IUPAP INTERNATIONAL UNION OF PURE AND APPLIED PHYSICS
International Newsletter on Physics Education
ICPE
International Commission on Physics Education • International Union of Pure and Applied Physics
Number 57 April 2009

ICPE Chair's Corner

Our Commission was entrusted with the task of implementing the action plans that emerged from the *World Conference on Physics and Sustainable Development* held at Durban in 2005, along with other members of the organizing committee for the Physics education segment. A direct outcome of this mandate has been the organization of *Physware*, a collaborative workshop to strengthen active learning in the developing world using low-cost equipment and appropriate technologies in the developing world, organized in February 2009 at the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste. The success of this workshop (see the report on page 11) has strengthened our resolve to sustain the venture as a regular series of *Physware* workshops at ICTP and other appropriate locations throughout the developing world. We were delighted to find support as Professor Sreenivasan, Director ICTP, engaged in intensive discussions with the participants to identify the variety of ways in which ICTP can further physics education activities and invited us to create a five year action plan for this thrust direction. By promoting programs specifically designed to inculcate a deeper understanding of the educational process in physics, ICTP can be instrumental in mentoring young physicists who not only contribute to the growth of advanced studies and research in physics but also foster the best pedagogical practices in the classrooms across the developing world. Indeed, there is need to break boundaries and forge synergetic coalitions of physicists – from physics departments and research institutions – and deeply motivated physics educators and physics education researchers for training and capacity building of high school and college physics teachers. Comingling the role of researcher and educator April hold the key to inspiring young students to careers in physics.

The most significant achievement of the *Physware* workshop was the attempt by participants from diverse cultural and professional backgrounds to transcend individual constraints and evolve a shared identity as a community of practice – developing new competencies with a common vocabulary and conceptual understanding of the problems in both physics and physics education; striving together to achieve common goals through a process of collective learning; developing a shared repertoire of pedagogical experiences, tools and resources. A recurring question was how best to carry forward this process of social learning by bringing others into the fold of the community. Setting aside the anecdotal evidence that chronicles wide spread cynicism towards adopting innovative practices, our workshop participants strategized to assume leadership roles: to share with colleagues what they had learnt, to adapt and adopt the active learning methods in their own classrooms by overcoming resistance by the local systems. Some have already organized *Physware* workshops in their institutes and in their regions. We look forward to the outcomes.

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In this issue

Welcome to New Commissioners

At the IUPAP General Assembly held at Tsukuba, Japan, October 14–17 October, nine new commissioners were elected to the ICPE. Their tenure is for three years I the first instance. We take this opportunity of welcoming them in the first year.

Michael Vollmer

Michael Vollmer is professor of physics at the University of Applied Sciences in Brandenburg Germany since 1994. He studied physics in Heidelberg, Germany, receiving a PhD (1986) and Habilitation (1991) in optical spectroscopy of metal clusters. Besides a year as post doc in Berkeley California he regularly spends some time abroad for teaching and research, e.g. in Thailand as well as at various institutions at universities and industry in the United States during sabbaticals. His scientific research interests mostly cover the fields of spectroscopy, atmospheric optics and infrared thermal imaging. In these fields he publishes regularly and has also written two books so far.

In physics education, he is strongly engaged in the field of in-service teacher training. He regularly organizes teacher training seminars at his university. He is also responsible for the organization of four to five official week-long teacher training seminars of the German Physical Society (DPG) in Bad Honnef, Germany per year. In addition he has also been giving teacher training courses in other countries like Switzerland and Namibia.

He was and is engaged in various activities of the German Physical Society (board member of section didactics of Physics, member of counsel of DPG, scientific counsel for the physics center in Bad Honnef, prize committee, etc) and he is on several advisory boards/editorial boards of journals in the field of physics education (Physics Education, European Journal of Physics, Physik in Unserer Zeit (German), phydid (German). He is also actively working as referee for a German grant program in this field.

When he is not working, he likes to spend time with his family, he also regularly enjoys ballroom dancing as well as volleyball.

Zulma Gangoso

My name is Zulma Gangoso, I am 61 years old and I was born in Córdoba, Argentina. I have two sons and one daughter (Marzio 35, Marco 28 and Nunzia 23). I have been married for 38 years with an italian man, who was born in Naples. Unfortunately he died in October, 2008.

I am a full time Professor at the Physics Department in Cordoba National University. I obtained my degree in physics with a study in cosmic radiation. I started teaching immediately. My first job was in a secondary school and this experience marked definitively my professional career.

After that I have taught physics at all levels of the educational system (elementary school, high school, teacher-training programs, undergraduate and posgraduate physics and physics education courses).

I´m doing research in Physics Education in the area of Problems Solving and Modelling. I have been advisor of major and doctoral thesis and the Director of several research projects on Physics Education in Argentina and co-director of other groups abroad.

I belong to and am an active participatant in the AFA (Argentina Physicists' Association) and the APFA. (Argentina Physics Teachers' Association). I have been a member of the Organizing Committee of the Argentine Physics Olympiad.

I am really honored to become a member of ICPE and I feel a great responsibility for this representation. I hope to be able to respond to the expectations that are generated by my work on the commission.

I have no doubt that Physics and Physics Education can change the life of many people, especially in countries with problems of development, like mine.

Gizaw Mengistu Tsidu

Gizaw Mengistu Tsidu was born in 1967, in Arsi, Ethiopía, and studied physics in his home country up to the level of M.Sc.. He obtained his Ph.D. in 2004 at the University of Karlsruhe, Germany. His research field of specialization is in atmospheric physics and remote sensing. He worked as a meteoroligist in Ethiopia and India early in his career, and was a post-doctoral fellow at the Institute for Meteorology and Climate Research and the University of Bremen in 2004–6. He is currently the chair of the Department of Physics at Addis Abbaba University.

He has taught to students at university level courses in (among others) statistical physics, laser spectroscopy and atmospheric dynamics and has supervised M.Sc. and Ph.D. students in fields such as atmospheric chemistry, regional climate modelling and coupling of atmospheric and oceanic circulations. He is currently Vice President of the Ethiopian Physical Society, and a member of the the Ethiopian Meteorological Society.

He is involved in evaluating and improving physics curriculums of his own university and others in Ethiopia; and he also works on keeping high school physics teachers up to date through newsletters and conferences of the Ethiopian Physical Society. He is also interested in improving high school physics textbooks and trying to solve the skill gap of undergraduate students during their first year in the university. He participates in outreach activities which create awareness of physics education by high school students and parents, and works to improve graduates' practical skills through improving undergraduate laboratories, arranging educational visits and on-job training for our prospective graduate to other institutions such as metrology laboratories, communication labs of telecommunication authorities, electricity cooperation labs and military workshops.

Edward Kapuścik

Edward Kapuścik was born in 1938 in a small town Racibórz, Poland. He got his Master of Science in physics in 1961 at the Jagiellonian University in Kraków. He got the PhD in physics in 1965 as well as the habilitation in 1975 at the same university. Since 1988 he is a Professor of Physics.

He started research in 1961 at the Institute of Nuclear Physics in Kraków and Joint Institute for Nuclear Research in Dubna, Russian Federation. His main subject is foundation of physics, quantum mechanics and quantum field theory, special and general relativity as well as teaching of physics. He wrote 120 scientific articles and one book. Since 1984 till 2006 he was the Head of PhD Studies at the Institute of Nuclear Physics in Kraków. During 1992 till 1998 he was a professor of physics at the Pedagogical University at Kraków and from 1998 till now he is the professor of physics at the University of Łódź where he heads the Chair of Modeling the Teaching Processes.

He is a member of the Polish Physical Society and the Editor in Chief of the journal "The Old and New Concepts of Physics (www.conceptsofphysics.net).

Hideo Nitta

Hideo Nitta is currently a professor in the Department of Physics at Tokyo Gakugei University. He gained his PhD in theoretical physics from Waseda University. He has had many papers and books published by Japanese and overseas publishers on many subjects including quantum dynamics, plasma physics and radiation physics

His interests in physics education have been focused on developing effective physics courses for pre-service teachers. He is a member of the Committee on Physics Education of the Physical Society of Japan, and he is also on the board of directors of the Physics Education Society of Japan.

Among his other publications, he is an author of the highly innovative *Manga Guide to Physics,* which teaches physics in a student-friendly way, by joining real Japanese-style manga with serious and practical instruction. The book's story revolves around Megumi, a high school tennis star frustrated by physics class—and the physics of tennis. Luckily for her, she befriends Ryota, a geeky physics Olympian. After he's persuaded to help Megumi avoid failing physics, Ryota teaches her about Newton's laws of motion, vectors and scalars, and inertia, velocity, and acceleration. With extended explanations and examples to help learning, this informative and charming guide will have students up to speed on the physics of motion in no time.

Nianle Wu

Nianle Wu is professor both of the Department of Physics and the Center for Advanced Studies Tsinghua University in Beijing China. He graduated from EE department of Tisnghua University in 1970, and then studied physics in Graduate School, and graduated in 1975. His scientific research interests mostly cover the fields of lasers, nonlinear optics and photonics. In these fields he publishes regularly and supervises about 10 post-graduate students. He has received a National Science Award in 1978 because of his research achievements on laser physics. During the 1980s and 1990s, he visited the IFSW University Stuttgart and the Fraunhofer Institute for Laser Technology in Aachen Germany, as a guest scientist.
His teaching career began in 1980. He loves teaching very much, and has taught several fundamental physics courses for undergraduates and also some professional optics courses for senior or graduate students. Since 1999, he has been the Director for Undergraduate Studies in Department of Physics, and currently he is the Vice Chair of the School of Science in charge of education. He greatest concern is how to increase students' interest in learning.

Since 2003, he has worked as the vice-chair of the Chinese Commission on Physics Education; He is responsible for the organization of conferences on physics education every year. Every time, more than 300–400 physics instructors, from all over the country, participate at these conferences. Some distinguished scientists are often invited to attend also. He enjoys acting as a bridge between scientists and educators.

Leoš Dvořák

Leoš Dvořák is associated professor of physics at the Faculty of Mathematics and Physics, Charles University in Prague/ Czech Republic and the deputy head of Department of Physics Education at that Faculty. He studied physics at the same Faculty, receiving his RNDr. (1976) and Ph.D. (1982) in theoretical physics, namely in general relativity. His Habilitation (1996), still in theoretical physics, included already parts oriented to physics education, particularly to use of computers in teaching and learning of theoretical physics. Since then his interests gradually changed to more general questions of physics education, teacher training, use of simple experiments in physics teaching and learning and also to informal physics education.

He has been engaged in pre-service training of physics teachers for more than 25 years giving lectures on subjects like classical and theoretical mechanics, classical electrodynamics, relativity, etc. but also seminars on physics teaching and learning and on modern trends in physics education. In recent years he has been strongly engaged also in in-service physics teacher training.

He is a member of a Board of Union of Czech Mathematicians and Physicists. He organized several years of the national conference "Fair of Inventions of Physics Teachers", was the head of Czech National

Steering Committee of the European program "Physic on Stage" (in 2002-2003, then the vice-head of this committee) and participated at organization of other formal occasions.

He is also active (and, in fact, more happy) in less formal activities, e.g. "spring camps for future physics teachers" or informal project "Heureka" joining physics teachers and future physics teachers in Czech Republic but also some teachers in Slovakia and guests from other countries.

He cannot imagine life without books and music. And, of course, without good people around.

Saalih Allie

Saalih Allie is associate professor in physics and academic development at the University of Cape Town, South Africa. He studied physics at the University of Cape Town (UCT) where he obtained an M.Sc degree in 1984. He then spent two years in the ion-solid division of iThemba LABS, the South African cyclotron facility, where he worked on laser doping of semiconductors. He obtained his PhD at UCT in 1997 in the area of experimental nuclear physics where he investigated the process of neutron-proton capture at intermediate incident neutron energies. His physics interests are centred around research that involves the detection of neutrons.

His teaching career started in 1986 when he was appointed to teach a special access course in physics at UCT for students from educationally disadvantaged backgrounds. This led to his appointment in1991 of Coordinator of the Science Academic Development Programme. His main responsibility in this role has been to oversee redress and equity initiatives aimed at increasing successful participation of students that are deemed to have the potential to succeed but who would not be admitted on the basis of their high school results. His work is carried out at several levels ranging from designing new approaches to the first year physics curriculum to make it more accessible to the students in question, as well putting together flexible degree structures such as extended degree programmes that allow for differential pace.

These activities led naturally to carrying out research in the area of physics education where his interests include laboratory work, conceptual understanding, and language issues in physics. He has published several papers with colleagues on topics that include laboratory report writing in physics and student understanding of experimental measurement. The broad theme that underlies his present research is the way that context, at a fine grained level, influences student understanding.

Between 2004 and 2006 he was a visiting associate professor with the Physics Education Group at the University of Maryland and in 2000 he was a Mandela Fellow at Harvard University. During his free time he likes to enjoy the abundant natural beauty of Cape Town including both mountain and beach walks.

Alexandru Jipa

We also extend a welcome to Profesor **Alexandru Jipa,** from the Faculty of Physics, University of Bucharest, Romania.

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

This brings up the other related question of how best to bring into the mainstream innovations in physics education. What is the process by which a successful pedagogical innovation can be transferred from the precincts of the developer's laboratory or institution to a wider international group? These questions defy easy answers. But important clues are provided by demographical mapping of innovative curriculums adopted the world over.

It is important that intensive capacity building workshops such as *Physware* that aim to train-the-trainer and create regional leaders should not remain just a spike in the career graph of the participants. Mainstreaming of innovation requires a critical number of teachers to affect change in the system. This is possible only by sustaining the capacity building efforts of regional leaders through international support as they span local and global divides.

Pratibha Jolly
ICPE Chair

Multimedia in Physics Education

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Regional Center for Didactics of Physics in Styria, Austria

Seven years ago the International Newsletter on Physics Education was dedicated to “Computer and Information Technology in Physics Education”, on the occasion of an international conference with the same title held in Manila, Philippines [1]. Within these past seven years, computer technology has doubled three to four times the capacities of its components, as predicted by Moore´s law. This development was utilized immediately by physics research; but was the influence on physics teaching equally strong? On the one hand, it is known that educational regimes are very resistant to innovations and change; while on the other hand, new or improved technological products allow for and trigger new ideas and methods, and can also contribute to advances in teaching and learning physics.

A first glance could give the impression that the second view is the more realistic one, since the use of multimedia in physics teaching has grown enormously. For example, the number of computer simulations of physical processes, offered as freeware on the market, is incredibly large —Google gives more than 300 000 entries just for the keywords “simulation+pendulum”! But how, and to what extent, have physics teachers used this offer? And more importantly, has the use of multimedia changed their teaching style, at high school or university?

It is impossible in such a short article to give a comprehensive overview or to answer the questions raised above with evidence from empirical investigations. Therefore I will restrict myself to some examples which can serve as spotlights on different aspects of multimedia. This view is grounded on my work with MPTL (Multimedia in Physics Teaching and Learning), a consortium established within the European Physical Society [2]. Also I will concentrate mainly on software which is freely available.

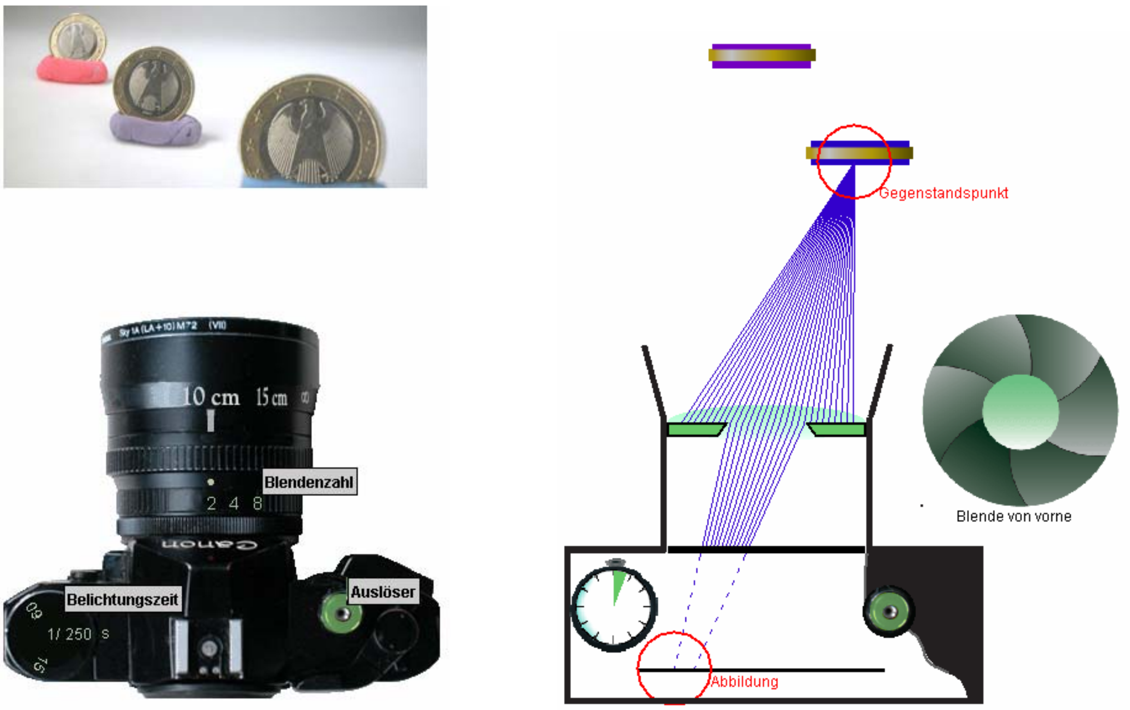

***Fig.1**: Two models of a virtual camera (from Ref. [9]). The user can shoot photos with the virtual camera and gets the corresponding photo, but he/she can also switch to a light-trace model of the camera. Variations of aperture and exposure time can be followed by the resulting photo and by the corresponding light beam.*

Simulations

The huge number of simulations which are available shows that many physicists (i) like to write their own programs, and (ii) think that their program might also be useful for others. Consequently there are many simulations on the same topic, exhibiting similar content. It will be addressed later in this article how difficult and time-consuming it is for an individual user to find excellent examples from mediocre ones. Things improved when collections of simulations were published. For example, pioneering work was done by F.-K. Hwang [3]. But in many cases this task has been attacked by groups of physicists or even universities, very often supported by national grants. Some examples from the United States are: MUPPET/CUPLE/CUPS [4], CPU [5], or PhET [6].

The use of simulations in physics teaching at every level has been facilitated enormously by the advent of small flexible Java applets. In the area of physics these small programs and simulations were given their particular name "Physlets"— the driving force having been supplied by W. Christian and his group [7]. We have seen that physicists like to create their own programs, but writing a program can also be of educational value for students. In both cases, the center of attention should be on the physics, and the programming of graphical displays or interactive elements is an unwanted burden. In order to help non-experts to create simulations in Java, F.Esquembre has produced an authoring tool, Easy Java Simulations (EJS) [8]. With EJS the user can concentrate on writing and refining the algorithms of the underlying physical model and does not have to spend tedious time on advanced programming techniques.

Any simulation of physical processes is based on an underlying model. Modeling in physics has a long tradition, in research as well as in education. But while models are useful tools for experts, beginners often have difficulty seeing the limits of models as well as their virtues. A simulation can therefore be of help in making the student aware of the attributes of a model. This can be accomplished, for example, by offering different models for the same context. One example is shown in figure 1.

Experiments

Multimedia tools have become indispensable in laboratory experiments, at universities as well as high schools. They support data acquisition from a range of sensors, and specialized software analyses the data and visualizes the results. Therefore experiments, which a few years ago could only be performed in well-equipped laboratories, are now standard in introductory labs. One example is in acoustics: A PC is sufficient to carry out real-time analysis of such complex sounds as the human voice. The appropriate software is freely available and consumer friendly, so that even high school students can work with it [10].

Either at schools or in university labs, experiments are usually done just once. But often it would be useful to repeat them in order to vary parameters, either as an exercise or to prepare for an exam. Beyond that, some experiments will never be part of a student lab, because they are too dangerous, too large or too expensive. Interactive Screen Experiments (ISE) are an attempt to overcome this situation [11]. Videos are prepared from experiments with special settings of parameters, collected in a data base. The user can choose among these settings and observe the corresponding experiment and its outcome.

An increase in sophistication is achieved by the so-called Remotely Controlled Labs (RCL). An experiment is set up in a laboratory. A user, who sits on his/her PC far away from the location of the experiment, can adjust the initial parameters of the experiment and can start it running. A video is taken of the experiment and the user gets immediately feedback by observing this video as well as getting the resulting data transferred on the PC. I want to give an example of an experiment which is neither dangerous nor large or expensive, but shows another facet of multimedia, namely global networking. H-J. Jodl and his group in Kaiserslautern managed to set oscillating several very accurate pendulums, in Aden, Naples, Kaiserslautern, Hermannsburg, and Riga [12]. By comparing their time-keeping behaviours, one can study the dependence of the gravitational acceleration on the geographical position.

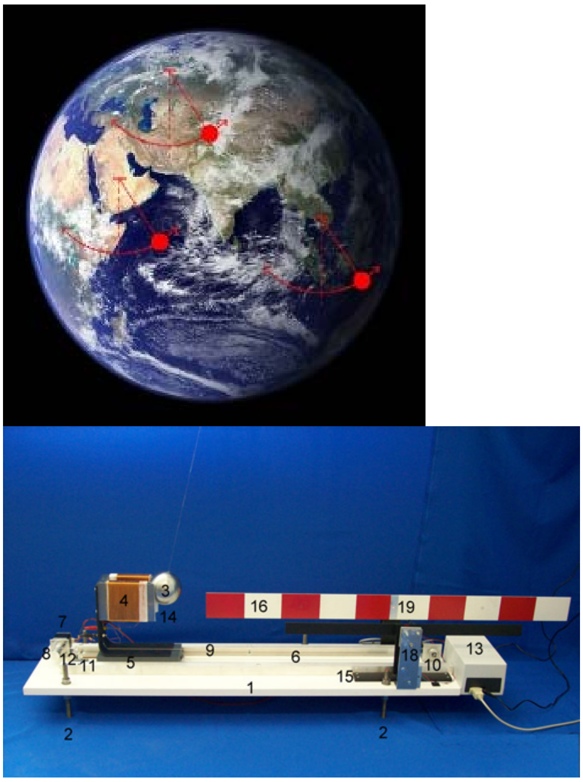

***Fig.2**: World pendulum. The same remotely controlled laboratory has been set up in different locations [12].*

One could object to ISEs and RCLs that the hands-on part of experiments is missing completely. On the other hand, once a modern experiment is set up, the controlling and data taking is very similar to a RCL.

Evaluation

As stated above, a huge amount of multimedia material is available on the (free) market. One cannot expect an individual user to find the time and effort to effectively search and evaluate these resources. Therefore a combined and systematic approach is needed. Available material has to be collected, criteria for evaluation has to be established, the material has to undergo an assessment according to these criteria, and qualified material has to be recommended and disseminated.

This task has been accomplished in the past years by a joint effort of two groups. Within the European Physics Education Network, a group called "Multimedia in Physics Teaching and Learning" (MPTL) was formed about 15 years ago [2]. In annual workshops this group has encouraged the production, presentation and dissemination of multimedia products. The "Multimedia Educational Resource for Learning and On-line Teaching" (MERLOT) is a consortium of American and Canadian universities whose goal is to improve the effectiveness of teaching and learning by increasing the quantity and quality of peer reviewed online learning materials [13].

The teams, MPTL and MERLOT, have established different sets of criteria for the evaluation of software products. Overall categories are: Motivation, Content and Method (MPTL) and Quality of Content, Potential Effectiveness for Teaching and Learning, and Ease of Use (MERLOT). Each category is defined by 4 to 5 questions which are scored on a 1– 5 scale. Because of the large number of items available, MPTL and MERLOT have decided to co-operate in a two-step evaluation process. Each group performs a preliminary review of the products from their lists in order to select items suitable for full evaluation. The results of the preliminary evaluation by the two groups are combined into a single list of materials selected for the final evaluations. This combined list is broken into sub-topics, similar to what is found in standard textbooks. Each of these items is reviewed by one member of each team, MPTL as well as MERLOT. These reviews are performed independently to provide a test of the consistency and repeatability of review results.

Despite the different lists of criteria, there was very good agreement between the results of the two review processes. If there were discrepancies, they were only slight ones about the ranking, whether a product was considered as excellent or "only" as very good. Results of the evaluation process have been published regularly as Recommendations of Software Products on the various fields of physics [14]. Several general features showed up being more or less independent of the respective topic of physics:

- Most of the sites can be assessed technically without problems.
- Many sites collect material from other sources.
- 80 – 90 % of the material is about standard tasks. These standard examples can be found multiple times.
- Most of the material is of mediocre quality; there are few very bad sites, but there are not too many really good ones either.
- Many sites are devoted to one, short and typical physical problem; only a few consist of a larger collection of material.
- Only about half of the simulations contain information about the physical background.
- Suggestions on how to implement the material in teaching/learning are very rare.
- Didactic reflections are missing for almost all products.

Conclusions

The quality of multimedia material to support physics teaching has improved substantially in the past years, both with respect to the layout and content. In some cases extensive field testing was performed before releasing new programs. Evaluations and recommendations by independent groups facilitate the search and choice of a desired product. A weak point is still the connection to pedagogical and didactical issues. Much more work has to be devoted to investigate the interaction of students with specific multimedia tools, in particular what elements promote a better understanding of the students.

I hope that this article could help to convince some of our skeptical colleagues that the implementation of one or the other multimedia product in their teaching will be of benefit, for them as well as for their students.

References:

[1] http://web.phys.ksu.edu/icpe/Newsletters/news.htm
[2] http://www.mptl.eu/
[3] http://www.phys.hawaii.edu/~teb/java/ntnujava/index.html
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PHYSWARE: Low-cost Equipment and Appropriate Technologies that Promote Undergraduate Level, Hands-on Physics Education throughout the Developing World

Report of a workshop held on 16– 27 February 2009, ICTP, Trieste

Directors: Pratibha Jolly (University of Delhi, India), Priscilla Laws (Dickinson College, US), Elena Sassi (University of Naples, "Federico II", Italy), Dean Zollman (Kansas State University, US); Local Organizer: Joe Niemela (ICTP)



Background: PHYSWARE is an initiative designed to enhance the quality of physics education at the tertiary level, especially in the developing world, and was conceptualized as a series of workshops. It is a direct outcome of recommendations from the physics education task force of the World Conference on Physics and Sustainable Development (WCPSD) co-sponsored in 2005 by ICTP, the International Union of Pure and Applied Physics (IUPAP), UNESCO and the South African Institute of Physics. The action plans, endorsed by all sponsors, emanate from the urgent need to strengthen physics education at all levels in all countries. These mandate development of model workshops and resource materials for physics teachers and teacher trainers that exemplify how active learning methods can be adapted to meet the needs of students in developing countries and further, mechanisms for electronic sharing of high quality physics education resources by establishing a website.

Objective: Within this framework, the first Physware workshop was held at ICTP from 16 to 27 February 2009. It brought together a talented group of physics educators to collaboratively explore active learning materials at the undergraduate level using affordable hands-on equipment that can be locally adapted by teachers and their students throughout the developing world. Physware also aimed at providing an exposure to appropriate technologies and computer-based tools for enhancing conceptual understanding. For obvious reasons, teaching of Newtonian Mechanics was chosen as the theme for the first workshop.
Another important aim was to provide a forum to the teacher-leaders to share experiences and exchange ideas about dissemination of active learning methods as they are expected to become leaders of similar efforts in their local regions.

Participants: In addition to the ICTP publicity network, a concerted attempt was made by the directors to outreach physics education communities by distributing the workshop poster at several physics education events across the world, posting it on pertinent websites and newsletters such as that of the ICPE. More than 200 applications from 48 countries were received, and 32 participants were selected from 27 countries in Africa, Asia, Latin America and Europe. The Physware participants represent a multicultural but eclectic group of talented and innovative physics teachers, teacher-trainers and administrators with demonstrated potential for assuming leadership role in dissemination activities organization of similar workshops.

Introductory Posters: Early in the workshop, the participants participate in evening poster sessions where they presented some of the innovative work done by them or some aspect of physics education in their institution or country. This served the dual purpose of breaking the ice and identification of areas of interest and work. The presentations also served to identify the large common denominator of problems faced by all countries.

Sessions: The two week workshop (10 working days) was structured to have four blocks of one hour forty five minutes on each day. Additionally, seven days included a two hour post dinner block to accommodate poster sessions and discussions. The participants were exposed to research based concept tests, diagnostic tools and learning cycles that promote active engagement. The first week activities, focused on laboratory work and class activities using no-cost and locally available materials, saw development of several innovative measurement set-ups and procedures. For instance, pendulums of different lengths were used as clocks to measure time in arbitrary units and a mahogany flower pendulum was used to study

damping. Later the ubiquitous cell phone provided a convenient mechanism for accurate measurement of time.
In the second week, the participants were exposed to computer-based measurement using motion sensors, force sensor and photogates. Powerful video capture and data analysis tools were used to analyze video clips of interesting motions such as that of a thrown basketball. One session was also devoted to how simulations can be integrated into a learning cycle to enhance conceptual learning.
Additionally, two technical sessions were organized to introduce participants to a virtual instrumentation project ongoing at the ICTP M-Lab, and to the construction of communication networks using low-cost wireless technologies, which generated a great deal of interest. In another session, participants evaluated features of low-cost computers, including the much in news "$100" computer from MIT.

Projects: The touchstone of Physware was collaborative work on projects. In the first week, participants worked with low-cost material to explore their use in active learning of topics of core importance in mechanics and presented the work through posters. In the second week, projects judiciously used appropriate computer-based technological tools. These included use of motion and force sensors, photogates; video data and graphical analysis software; and free/open source software. As many as fourteen projects were carried out in a span of a day. All the groups made a power point presentation. For example, one project evaluated effectiveness of the use of video capture and timing devices, to measure the time of free fall. Two of the projects entailed creation of proposals for workshops and a course in physics education for teachers. We hope some of this work can be refined for publication.

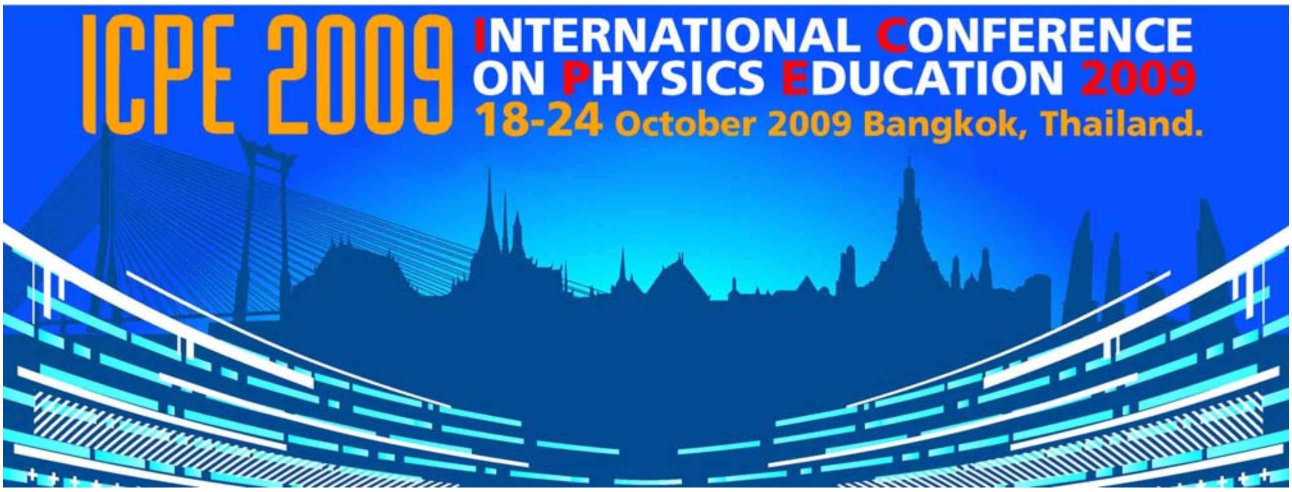
Special Discussions: A two hour evening session was devoted to discussing under-representation of women in physics. Participants shared informal statistics, country reports, personal experiences and fruitful interventions. Proceedings and resolutions emanating from the three IUPAP sponsored International Conferences on Women in Physics held at Paris 2002, Rio de Janeiro 205 and Seoul 2008, were shared. As a natural extension, issues of multicultural and multiethnic classrooms were also discussed.
Participants also had discussions with the Associate Director and Director of ICTP, to apprise them on the problems of physics education in developing countries and the need for ICTP to initiate programs in the area. The group also deliberated separately to provide inputs to an action plan for consolidating Physware as a series of global and regional workshops.

Towards a community of practice: A highlight of the workshop was the creation of a Physware Discussion Group and a Blog —in addition to the Physware Workshop site at the ICTP portal and the Wiki created by the directors. Participants were quick on the uptake and used the sites for exchange of information, resources and discussion on several threads. One participant volunteered to be the webmaster and led the participants through a special tutorial on how best to use a blog.
Another session was devoted to discussing the establishment of community of practice to further learning and collaboration through the sharing of resources, experiences and best practices through structured communication. It was decided to request ICTP to facilitate use of a web-based system that would enable the formation of a Physware community to continue the collaboration forged at the workshop while working in their respective countries. This is essential if the group is to produce concrete outcomes that can be shared globally and impact regional practice of physics education in the long term.

Feedback and Evaluation: A measure of the success of this workshop is the immense enthusiasm and diligence with which the participants worked until late at night — 10 pm on most evenings, Feedback of the participants on formal evaluation forms has been extremely positive on all counts.

Future Plans: Physware has successfully established a primary network of outstanding physics teachers who are familiar with best practices in physics education. They are enthusiastic about sharing their knowledge of active learning using low-cost materials and emerging technologies. They are anxious to find solutions to regional and local physics education problems. We are pleased that ICTP has agreed to maintain a website to facilitate formation of a Physware Community of Practice to strengthen local and regional outreach of participants.
Most participants plan to take a lead role in their regions and develop further the collaboration established with other Physware participants at a global level. There is an overwhelming consensus that ICTP should organize a series of Physware workshops on other introductory physics topics and also facilitate the organization of regional Physware workshops in developing countries. To move forward on these recommendations, the Physware directors plan to submit a five year action plan to ICTP for additional workshops, promotion of regional collaborations and development of the related Community of Practice.

Acknowledgments: We thank John Wiley & Sons, Inc., Prentice Hall, ICTP, ICPE and Indian Academy of Science for gift of books to the participants; Vernier International for gift of Logger Pro and some hardware; COACH AMSTEL for loan of equipment and gift of software; Physics Education Group at University of Udine for loan of equipment. We acknowledge the support provided by ICTP, IUPAP, UNESCO and the US National Science Foundation. We also thank Ms. Stanka Tanaskovic for the excellent logistic and administrative support.



The conference will cover the entire scope of Physics Education and related fields. Prospective authors are invited to submit original papers on their latest work. We also invite proposals for Workshops and Topical Forums.

ICPE 2009 "Development and Innovation in Physics Education" sub-themes are:

A. Bringing physics education into the 21st century
A1 Setting the agenda for physics education reform
A2 Physics curriculum design, development, and implementation
A3 Bridging the gap in physics education between schools, universities and workplaces
A4 Enhancing public awareness on the role of physics

B. Engaging physics education to the real world
B1 Exploring physics education within local and cultural contexts
B2 Making physics education more inclusive for women and other under-represented groups
B3 Teacher training and support for physics education initiatives
B4 Enhancing community outreach

C. Developing new and effective learning approaches for physics education
C1 Economically sustainable and appropriate technologies for physics education in developing countries
C2 Current findings in physics education research
C3 Linking physics teaching-learning practices to physics education research
C4 Role of ICT and other new technologies in physics teaching-learning

D. Preparing physics education to provide solutions to global challenges
D1 Role of physics-related organizations and networks in promoting innovations in physics education globally
D2. Role of physics education in providing solutions for probable global challenges
D3 Renewing physics education by incorporating ideas from current and future emerging technologies
D4 Physics in multidisciplinary contexts

The city of Bangkok where the conference will be held has been named "World's Best City, 2008" by *Travel and Leisure* magazine. It also recently won the "2007 Best City in Asia for the seventh year in a row in the *Conde Nast Traveler Readers' Choice* awards.




For any questions regarding the conference, please contact the conference secretary

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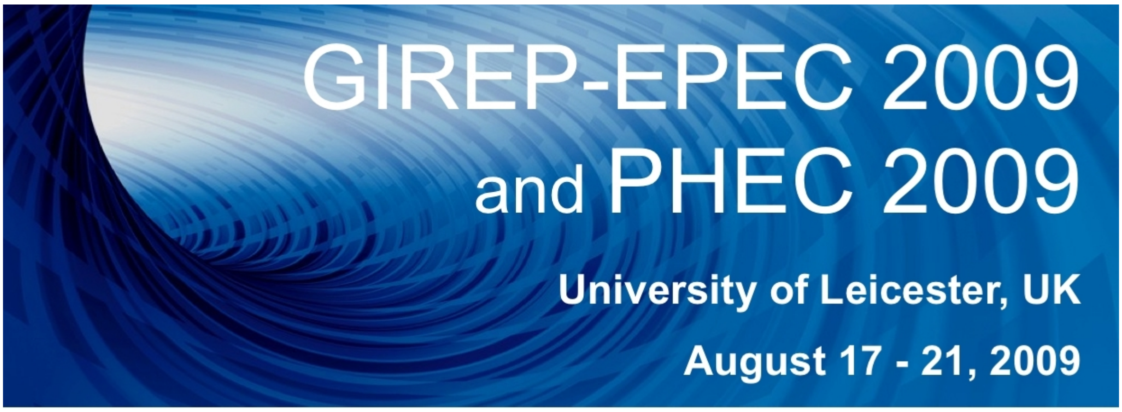
or visit our web site **http://www.icpe2009.net**

Please note the following important dates:

19 June 2009 — Final call for abstract submission
10 July 2009 — Presenters notified
17 July 2009 — Last day for early registration
17 September 2009 — Final program and schedule
18–24 October 2009 — Conference period



GIREP-EPEC 2009 : Call for papers

You are invited to register for the international conference for physics teachers, educators and researchers to be held at the University of Leicester, UK, August 17–21, 2009.

The conference is sponsored by the International Research Group on Physics Teaching (GIREP), Physics Education Division of the European Physical Society and will incorporate the Physics Higher Education Conference 2009.

The conference has the theme of Community and Cooperation and will bring together physics researchers and physics educators at all levels to encourage the exploration and exchange of ideas concerning new developments in teaching and new topics that might help to shape future curricula. The plenary talks reflect this by being divided into a physics frontiers strand and a physics education strand. The speakers in each strand emphasise the international nature of the conference, and include distinguished invitees from Mexico and the USA as well as several European speakers.

Frontiers of physics:
Ken Pounds (Leicester) X-ray astrophysics;
Els de Wolf (Amsterdam) Neutrinos;
Martina Knoop (Marseille) Spectroscopy of cold atoms;
Steve Swithenby (Open University) Brain imaging.

Developments in physics education:
Dean Zollman (Kansas State) Learning from video fragments of experienced teachers;
Josip Slisko (Puebla) Repeated errors in physics textbooks and the culture of teaching;
Elizabeth Swinbank (York) and Phil Scott (Leeds) Role of the teacher in concept learning;
Hans Niedderer (Bremen) Student ownership in physics learning.

Proposals are invited for oral presentations, workshops, posters and symposia. These should be submitted via the Abstract Submission Form on the conference website. The closing date for abstracts is 25 April 2009.

Early registration fee (by 25th April): £160 (£140 for EPS and GIREP members)
Registration fee after 25th April: £200 (no concessions)
University Halls of residence accommodation is guaranteed for registrations by 25th April: £159

Please visit the conference website for full details, including registration and submissions.
http://www.physics.le.ac.uk/girep2009

IUPAP – ICPE
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International Union of Pure & Applied Physics

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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 October 2009.
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