

# International Newsletter on Physics Education



International Commission on Physics Education • International Union of Pure and Applied Physics

Number 56

October 2008

## ICPE Chair's Corner

October 2008 is the month of change at IUPAP and at ICPE. The Council and Commission Chairs meeting held on 13–14 October was followed by the 26th General Assembly at the Science City Tsukuba in Japan. The members who leave the commission after a distinguished innings are profiled in this issue. We congratulate and thank them for their vibrant contribution to the various activities of the commission and the larger cause of physics education.

It was exciting to be in Tsukuba shortly after the announcement that the 2008 Nobel Prize in Physics had been swept by the Japanese theoretical physicists Yoichiro Nambu, Makoto Kobayashi and Toshihide Masukawa. The penultimate session of the General Assembly was devoted to highlighting Physics in Japan and this was followed by visits to the cutting edge facilities on the frontiers in the vicinity, including KEK (High Energy Accelerator Research Organization) where Kobayashi is based. Kobayashi is currently also the executive director of the Japan Society for Promotion of Science. It was stirring to read in the newspaper *The Daily Yomiuri* (11 October, p13) that one of the first acts after winning the prize, Kobayashi and Masukawa met with the Minister of Education, Science and Technology. I quote below from this article what the laureate had to say:

“(...) slammed teaching methods that are geared toward helping students to pass university entrance and other exams. Masukawa expressed dismay with the way teachers instruct students sitting for exams only to select easy questions that do not require deep thought. Such methods are polluting education and creating people who do not think for themselves. Parents meanwhile have become more keen about the results of education (namely, higher test scores and passing exams). Kobayash singled out for criticism the officially screened textbooks, complaining they deprive students of the will to read. Authorized textbooks only contain the bare minimum required to pass exams. They need to include more stories.”

The concerns about physics education voiced by the laureates from a scientifically and technologically pioneering country such as Japan, summarize in essence the paradoxical disconnect between the excellence of research at the frontiers and the teaching-learning of

physics in the classrooms across the world. It is these grave concerns that motivated IUPAP to move and adopt the Resolution on the Importance of Active Learning and Hands-on Physics Education, included in this issue, along with the background note (see page 5). We hope that stakeholders across the world will take this as a wakeup call for the future of physics and of humankind.

On a positive note, if we can extrapolate a conclusion from the upsurge of interest witnessed at the Active Learning Workshops reported in our newsletter, the community of physics educators appears ready to contribute towards revitalizing itself and the classroom.

*Continued page 4*

### In this issue

<b>From the Chair</b> .....	1
<i>Pratibha Jolly</i> <i>University of Delhi</i>	

### Articles

Science alone cannot lead to Development: Development without Science cannot exist

*Zohra Ben Lakhdar, Faculté des Sciences de Tunis-  
Société Tunisienne d'Optique* .....

2  
Authentic collaboration: a promising paradigm for physics education reform

*Digna Couso*  
*Universitat Autònoma de Barcelona (Spain)* .....

### Report

Resolution on the Importance of Active Learning and Hands-on Physics Education .....

5  
Proposal for IUPAP Young Scientist Prize in Physics Education .....

### Upcoming Conference

ICPE 2009 Development and Innovation in Physics Education, Thailand .....

### Notice

Farewell to retiring commissioners .....

## Science alone cannot lead to Development: Development without Science cannot exist

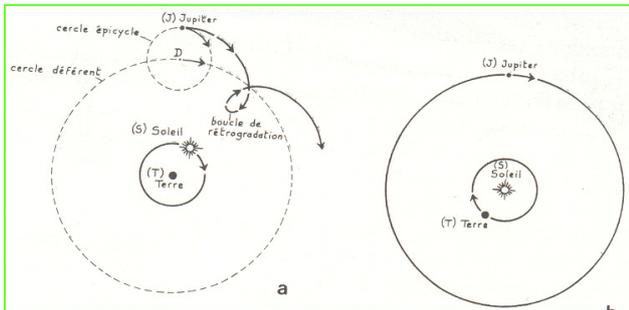
Zohra Ben Lakhdar

Faculté des Sciences de Tunis- Société Tunisienne d'Optique

### Science and Human Progress

Scientific research and the technical applications associated with it have transformed our lifespan and the way of life. The benefits arising from biomedicine alone are enormous, and other disciplines have also led to improvements, such as communications and greater opportunities to travel—even through space. Physics lies behind most scientific disciplines. It covers a very large range of applications, from tele-education to tele-medicine, which are all important for sustainable development. In a very real sense, physics underpins human progress.

Until the second century, the Earth was considered to be the centre of the Universe. This geocentric vision, usually attributed to Aristotle had a lifetime of about 1300 years. At the 15th and 16th centuries, our vision of the Universe became heliocentric.



Today, we no more think of ourselves as being the centre for everything. The universe is inexpressibly wider (approximately  $10^{10}$  light years (LY) compared with Earth dimension approximately  $10^{-6}$  LY) and more and more complex.

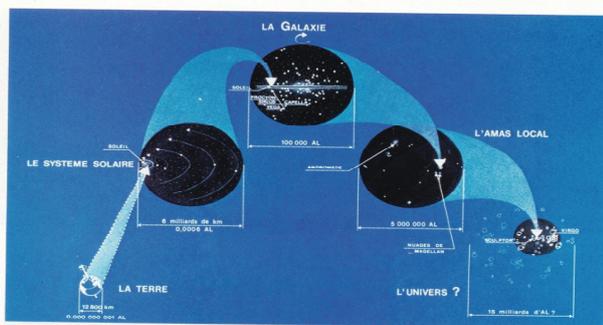


Figure 24 — La place de la Terre dans l'univers.

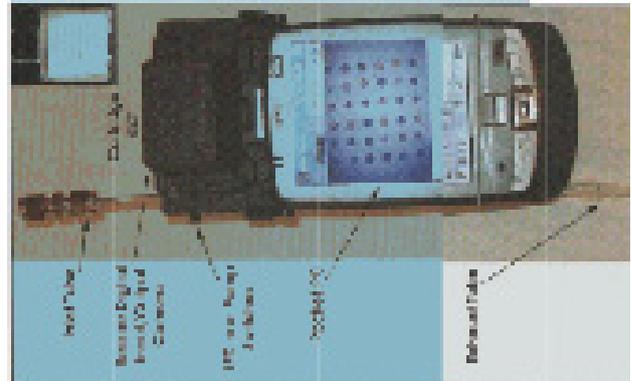
So physics can be thought of as building a bridge between the nano world and the Universe. And the same

messenger, light or electromagnetic waves, can be used to exchange information between these two worlds. **Physics enlightens our minds.**

### Science, Technology and Development

This messenger between the Universe and the nanoworld uses the language of atoms and molecules. Understanding this language leads to knowledge of the structure of matter, which in turn leads to development of new technologies: miniaturization, efficiency, high functionality, speed and high complexity. These are all based on interdisciplinary skills: science, engineering, environment, industry, communication, medicine and agriculture.

As just one example, (from *Photonics*, March 2007) consider a cell phone.



No longer is it merely a telephone, it is a detector of pollution, a Secure digital-input/output, a camera, an LED and pump switch, a pocket PC. This technology is based on the knowledge and know-how of physics where electronic, optics, mechanics, thermodynamics, atomic and molecular physics, are present—photonics.

### Building careers with physics

Building a career with physics seems an excellent way for students to get job; there is no technology without physics. But technology today is changing so rapidly, and the speed of change means that the student needs expertise in several areas. Development must occur on a **global level**, with pieces of a product being manufactured in different companies over the world. And to succeed in the long term, the product has to be sold globally.

So building a career with physics is an open way *for highly qualified people!* In the words of Wendy A. Laurin (*Photonics*, September 2007):

“One universal problem that photonics deal with is a lack of qualified people to hire (engineers or scientists).”

**Science and Society**

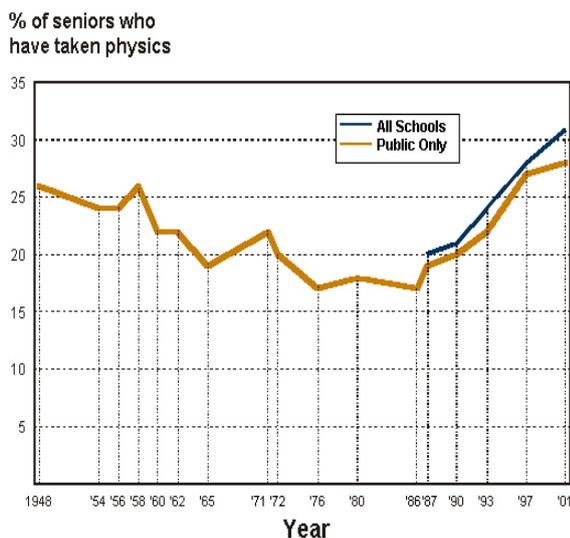
Science and technology induces globalization, leads to the production of new plants, to stem cells, cloning and the conquest of space! Truth is changing over time. “Truth is daughter of its time”, said Galileo, who was condemned by the church in the 16th century, because of his heliocentric vision of the world.

Science and technology leads today to a new vision of the Universe: the Universe is today a **one city** with **interdependence** – all things are dependent on one another. We all participate in this interdependence; we are citizens of this universe. Our city is the universe, where the Earth is an area zone and the university campus is Africa. All people in the world have to live together in peace with sustainable development. Sustainable development is based on human resources, on a knowledge society. Therefore all citizens need a basic understanding of science and technology.

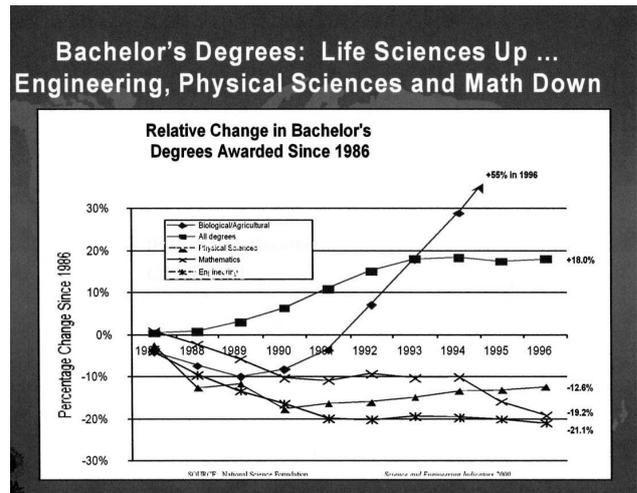
**Science in developed countries**

Physics has an essential contribution to make to the training of science or engineering specialists, but it is also important for the skilled worker, the informed citizen and, in fact, for anyone trying to make a sense of the world. But while science culture takes place in developed countries, a decrease of student involvement in physics has been observed,

As an example, the declining percentage for physics in USA between 1948–86 is shown in this figure.



Likewise between 1986–96 for mathematics and engineering.



Physics education, for many students, seems a boring and very difficult subject with no link with technology and everyday life.

The science community is aware that there is a need to “reinvent” the lecture. No physics today equals no technology tomorrow! Students must be interested in physics. Recently, physics education research has focussed on the active construction of a conceptual framework taking place within a suitable pedagogy. This is **Active Learning**, based on the idea that, in order to learn, students must actively construct the knowledge themselves. This realization began around 1980 in USA, and the hint of significant success from 1987 onwards can be discerned in the previous figures. This approach, or the equivalent *main à la pâte*, has been adopted later and is in development in many other developed countries

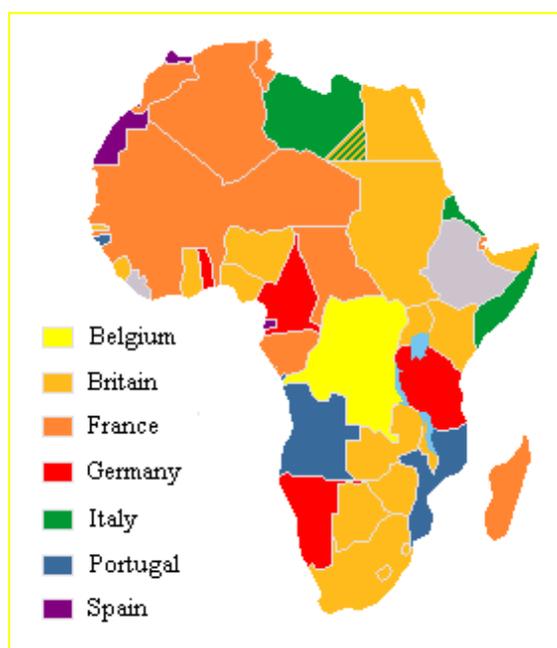
But the development of science and technology needs more human resources! It needs an involvement of the society. It needs a *political vision*. Development without science cannot exist, but science alone cannot lead to development. It has been argued (Barcelona goal 2000),

“The essential condition for the EU to become in 2010 the most competitive and dynamic knowledge-based economy in the world is *the right number of human resources in science, engineering and technology*: 0.5 million researchers (or 1.2 million research-related personnel) are needed to meet that goal between 2000 and 2010 *in addition* to their current number of researchers with an increase in the proportion of European GDP invested in *research from 1.9% to 3%.*”

How do we get this number?

**Science in Africa**

Africa is a rich continent with a plurality of cultural traditions and natural resources, and was colonized until about 1960 by European countries.



Africa has never known an industrial revolution. It is characterized by a lack of scientists, of technicians, and of a scientific culture. (In Tunisia, for example, in 1960 there were 2 PhDs in science—for a population of some 3.5 million.) Yet each country faces a new technological world with its independence.

African societies are consuming technology (cell phone are everywhere!) and contributing to development outside Africa. The best students in Africa are leaving their countries for research activities in developed countries. Experts estimate that over 30,000 PhD holders of African descent, many with science degrees, live and work outside Africa. That number far exceeds the total number of African born scientists with PhDs working in Africa! This diaspora might be useful if an *adequate environment could be offered in their countries*. The population of Africa will be multiplied by a factor 2 in 2050: European countries by a factor of 0.98! Young African people represent real wealth indeed.

### ICPE Chair's Corner (continued from page 1)

We are in the process of creating a repository of innovative ideas and active learning resource materials, especially those integrating low-cost indigenously developed equipment and appropriate technologies. We would like to feature in our newsletter stories on innovative physics education and examples of praxis from across the world.

It has been our endeavour to recognize and award contributions to physics education. The ICPE medal, instituted in 1979 commemorates outstanding contributions extending over a considerable period of time, such as transcend national boundaries. The commission has decided to confer the 2008 ICPE Medal

African development needs science education and research development. The science conducted should be of the highest possible standard and to empower students with skills, there should be a policy of security for human resources. The project, *Active Learning in Physics for Developing countries of Asia and Africa*, developed by UNESCO for training of trainers, should be adopted on a large scale in each country.

To obtain benefits from the young scientists, to provide them with opportunities to contribute to the process of socio-economic development, and to ensure a sustainable existence of its human resources, a strategy for research and technology development is needed. *Pilot centers for research should be developed*. The involvement of politicians, of institutions, of society itself, at national as well as international level, such centres are needed. Science alone cannot lead to development and development without science cannot exist. Africa needs science to get up but science alone cannot waken Africa.

### References

- Google (2008) Science>Physics>Education>Research  
<http://www.google.com/Top/Science/Physics/Education/Research/>.
- Ryerson University (2008) *Physics Education Research*,  
<http://ryerson.ca/physics/research/per.html>.
- Milner-Bolotin, M. and Antimirova, T. (2007) Physics Education in Canada: An overview of recent developments, *Canadian Undergraduate Physics Journal*, VI(I), 28–29.
- Canadian Association of Physicists (2007) Open letter,  
<https://www.cap.ca/news/briefs/SSHRC.pdf>.
- Council of Canadian Academies (2006) *The State of Science and Technology in Canada*.  
[http://www.scienceadvice.ca/documents/The\\_State\\_of\\_Science\\_and\\_Technology\\_in\\_Canada.pdf](http://www.scienceadvice.ca/documents/The_State_of_Science_and_Technology_in_Canada.pdf).
- The DPE/CAP Undergraduate Physics Curriculum Project  
<https://www.cap.ca/edu/curriculum/curr.html>.
- Carl Wieman Science Education Initiative at the University of British Columbia (2008)  
<http://www.cwsei.ubc.ca/departments/index.html>.

to UNESCO as an organization in recognition of its proactive role in supporting initiatives in physics education, especially in the developing world. The ceremony will be in Bangkok during the ICPE 2009 conference. We are extremely happy to announce the institution of the IUPAP Young Scientist Prize in Physics Education (see page 16) and invite nominations for 2009. This prize is momentous for it is the young physics educators who will lead the change.

Pratibha Jolly

Pratibha Jolly, ICPE Chair, Delhi

# RESOLUTION on the Importance of Active Learning and Hands-on Physics Education

*The following resolution, was passed unanimously at the IUPAP 26th General Assembly held at Tsukuba, Japan, October 14–17, 2008*

IUPAP urges that National Governments, Physical Societies, Funding Agencies, Physicists, and Physics Educators in all countries

- support best practice of physics education and physics education research at all levels by encouraging teaching methods, including laboratory work, that actively engage the hands and minds of learners.
- make available funds for establishment of well equipped laboratories and designing appropriate curricula that lay particular emphasis on teaching the skills of the experimenter.
- support indigenous development of low-cost instruments, physics apparatus and equipment, and — when finances allow it — computer-based data-acquisition systems for real-time measurements at the appropriate level of sophistication for a variety of uses in teaching of physics in the classroom and the laboratory.
- support curricula that teach physics with an appropriate diversity of methods, including hands-on approaches, that encourage critical thinking and help students understand how physics is relevant to their local cultures and to a sustainable future for humankind.

## Background

Physics is an experimental science whose aim is the observation, description, modeling and understanding of the natural world in which we live. The process of reproducing phenomena in the laboratory enables scientists to study, in quantitative detail, aspects of specific phenomena, and to understand specific concepts. Modern methods of measurement and techniques of instrumentation contribute to the advancement of science and to its applications. It is thus natural to include work in a well equipped laboratory in the teaching of physics.

Moreover, contemporary research in the teaching and learning of physics indicates that hands-on activities and other interactive approaches, when integrated in teaching, lead to an increase in student understanding of the subject.

We are thus gravely concerned that, across the world, the predominant mode of teaching continues to be textbook based lectures. Laboratories are underused, or not used appropriately, as a part of the learning process in both developed and developing countries. Very few institutions, including those in developed countries, provide active learning techniques which are integrated throughout the students' learning of physics and which can help students visualize the physics they are learning and enhance their qualitative and quantitative

understanding. Even where laboratory work and/or hands-on activities are an integral part of the curriculum, they often follow a cookbook approach that fails to impart procedural and conceptual knowledge about the activity, which then becomes hands-on without engaging the students minds.

Such an algorithmic approach imparts neither the craft of the experimenter nor an understanding of the physical world. Students fail to grasp concepts of reliability and validity of data; the significance of errors of measurement and measurement uncertainty; and the notion of refining the process of measurement to obtain the desired accuracy. Nor do they appreciate the inherent interplay of theory and experiment in the progress of science. All of these should be outcomes of effective education in physics.

Systematic research on students' conceptions of physics has shown that students bring to the classroom their own thoughts and views about the world. For teaching to be effective, the student must be made an active participant, rather than a passive recipient, in the reconstruction of his or her own knowledge. Effective teaching-learning environments, whatever be the relative emphasis on textbook-based lectures, problem-solving or inquiry-based learning, recognize the importance of hands-on activities, laboratory and project work.

In some countries hands-on activities are being integrated effectively into teaching of science in the early years of school, and, where available, provide an important base for active learning of physics in later school years and in universities. These successful strategies need wider adoption and dissemination at all levels.

To help give effect to the resolution, we suggest that:

- special sessions be organized on educational aspects of hands-on learning, experimentation, and appropriate assessment, in discipline specific conferences of the IUPAP commissions;
- multinational collaborations and workshops be organized for design and development of resource material for active learning and laboratory work; and further, dissemination through professional training of physics educators; and
- electronic resource centers be established for exchange of ideas about local initiatives, teaching materials, prototypes of "hands-on" equipment, in particular those that can be locally adapted for construction by the teachers and their students, to serve a variety of educational needs in diverse cultural contexts.



**ICPE 2009** 18-24 October 2009  
Bangkok Thailand  
[www.icpe2009.net](http://www.icpe2009.net)

**INTERNATIONAL CONFERENCE ON  
PHYSICS EDUCATION 2009**

**Development and Innovation  
in Physics Education**

This ICPE 2009 in Thailand is proposed as one in the world renowned series, *International Conference on Physics Education*, supported by the IUPAP. Given the significant success that the previous conferences (Delhi, Tokyo and Marrakech) of the ICPEs have drawn, we envisaged that this event will add another brick to what is starting to be a solid foundation towards a path to sustainable development in physics education.

By the time the ICPE 2009 is held in October 2009, almost 5 years would have passed since physicists all over the world started celebrating World Year of Physics in early 2005. The theme of the conference “*Development and Innovation in Physics Education*” reflects one of our major aims, which is to gather pertinent information on the advancement in physics education as a result of higher level of awareness from the events in 2005.

The conference primarily focuses on offering the floor for physics educators to present issues and examples which emphasize the aforementioned theme and the following sub-themes:

- A. Bringing physics education into the 21st century;
- B. Engaging physics education to the real world;
- C. Developing new and effective learning approaches for physics education; and
- D. Preparing physics education to provide solutions to global challenges.

The City of Bangkok, where the conference will be held, has been named “World’s Best City 2008” by the *Travel + Leisure* magazine. It also recently won the “2007 Best

City in Asia” for the seventh year in a row in the *Condé Nast Traveler Readers’ Choice Awards*.

This capital city of Thailand is beautifully located on the banks of Chao Phraya River of the Southeast Asian Peninsula. It is well connected globally by all major international airlines through its new Suvarnabhumi International Airport.

Bangkok has everything to offer to different types of visitors, from its modern infrastructure and world-renowned hospitality and service, to rich culture and to-die-for cuisine. Bangkok is very well connected by road, rail and airlines with the rest of Thailand. Bangkok would be an excellent base for visiting other world famous destinations such as Pattaya beach, Phuket island – Pearl of the Andaman Sea, and Chiang Mai – the ancient city of northern Thailand among others.

We look forward to welcoming you in Bangkok. For any questions regarding the conference, please contact the conference secretary

Dr Boonchoat Paosawatyanong  
Department of Physics, Faculty of Sciences  
Chulalongkorn University  
Bangkok 10330 THAILAND  
[paosawat@sc.chula.ac.th](mailto:paosawat@sc.chula.ac.th)  
Fax: + 662 253-1150

For registration, call for papers, accommodation and other details please visit the conference web site

<http://www.icpe2009.net>

## Authentic collaboration: a promising paradigm for physics education reform

*Digna Couso*

*Centre for Research in Science and Mathematics Education (CRECIM)*

*Universitat Autònoma de Barcelona (Spain)*

*digna.couso@uab.es*

*This paper is the summary of the keynote talk given by the author at the last GIREP 2008 International Conference on “Physics Curriculum Design, Development and Validation” in Nicosia, Cyprus. The complete presentation is available at: <http://www.ucy.ac.cy/girep2008/index.htm>*

### **The problem of physics innovation: forgetting that teachers matter**

When thinking on innovation in physics education, what generally comes to our minds are new research-based teaching and learning materials which, either as small scale attempts or as part of a broad reform agenda, try to bring to the school new contents, new tools and new pedagogical approaches. However, we know from research in educational reform that top-down, product-oriented attempts to change the physics classroom by just flooding the system with new ideas and materials generally “fall flat” (Fullan 2001). Within these contexts, reforms are only adopted on the surface and implementation fails, producing minimum classroom change.

Implied in any physics education innovation that focus on *delivering* educational ideas and materials to schools is a technological conception of educational change. Within this so-called input/output view it is considered that a very well designed “input” to the educational system will automatically produce the desired output. In other words, it is expected that the didactical knowledge “built-in” to the teaching and learning materials or reform policy documents would be used in the system (by its participants) in an almost straightforward manner. Unfortunately, things in education, as in any social setting, are much more complex. Innovative school materials and curriculum official documents are intended to be used by particular science teachers with particular knowledge, beliefs and values in particular school settings. As the OCDE (2005) report has stated, teachers matter a lot in this process.

### **Why do teachers matter? Innovation as teacher and school development**

That teachers are crucial for any innovation attempt is not new. Black and Atkin’s (1996) study of Science Education reform found better results associated with teachers’ active participation in all phases of innovation, from planning to assessment. The reason behind these results is related to the fact that teachers always make transformations, both regarding subject matter and particularly pedagogical content knowledge, when facing top-down traditional innovations. Unfortunately, these transformations often distort the innovation’s rationale in

significant ways (Pintó 2005). Even highly motivated teachers have been shown to implement the new curriculum without taking into account most of its didactical/pedagogically “critical details” (Viennot, Chauvet et al. 2005). Ogborn (2002) has discussed this issue, advocating the need for teachers to have *ownership* of innovations, not only in emotional terms, but mostly regarding the mastering of the knowledge involved. As some authors have pointed out, innovation can be seen as essentially a matter of teacher learning (van Driel, Beijaard et al. 2001).

As an alternative to this traditional view of innovation (which is still much in use), bottom-up approaches to reform have been proposed. These are approaches that place teachers at the centre of reform, acknowledging their important role in this process. In bottom-up scenarios the idea is going beyond supporting teachers to learn an already decided, fixed, one-size-for-all rationale. Real ownership can only be achieved if teachers share and co-construct the innovation themselves, together with researchers, and adapt it coherently to their context. In this sense, bottom-up scenarios bridge the well-know research-to-practice gap by challenging the traditional separation between science education design (“knowledge production”) and implementation (“knowledge consumption”). In these initiatives it is not only important to bring relevant research results from university to teachers and schools but also to enrol teachers and schools in a collective process of inquiry that also generates useful knowledge.

Interestingly, bottom-up approaches to innovation and reform have been shown to challenge the traditional distinction between university and teachers/school knowledge. In other words, they challenge the distinction between knowledge-*for*-practice (formal knowledge: universal, already known, university-produced, learned in teacher education) and knowledge-*in*-practice (practical knowledge: tacit, embedded in the action of expert teachers, acquired through reflection). In these scenarios what is advocated is a new relationship between knowledge and practice: that of knowledge-*of*-practice (Cochran-Smith and Lytle 1999) in which the focus is shifted towards the process of problematising what we know and do by systematic and intentional collective inquiry.

Central to these approaches is the establishment of a work culture of reflection, inquiry and learning among teachers and researchers to analyse and inform practice. These initiatives imply an enlarged idea of the teaching profession. In the literature different metaphors are described: the teacher becoming curriculum developer, decision maker, action researcher, life-long learner,... Of course, to be involved in this process implies new roles and expertises from teachers, which is the actual challenge of reform. In this sense, the focus of physics reform changes from a product orientation to a process one: how to motivate and sustain the process of innovation, which in fact is a process of teacher and school development.

### **Physics innovation happens in communities**

To attain teachers' active participation, ownership and leadership regarding innovation, needs new scenarios for collaboration between teachers and researchers. In the literature, different collaborative initiatives have been explored, such as School-University Partnerships, Communities of Practice and particularly the very interesting notions of Communities of Inquiry and Professional Learning Communities. At the heart of these initiatives is the powerful idea of community with its five distinctive features: shared beliefs and understandings; interaction and participation; interdependence; concern for individual and minority views and meaningful relationships (Westheimer 1998).

Community is stressed in bottom-up reform, not just as a possible setting for organising teachers' and researchers' joint work, but mainly because it is a setting for learning and development. Social theories of learning emphasise the idea of learning as social participation (Lave 1996), that is, as being an active participant in the practice of a particular social community. This can be, for instance, the community of teachers and researchers that try to increase students' learning of physics by changing their practice. In this sense, Shulman and Shulman (2004) include *Community* as one of the features of accomplished teacher development, together with other five individual ones: Vision, Motivation, Understanding, Practice and Reflection. For the authors, individual development always occurs within a community, which can actively enhance, inhibit or be neutral regarding it. The interesting idea here is that by shaping school communities and acting on them, we can act on teacher development.

### **Changing practices for increasing physics students' learning... all of us!**

Despite the importance of collaboration and community for teachers' learning, we can not simply equate learning with improvement and assume benevolence or efficiency of any community of practice. The important issue here is not that learning occurs, but what is actually learnt. As Wenger (1998) points out "*communities of practice should not be romanticized; they can reproduce counter-productive patterns [and] in fact, I would argue they are the very locus of such reproduction*" (p. 132).

In this sense, the role of science education researchers is crucial to promoting and supporting teachers' collaboration in a professional learning community: promoting discussion, fostering interdependence, motivating questioning, inquiring practice, managing reflection.

What is described above is substantially different from the traditional role that science education researchers used to play. The professional who has to engage and support "*a group of people sharing and critically interrogating their practice in an ongoing, reflective, collaborative, inclusive, learning-oriented, growth-promoting way, and operating as a collective enterprise*" (Bolam, McMahon et al. 2005, p5) needs particular knowledge, skills and strategies that go beyond the traditional ones in physics education. The conclusion is clear: in the same way that changing teachers' role is crucial to change existing practices within the physics classroom, science education researchers' role need also to change in order to promote and support a different teachers' room or university seminar.

What should be happening in this staff room or faculty seminar among teachers and researchers involved in physics innovation is what we have named "*authentic collaboration*". With this, we refer to the sort of collaboration that is produced when both groups of professionals:

- acknowledge their common objective (increasing students' learning);
- accept that they need new knowledge to solve it (learning, inquiring, reflecting, research and evidence-based practice...); and
- truly collaborate to produce it (sharing agenda, distributing leadership, trusting each other...)

### **How can *authentic collaboration* be promoted?**

The ideas presented and discussed above can be re-elaborated in the form of suggestions for authentic collaborative settings. In this sense, authentic collaboration can be promoted by:

- Building a learning/inquiry culture. This means helping schools to become intellectually stimulating places for teachers, as we want them to be for students. The questioning, evidence-informed, reflective, self-evaluative and critical attitude we expect from the physics student should be part of the day to day work of schools and science teachers.
- Integrating relevant/fitted to purpose continuous professional development (CPD), which is collaborative, school-based, classroom-oriented and which focuses on supporting teacher inquiry, such as evidence-based CPD.
- Understanding the crucial role of teachers' leadership, relating it with empowerment and relying on interesting notions such as distributed leadership, which should be carefully planned and managed.
- Taking into account trust, which has shown to be the single strongest facilitator of these initiatives. Activities such as mutual enquiry and team-teaching,

which are so important for teachers' learning and development, challenge teachers' confidence and they can only be successful in an environment of trust.

- Ensuring structural resources, in particular time, which is crucial. All features encompassed in authentic collaboration, such as learning, collegiality, empowerment, trustfulness, etc. take time, which is generally hugely underestimated by educational researchers.
- Ensuring high quality external support, which means for physics education researchers to master and move easily among their multiple roles (initiators, facilitators, providers of CPD, researchers, etc.)

The authentic collaborative initiatives described above are certainly costly. Initiating, facilitating and researching in inquiry/learning communities with science teachers or schools is both personally and professionally demanding and time-consuming. Perhaps it is a task that many people interested in physics education find infeasible. However, their results are promising, in the sense that they have shown success in achieving change that is relevant (both locally and globally meaningful), more sustainable (by developing teachers' inquiry and collaborative attitude and skills), and knowledgeable (using existing formal and tacit knowledge and producing new fitted-to-purpose knowledge). In this sense, even if we do not have the possibility of participating in physics innovation within this rationale, we can use its core ideas in other scenarios: with pre-service teacher students, in traditional CPD, in our own collaboration with colleagues. By starting to make this shift from product orientation towards a focus on processes and community across educational settings, we will start to introduce these important ideas in the general educational agenda. This way, perhaps, also policy-makers will be able to understand that real change in Science Education will take time and this sort of involvement and compromise. In the meanwhile, we can continue to participate in high quality physics curriculum design, development and validation trying to involve teachers much more than we usually do.

### References

Black, P. and J. M. Atkin (1996) *Changing the subject. Innovations in Science. Mathematics and Technology education*. London, Routledge.

Bolam, R., McMahon, A., Stoll, L., Thomas, S. et al. (2005) *Creating and Sustaining Effective Professional Learning Communities*. DfES Research Report RR637. Bristol, University of Bristol.

Cochran-Smith, M. and Lytle, S. (1999) Relationships of knowledge and practice: teacher learning in communities. *Review of Research in Education*. A. Iran-Nejad and P.D. Pearson. Washington DC, American Educational Research Association, 249–305.

Fullan, M.G. (2001) *The New Meaning of Educational Change*. London, RoutledgeFalmer.

Lave, J. (1996) *The practice of learning. Understanding practice: Perspectives on activity and context*. S. Chaiklin and J. Lave. Cambridge, Cambridge University Press, 3–32.

OECD (2005) Teachers Matter. Attracting, Developing and Retaining Effective Teachers Education and Training Policy. Paris, Organisation for Economic Co-operation and Development.

Ogborn, J. (2002) Ownership and transformation: Teachers using curriculum innovations. *Physics Education*, **37**(2), 142–146.

Pintó, R. (2005) Introducing curriculum innovations in science: Identifying teachers' transformations and the design of related teacher education. *Science Education*, **89**(1), 1–12.

Shulman, L.S. and Shulman, J.H. (2004). How and what teachers learn: a shifting perspective. *Journal of Curriculum Studies*, **36**(2), 257–271.

van Driel, J. H., Beijaard, D. and Verloop, N. (2001) Professional Development and Reform in Science Education: The Role of Teachers' Practical Knowledge. *Journal of Research in Science Teaching*, **38**(2), 137–158.

Viennot, L., Chauvet, F., Colin, P. and Rebmann, G. (2005) Designing strategies and tools for teacher training: The role of critical details, examples in optics. *Science Education*, **89**(1), 13–27.

Wenger, E. (1998) *Communities of practice: Learning, meaning, and identity*. Cambridge, Cambridge University Press.

Westheimer, J. (1998) *Among school teachers: Community, autonomy, and ideology in teachers' work*. New York, Teachers College Press.

## Notice

### A New Journal: *CAL-laborate International*



*CAL-laborate International* is a refereed journal published by UniServe Science at The University of Sydney, Australia. The focus of *CAL-laborate International* is collaborative teaching, innovative laboratory teaching and the use of information technology in tertiary teaching and learning for the sciences. The October 2008 issue contains five papers on tertiary Physics teaching by Australian academics. The papers are available online at <http://science.uniserve.edu.au/pubs/callab/current.html>.

Papers which cover topics such as eLearning, collaborative teaching developments and laboratory teaching in all areas of tertiary science teaching and learning are welcome. The deadline for submission of articles for consideration for the May 2009 issue of *CAL-laborate International* is 31 March 2009.

## Farewell to retiring commissioners

*As laid down by the IUPAP by-laws, the term of office for all general members of the ICPE is for a term of three years, with the possibility of re-election once. At the IUPAP General Assembly held at Tsukuba, Japan, October 14–17 October, nine new members were elected. These will be welcomed in the next issue. In the meantime we offer our heartfelt thanks for all their good work and best wishes for their future to the eight members who are retiring.*

### Diane Grayson

Diane has run her own consultancy, Andromeda Science Education, since 2005. Her work includes running workshops for Physics teachers, writing high school textbooks, running academic development workshops for university academics, conducting policy research, carrying out programme evaluations, advising on school and university physics curricula, speech-writing for government ministers and supervising a few post-graduate students on the side. She is also Professor Extraordinarius in the Physics Department at the University of Pretoria. In the past, she has been Professor of Science Education at the University of South Africa, Academic Vice-Principal of the Mathematics, Science and Technology Education College, and Coordinator of the Science Foundation



Programme at the former University of Natal. She did her PhD with the Physics Education Group at the University of Washington, under the supervision of Lillian McDermott. In addition to serving on the ICPE, she also served on the Council of the South African Institute of Physics for 6 years, holding the education portfolio. She enjoys acting as a bridge between scientists and educators in her country. Since 2005 she has been a member of the working group of Women in Physics in South Africa,

which aims to attract and keep more women in physics. When she isn't working, she likes to do Tai Chi, trout fish, read, watch movies and hang out with her family and friends.

### Mauricio Pietrocola

Mauricio started his professional career as a physics teacher at high school level. Parallel of this activity, he obtained his master degree in Physics Education at the University of Sao Paulo. In 1992, he finished his doctor degree in History and Epistemology of Science at the University of Paris VII (Denis-Diderot). He is now associate professor at the Faculty of



Education at University of São Paulo. His interests in development and research have been focused mainly in curriculum innovation and development and in pre and in-service courses for physics teachers. He is currently (2008) the vice-chair of the International Commission on Physics Education

### Hans-Joachim Schlichting

H. Joachim Schlichting is director of the Institute of Didactics of Physics within the department of physics of the University of Muenster (Germany). His work includes giving lectures in physics and physics education to physics teacher students, writing high school and college textbooks and conducting research in physics education (about 450 publications).

The research interests cover the following fields:

- investigation of formation of physical concepts and their simplification in the formulation of strategies for the understanding of physics through the adaptation of suitable exemplary topics, e.g. the physics of everyday life;
- developing simplified, yet scientifically rigorous, theoretical and experimental representations of topics of modern physics (e.g. problems of non-linear physics) and investigating the corresponding concepts in the teaching and learning process;

- investigation of learning physics within non-physical contexts (physics of sports, physics in everyday life contexts, physics of natural phenomena); and
- investigation of the interactions of physics and culture (art, music, literature).

He is full Professor and was engaged in professional organisations as

- head of the Section of Didactics of Physics of the German Physical Society,
- member of the “Vorstandsrat” of the German Physical Society and
- head of the working group of special didactics in Nordrhein-Westfalen

He did his PhD in theoretical physics at the university of Hamburg and his postdoctoral lecture qualification in physics education at the university of Osnabrück. In 2008, he received the Robert Wichard Pohl Prize of the German Physical Society.

### Luo Xingkai

Dr. LUO Xingkai is a professor at Faculty of Physics and director at Research Institution of Science Education in Guangxi Normal University where he has worked for pre-service and in-service teacher education since 1988. Prior to that, he taught Physics at a high-school for five years in Hunan after he received a diploma of Physics at Shanyang Teacher's College in 1980. He got his Master Degree of Physics Education in 1988 from Suzhou University and Ph. D of Comparative Science Education in 1999 from Beijing Normal University.



“National Classic Course” title by the Ministry of Education which is up to now the only one course acquiring such a great honor in his university.

Since 2000, He has worked as a director and chief investigator for a MOE financed project “Inquiry-based Science Learning & Teaching in the Framework of the New National Curriculum” and was recently awarded a prize in “The Third National Selection of the Educational Research Excellence”.

Because of his long time effective innovations in physics teacher education program, Prof Luo has received many awards including “Special Award to Outstanding Academic Experts” by State Council of the P. R. China in 1995, “National Model Teacher”, special honor awarded by the Chinese Ministry of Education and the Ministry of Human Resources in 2001, and the latest “Guangxi Provincial Famous Professors Award” by Guangxi Provincial Education Administration in 2006. In 2007, “Theory and Practice for School Physics Education”, a teacher education curriculum designed and taught by him with assistance of his colleagues, was awarded the

Prof Luo has served as a member of the International Commission on Physics Education since 2002 and he is also education committee member of the Chinese Physical Society. He has for many year been active in physics education exchange both domestically and internationally. In 1999 in Guilin, he organized ‘99ICPT, the largest international physics education conference ever hold in China. He had been several times invited as a plenary speaker at international physics education conferences in physics education and impressed the audiences with his in-depth thinking in science education and innovative ways of teaching physics using hands-on activities and experiments in particular.

*Our thanks and best wishes to the others retiring at this time:*

- **Pedro Goldman**, Dept. of Physics & Astronomy, University of Western Ontario, Canada
- **Hiroshi Kawakatsu**, Faculty of Education, Kagawa University, Japan
- **Sung-Muk Lee**, Department of Education, Seoul National University, Seoul, Korea
- **Andras Patkos**, Department of Atomic Physics, Evtvvs University, Budapest, Hungary

## ICPE Members

The General Assembly of IUPAP held in Japan in October 2008 brought in several new members on board the Commission for a period of three years.

The reconstituted commission is:

**Chair:** Pratibha Jolly, India  
**Vice-Chair:** Robert Lambourne, UK  
**Secretary:** Dean Zollman, USA

**Members:** Saalih Allie, South Africa  
 Leos Dvorak, Czech Republic  
 Zulma Gangoso, Argentina  
 Alexandru Jipa, Romania  
 Edward Kapuscik, Poland  
 Gizaw Mengistu, Ethiopia  
 Hideo Nitta, Japan  
 Ann-Marie Pendrill, Sweden  
 Elena Sassi, Italy  
 Michael Vollmer, Germany  
 Nianle Wu, China

**Associate Members:** Minella Alarcon, UNESCO  
 Lakshman Dissanayake, Sri Lanka  
 Ian Johnston, Australia  
 Cesar Mora, Mexico

The contact addresses of the members are available at [www.iupap.org](http://www.iupap.org).

Pratibha Jolly  
Chair

# Proposal for IUPAP Young Scientist Prize in Physics Education

*The following proposal was also accepted at the  
IUPAP General Assembly held at Tsukuba, Japan, October 14–17, 2008*

**Name of the Prize:**

IUPAP Young Scientist Prize in Physics Education

- A previous Prize recipient will not be eligible for another Prize.

**Frequency/Venue:**

- Up to three IUPAP Young Scientist Prizes will be awarded in each three year period. The Prizes will be announced and presented at a conference sponsored by the commission.

**Nomination procedure:**

The application for the Prize would include the following:

- The paper, in its original language, on which the application/nomination for the Prize is based.
- A summary of the paper in English.
- A complete CV in a format provided by the commission.
- 3 letters of recommendation
- A summary of the applicant's/nominee's physics education work to date (limited to 3 pages).

**Criteria for selection:**

- Research will include educational development such as development of instructional materials as well as physics education research. The impact of the research and/or development will be judged in the local context.
- Each nominee will submit a paper which he/she would be required to present at an ICPE sponsored conference if selected for the award. The paper must have been accepted by a refereed journal prior to the conference for which it was submitted.
- All physics educators who meet the basic criterion on being within eight years of their PhD (with appropriate adjustments) are eligible.
- Research in areas other than physics education will not be eligible.
- Research and development experiences in informal education will be considered equally with that based on work in formal settings. For formal education there will be no restrictions on the level at which the research or development was conducted.

**Procedure for forming the selection committee:**

The selection committee will consist of the executive members (Chair, Vice-Chair and Secretary) and two other members of the Commission (appointed in consultation, by the three executive members during the second year of tenure of the commission). The selection committee will use carefully established assessment procedures and could choose to consult with other commission members and appropriate external assessors.

**Type of Prize:**

- The Prizes will be of \$1000 each, plus a medal and certificate to be provided by IUPAP.
- The Prize money will normally be given as a contribution towards the expenses for attending the ICPE sponsored conference.

## IUPAP – ICPE

### International Commission on Physics Education International Union of Pure & Applied Physics

**Editor:**

A/Prof Ian D. Johnston  
School of Physics  
The University of Sydney  
Sydney, NSW 2006, Australia  
tel: +61 2 9351 5982  
fax : +61 2 9351 7726  
email: i.johnston@physics.usyd.edu.au

**Publisher:**

UniServe Science, Science Clearinghouse  
Carslaw Building (F07),  
The University of Sydney  
Sydney, NSW 2006, Australia  
tel: +61 2 9351 2960  
fax : +61 2 9351 2175  
email: BioSciCH@mail.usyd.edu.au  
web: <http://science.uniserve.edu.au/>

For comments, questions, suggestions please contact the editor.

The International Newsletter on Physics Education is a bi-annual publication of the International Commission on Physics Education. The next issue comes out in April 2009.

Visit our web site at:

<http://www.phys.ksu.edu/icpe/>