noel_entwistle@education.ed.ac.uk

Ergin, Omer; Department of Primary Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Ertepinar, Hamide; Department of Elementary Science and Mathematics Education, Faculty of Education, Middle East Technical University, Ankara, Turkey.

Euaggelou, Euthimios; School of Pedagogical and Technological Education, Athens, Greece.

Filios, Andronikos; School of Pedagogical and Technological Education, Athens, Greece. afilios@aspete.gr

Gavroglou, Konstantinos; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. kgavro@cc.uoa.gr

Geban, Ömer; Department of Secondary Science and Mathematics Education, Faculty of Education, Middle East Technical University, Ankara, Turkey.

Geyer, Claudia; Faculty of Social Sciences (SOWI), University of the GAF Munich, Germany.

Gikopoulou, Rania; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. rgicop@yahoo.com

Goclowska, Barbara; Maria Curie Sklodowska University, Lublin, Poland. gocbar@tytan.umcs.lublin.pl

Gorodetsky, Malka; Department of Education, Ben Gurion University, Beer Sheva, Israel.

Gosselin, Catherine; Université du Québec à Montréal, Canada.

Haerle, Florian; Carl von Ossietzky Universtität Oldenburg, Germany. florian.haerle@mail.uni-oldenburg.de

Hagai, Ety; Department of Education, Ben Gurion University, Beer Sheva, Israel.

Haglund, Liza; Department of Education, Stockholm University, Stockholm, Sweden.

Hakkarainen, Olavi; Department of Physics, University of Jyväskylä, Finland.

Halkia, Lia; Department of Primary Education, National and Kapodistrian University of Athens, Greece. kxalkia@primedu.uoa.gr

Halldén, Ola; Department of Education, Stockholm university, Stockholm Sweden. ola.hallden@ped.su.se

Hessels, An; Center for Instructional Psychology and Technology, University of Leuven, Belgium.

Hoddeson, Lillian; University of Illinois at Urbana-Champaign, USA. hoddeson@uiuc.edu

Honkela, Timo; Neural Networks Research Center, Helsinki University of Technology, Finland. timo.honkela@hut.fi

Ikospentaki, Kalliopi; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. ikopopi@hotmail.com

Janssens, Dirk ; Department of Mathematics, University of Leuven, Belgium.

Kalouri, Ourania; School of Pedagogical and Technological Education, Athens, Greece. rkalouri@otenet.gr

Kamilatos, Charalambos; Secondary Education, Greece. chdkam@hotmail.com

Kangassalo, Marjatta; University of Tampere, Finland.

Karasavvidis, Ilias; Department of Primary Education, School of Education, University of Crete, Greece. ikaras@phl.uoc.gr

Keiny, Shoshana; Department of Education, Ben Gurion University, Beer Sheva, Israel. shoshk@bgumail.bgu.ac.il

Kindi, Vassiliki; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. vkindi@cc.uoa.gr

Kleeman, Sara; Oranim, Academic College of Education, Israel. klee1982@012.net.il

Kokkotas, Panagiotis; Pedagogical Department of Primary Education, National and Kapodistrian University of Athens, Greece. kokkotas@primedu.uoa.gr

Kollias, Vassilis; Department of Primary Education, University of Thessaly, Volos, Greece. vkollias@cc.uoa.gr

Korre, Irini; School of Pedagogical and Technological Education, Athens, Greece. sklirakis@mland.gr

Koschmann, Timothy; Department of Medical Education, Southern Illinois University, USA. tkoschmann@siumed.edu

Koukoutsakis, Antonis; Cognitive Science and Educational Technology Lab, National and Kapodistrian University of Athens, Greece. antkouk@phs.uoa.gr

Koulianou, Maria; Cognitive Science and Educational Technology Lab, National and Kapodistrian University of Athens, Greece. mkoulian@phs.uoa.gr

Kourkoutas, Ilias; University of Crete, Greece. larpsy@yahoo.com

Kousathana, Margarita; National and Kapodistrian University of Athens, Greece. mkousathana@yahoo.com

Koutsiouba-Peonidis, Martha; Higher School of Pedagogical and Technological Education, Thessaloniki, Greece. peonidis@edlit.auth.gr

Koutsogiannis, Vassilios; School of Pedagogical and Technological Education, Athens, Greece. macleod@in.gr

Koutsoukos, Anastassios; School of Pedagogical and Technological Education, Athens, Greece. ankoutsoukos@yahoo.gr

Koutsoupias, Nikolaos; Department of Balkan Studies, University of West Macedonia, Greece.

Kumpulainen, Kristiina; Department of Educational Sciences and Teacher Education, University of Oulu, Finland. Kristiina.Kumpulainen@oulu.fi

Kynigos, Chronis; Educational Technology Lab, National and Kapodistrian University of Athens, Greece. kynigos@cti.gr

Kyriakopoulou, Natassa; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. tonia@aueb.gr

Lagos, Dimitrios; School of Pedagogical and Technological Education, Athens, Greece. dlagos@aspete.gr

Lagus, Krista; Neural Networks Research Center, Helsinki University of Technology, Finland.

Lapointe, Judith; University of Texas, USA.

Lefebvre, Sonia; Université du Québec à Trois-Rivières, Canada.

Legault, Frédéric; Université du Québec à Montréal, Canada.

Lehtinen, Erno; University of Turku, Turku, Finland. erno.lehtinen@utu.fi

Levinas, Marcelo Leonardo; Instituto de Astronomía y Física del Espacio and Facultad de Filosofía y Letras, Universidad de Buenos Aires, Argentina.

Ligovanli, Katerina; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. kaligova@phs.uoa.gr

Limon, Margarita; Universidad Autónoma de Madrid, Spain. Margarita.Limon@uam.es

Liu, Shu-Chiu; Physics Education, Institute of Physics, University of Oldenburg, Germany. shu.c.liu@mail.uni-oldenburg.de

Lonka, Kirsti; Department of Learning, Informatics, Management and Ethics, Karolinska Institute, Sweden.

Lundholm, Cecilia; Department of Education, Stockholm University, Sweden. cecilia.lundholm@ped.su.se

Lyndon, Harry; Department of Education and Children's Services, Government of South Australia. Lyndon.Harry@saugov.sa.gov.au

Machamer, Peter; University of Pittsburg, USA. pkmach@pitt.edu

Malandrakis, George; Department of Primary Education, School of Education, University of Crete, Greece.

Mamalougos, Nektarios; Physics Laboratory, Department of Physics, National and Kapodistrian University of Athens, Greece. nektar@phys.uoa.gr

Maragos, George; University of Crete, Greece. gmaragos@phl.uoc.gr

Markopoulou, Anna; School of Pedagogical and Technological Education, Athens, Greece.

Mason, Lucia; Department of Psychology, University of Padua, Padua, Italy. lucia.mason@unipd.it

McCloughin, Taeim; St. Patrick's College, Dublin City University, Ireland. tom.mccloughlin@spd.dcu.ie

McGuigan, Linda; University of Liverpool, UK. l.mcguigan@liverpool.ac.uk

Megalakaki, Olga; Faculté de Philosophie, Sciences humaines et sociales, Université de Picardie, France. megalakaki@wanadoo.fr

Mercier, Julien; Université McGill, Canada.

Merenluoto, Kaarina; Department of Teacher Education, University of Turku, Finland. kaamer@utu.fi

Mol, Athanassios; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. molath@phs.uoa.gr

Morali, Sevgi; Department of Mathematics Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Mosialos, Stergios; School of Pedagogical and Technological Education, Athens, Greece.

Mouzakis, Charalambos; School of Pedagogical and Technological Education, Athens, Greece. hmouzak@primedu.uoa.gr

Nault, Geneviève; Université du Québec à Montréal, Canada.

Nersessian, Nancy; Georgia Institute of Technology, USA. nancyn@cc.gatech.edu

Nevanpää, Tiina; Institute for Educational Research, University of Jyväskylä, Finland. Tiina.Nevanpaa@ktl.jyu.fi

Orfanos, John; School of Pedagogical and Technological Education, Athens, Greece.

Österlind, Karolina; Department of Education, Stockholm University, Sweden. karolina.osterlind@ped.su.se

Pekmez, Esin; Department of Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Peltola, Kari; University of Tampere, Finland.

Petersson, Gunilla; Department of Education, Stockholm University, Sweden. gunillap@ped.su.se

Piliouras, Panagiotis; Pedagogical Department of Primary Education, National and Kapodistrian University of Athens, Greece. ppiliour@primedu.uoa.gr

Pneumatikos, Dimitris; School of Education, University of West Macedonia, Greece. dpnevmat@eled-fl.auth.gr

Portides, Demetris; University of Cyprus, Cyprus.

Potvin, Patrice; Université du Québec à Montréal (UQÀM), Canada. potvin.patrice@uqam.ca

Prinou, Lucia; Department of Primary Education, National and Kapodistrian University of Athens, Greece. lprinou@yahoo.com

Psycharis, Giorgos; Educational Technology Lab, National and Kapodistrian University of Athens, Greece. gpsichar@cti.gr

Psyllos, Dimitrios; Department of Primary Education, Aristotle University of Thessaloniki, Thessaloniki, Greece. psillos@skiathos.physics.auth.gr

Psyllos, Stathis; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. spsillos@phs.uoa.gr

Raftopoulos, Athanassios; Department of Psychology, University of Cyprus, Cyprus. araftop@ucy.ac.cy

Raisis, Vasilis; National and Technical University of Athens. vraisis@central.ntua.gr

Richer, Jeanne; CEGEP de Trois-Rivières, Canada.

Rodriguez Moneo, Maria; Universidad Autσnoma de Madrid, Spain. maria.rodrvguez@uam.es

Rowlands, Mark; University of Exeter, UK. M.N.J.Rowlands@exeter.ac.uk

Russell, Terry; University of Liverpool, UK. qe02@liverpool.ac.uk

Saari, Heikki; University of Joensuu, Finland.

Särelä, Jaakko; Neural Networks Research Center, Helsinki University of Technology, Finland.

Savinainen, Antti; Kuopion Lyseo High School, Finland.

Sfard, Anna; University of Haifa, Israel. annasfard@math.msu.edu

Sheu, Jen Jang; Center of Teacher Education, National Chung Hsing University, Taiwan. sheu2000@ms10.hinet.net

Siereki, Vassiliki; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. vaso@vip.gr

Sintonen, Matti; University of Helsinki, Greece. matti.sintonen@pp.htv.fi

Skopeliti, Irini; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. eskopel@phs.uos.gr

Skordoulis , Constantine; Department of Primary Education, National and Kapodistrian University of Athens, Greece.

Smyrnaiou, Zacharoula; Education Research Center, Ministry of Education, Greece. zacharoula@yahoo.fr

Smyrnaiou, Zacharoula; Education Research Center, Ministry of Education, Greece. zacharoula@yahoo.fr

Souyoul, Alkeos; Department of Mathematics, National and Kapodistrian University of Athens, Greece. alkeos@math.uoa.gr

Stamovlasis, Dimitris; Education Research Center, Ministry of Education, Greece. stadi@cc.uoi.gr

Stathopoulou, Christina; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. chrp@otenet.gr

Stern, Luli; Department of Education in Technology and Science, Technion – IIT, Haifa, Israel. lstern@techunix.technion.ac.il

Strömdahl, Helge; Linköping University, Sweden. helge@kth.se

Svensson, Lennart; Department of Education, University of Lund, Sweden. Lennart.Svensson@pedagog.lu.se

Taskin Can, Bilge; Department of Primary Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Thomas, James; Focus on Learning, Kalamazoo MI, USA.

Tirosh, Dina; Tel Aviv University, Israel. dina@post.tau.ac.il

Trouki, Evie; Educational Technology Lab, National and Kapodistrian University of Athens, Greece. etrouki@cti.gr

Tsagliotis, Nektarios; Department of Primary Education, University of Crete, Greece. ntsag@edc.uoc.gr

Tsaparlis, Georgios; University of Ioannina, Greece. gtseper@cc.uoi.gr

Tselfes, Vassilis; Department of Early Childhood Education, National and Kapodistrian University of Athens, Greece. tselfesv@ecd.uoa.gr

Tsinorema, Stavroula; University of Crete, Greece. tsinorema@phl.uoc.gr

Tsirempolou, Erifylli; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. etsirebol@phs.uoa.gr

Tuominen, Eva; Early Childhood Education Unit, University of Tampere, Finland. Eva.Tuominen@uta.fi

Turnuklu, Elif; Department of Mathematics Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Tzembelicos, Constantinos; School of Pedagogical and Technological Education, Athens, Greece. constantlnetzemb@yahoo.com

Unal, Gul; Department of Primary Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey. gul.unal@deu.edu.tr

Uzuntiryaki, Esen; Middle East Technical University, Ankara, Turkey. esent@metu.edu.tr

Vainas, Kostas; School of Pedagogical and Technological Education, Athens, Greece.

Vamvakoussi, Xenia; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. xenva@phs.uoa.gr

Van Dooren, Wim; National Fund for Scientific Research – Flanders, Centre for Instructional Psychology and Technology, University of Leuven, Belgium. wim.vandooren@ped.kuleuven.ac.be

Vanier, Nathalie; Université du Québec à Montréal, Canada.

Vasama, Satu; University of Oulu, Finland.

Verikios, Petros; Department of Mathematics, National and Kapodistrian University of Athens, Greece. pverikios@math.uoa.gr

Verschaffel, Lieven; Center for Instructional Psychology and Technology, University of Leuven, Belgium.

Viiri, Jouni; Department of Education, University of Joensuu, Finland. jviiri@joyx.joensuu.fi

Vosniadou, Stella; Department of Philosophy and History of Science, National and Kapodistrian University of Athens, Greece. svosniad@cc.uoa.gr

Weil-Barais, Annick; Faculté des Lettres, Langues et Sciences Humaines, Angers, France.

Wihlborg, Monne; Department of Education, University of Lund, Sweden. Monne.Wihlborg@pedagog.lu.se

Winteler, Adi; Faculty of Social Sciences (SOWI), University of the GAF Munich, Germany. s11aaddi@UniBw-Muenchen.de

Wiser, Marianne; Department of Psychology, Clark University, Worcester, MA, USA. mwiser@clarku.edu

Yiannoutsou, Nikoleta; Educational Technology Lab, National and Kapodistrian University of Athens, Greece. yiannou@ppp.uoa.gr

Yildiz, Eylem; Department of Primary Science Education, Buca Faculty of Education, Dokuz Eylum University, Turkey.

Zachariades, Theodossios; Department of Mathematics, National and Kapodistrian University of Athens, Greece. tzaharia@math.uoa.gr

Zemel, Alan; Department of Medical Education, Southern Illinois University, USA.

Zietsman Thomas, Aletta; Institute for Science Education, Department of Physics, Western Michigan University, USA. aletta.zietsman@wmich.edu