IUPAP INTERNATIONAL UNION OF PURE AND APPLIED PHYSICS

International Newsletter on Physics Education

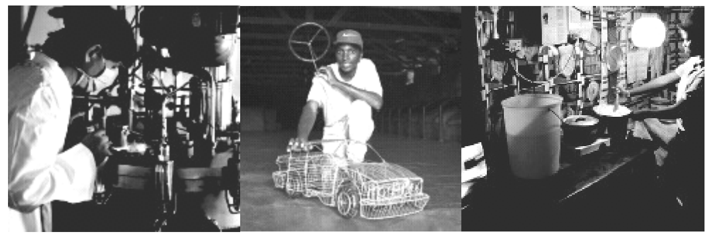
ICPE

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

Number 47 April 2004

INTERNATIONAL PHYSICS EDUCATION CONFERENCE TO BE HELD IN SOUTH AFRICA

The International Commission on Physics Education (ICPE), in collaboration with Africa Institute of Physics (SAIP), will hold an International Physics Conference on July 5-8, 2004 at the University of Natal, Durban, South Africa.



The Conference on "*What Physics Should We Teach?*" will be structured into seven (7) strands in order to maximize debate and discussion. For each strand, there will be a plenary talk to be followed by small group discussion and a guided poster session.

The seven strands are:

1. *Overcoming fragmentation in physics* (integrating physics topics);
2. *Blurring the boundaries of physics* (relationship between physics and other disciplines);
3. *Different strokes for different folks* (which groups of students need what kind of physics);
4. *Origin and ways of knowing* (history and philosophy of physics, epistemology);
5. *Skills* (skills needed for and developed by physics, e.g., cognitive, mathematical, experimental, entrepreneurial);

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In this issue

Teaching and Learning Physics in New Contexts

GIREP2004 ostrava.cz

The GIREP 2004 International Conference on "Teaching and Learning Physics in New Contexts" will be held on 19-23 July 2004 at the University of Ostrava, in collaboration with the Technical University of Ostrava and Union of Czech Mathematicians and Physicists in Ostrava, Czech Republic.

The topics of the Conference include physics and physics teaching/learning process with regard to ecology, climate, biology, biophysics, chemistry, medicine, industry, economics, the arts, and all processes that can improve our living conditions from the point of view of physics.

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THE VIII INTER-AMERICAN CONFERENCE ON PHYSICS EDUCATION

The VIII Inter-American Conference on Physics Education (VIII IACPE) was held at Havana, Cuba, 7 to 11 July 2003. Its venues were Havana University and Havana Libre Hotel. The VIII IACPE was organized by an Inter-American Council and the Cuban Physical Society. The general theme of the Conference was "Teaching Physics for the Future", and its goal was "to present, discuss and publish new ideas and results for improving physics teaching at all educational levels and improve the preparation of physics teachers".

The VIII IACPE was endorsed by the American Association of Physics Teachers (AAPT) and the American Physical Society (APS). It also had the endorsement and support of UNESCO, Latin American Center of Physics (CLAF) and the International Commission of Physics Education of the International Union of Pure and Applied Physics (ICPE/IUPAP). One hundred sixty-seven (167) delegates from 20 countries were present in the VIII IACPE. Sixty-two (62) delegates were Cubans and the rest from the other countries.

The main themes of the papers presented were:

- Teaching physics at non university levels
- Teaching physics at university level
- Preparation of physics teachers
- Informal education of physics
- Use of technologies in physics teaching
- General themes on physics teaching
- Themes of physics
- Epistemology and history of physics in physics teaching

The themes of the lectures and the lecturers were the following:

- The History of the Inter-American Conferences on Physics Education Through Its Recommendations. Moreira, Marco A., Federal University of Rio Grande do Sul, Brazil
- Reflections About the Methodology of the Researches in Science Education. de Cudmani, Leonor Colombo. University of Tucumán, Argentina.
- Physics Education Research – The Key to Student Learning and to the Preparation of Teachers. Mc Dermott, Lillian. University of Washington, United States of America. (Oersted Medal 2001).
- The Role of Physics in Education. Lederman, Leon. (Nobel Prize in Physics, 1988), United States of America.
- Past and Present of the Cuban Physics Career. de Melo, Osvaldo. Dean of Physical Faculty. Havana University, Cuba.
- The Development of Physics in Cuba. Fajer Victor. President of Cuban Physical Society, Cuba.

A roundtable discussion on the "Role of Physical and Physics Teachers Societies in the Improvement of Physics Teaching at the Inter-American Region" was conducted with the following speakers: Charles Holbrow (Presidet of AAPT); Fredrick Stein (Director of Education of APS); Deise Miranda (Vocal for Teaching of Physics in Brazilian Physical Society); Eduardo Moltó (Vice-President of Cuban Physical Society).

Two workshops were held, as follows:

1. Teaching with the Cosmology, Nuclear Science, Particles and Interactions, and Plasma Charts and Materials from the Contemporary Physics Education Project (CPEP). Aubrecht, Gordon. Ohio States University, United States of America.
2. The Project SDSS in the FERMILAB. Lara, Cristóbal. FERMILAB, United States of America.

The main recomendations of the working groups were the following:

Working Group 1: *The Teaching of Physics in High School*

1. To organize meetings (such as one on Didactics of Physics) between this and the IX IACPE, set up by the next IAF Organizer, with the support of an international team.

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6. *Conceptual organization* (selection, sequencing and development of concepts to increase learning); and
7. *Physics for today* (incorporating recent physics developments, technological applications)

The deadline for registration is May 21, 2004. For more information, visit the website, *www.saip.org.za/Conference.html*, email to *ICPE2004@nu.ac.za* or contact Prof. Diane Grayson (*graysdj@unisa.ac.za*).

RELEVANCE OF PHYSICS EDUCATION IN THE 21ST CENTURY

Increasing the relevance of physics education in the 21st century was the theme of the Conference of the Asia-Pacific Physics Teachers Association, Philippines Chapter held on 15-17 April 2004 at the University of the Philippines National Institute for Science and Mathematics Education Development. The objectives of the conference were to: (1) discuss current developments and issues in physics and technology education at secondary and tertiary levels, (2) share experiences and researches in promoting relevant physics lessons, and (3) strengthen multi-sectoral cooperation.

Over a hundred physics teachers and professors attended the talks and workshops on the following topics:

- Broadening Scientific and Technological Literacy: A Challenge for Physics Education
- Improving Curriculum and Practice in Physics and Technology Education
- Use of Innovative Technologies in Physics and Technology Education
- Research in Physics and Technology
- Physics Education Research
- Hands-On and Minds-On Physics
- Basic Education Physics Curriculum in Context

Other activities included visits to observatories on campus.

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2. Send to all Ministries of Education, Physical Societies and Physical Teachers Societies in the hemisphere, a well-founded document indicating the importance of strengthening Physics education at the high school and secondary levels.
3. Considering the need of strengthening the experimental work at these levels, we recommend the creation of Workshops and Seminars on the subject to take place during the next IACPE, and also in the period between the present one and the next one.
4. To ask organizations such as UNESCO, OEA, OREALC, OEI, CAB, etc., for systematic support to the Ibero-American Physics Olympiad and other similar events.
5. To give this group a permanent character, in such a way that it can propose new initiatives before the next IACPE, and contribute to the propaganda of well-proven didactical ideas –which can be done through the IACPE webpage.

Working Group 2: *Use of New Technologies in Physics Teaching*

1. Creation of a webpage with the goal of receiving and spreading contributions on different ways of using and evaluation of new technologies in Physics teaching. The people responsible for this proposal, are: Marcelo de Oliveira Souza (Brazil) (*mm@venf.br*); Ricardo Buzzo Garrao (Chile) (*rbuzzo@ucv.cl*)
2. Creation of an InterAmerican Center for the development of multi-media software for Physics teaching. The idea is to give workshops on the creation of multi-media software and its free distribution to all members of the Physics community. The people responsible for this proposal, are: James Sullivan (United States) (*James. Sullivan@uc.edu*); Rolando Blest (Chile) (*rblest@lauca. usach.cl*)
3. Creation of a forum about the use and abuse of new technologies in Physics teaching, aimed at the evaluation the individual experiences and their impact in the learning process. The people responsible for this proposal, are: Alejandro González (Mexico) (*xaghx@ yahoo.com*); Julio Vázquez (Cuba) (*geavarona@cuba solar.cu*)

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The organizers of the Conference are Prof. Erika Mechlova (*erika.mechlova@osu.cz*) of the Department of Physics, Faculty of Science, University of Ostrava and Prof. Petr Wyslych (*petr.wyslych@vsb.cz*) of the Department of Physics, Technical University of Ostrava. For more information, contact the Conference Secretary, Jana Janoscova (*jana.janoscova@ osu.cz*), or visit the Conference website, *http:// www.girep2004.cz*.

SHARING NON-STANDARD EXPERIMENTS
FOR INTRODUCTORY PHYSICS LAB

by Edward Kluk, Dickinson State University, Dickinson ND

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HOME-MADE POWER SUPPLY WITH REGULATED VOLTAGE OR REGULATED CURRENT

Introduction

This inexpensive and sturdy power supply is based on an adjustable voltage regulator LM317T and works either in voltage (1.3 - 9.5 V) or current (0.05 - 0.55 A) regulation modes. The current regulation mode works for low external resistances which are not exceeding 60 ohms. An internal fuse of LM317T switches the power supply automatically off when overheated, preventing any damage. In our Introductory Physics and Chemistry Labs these pover supplies are used for eight years without a single failure. Building a few of them lowers costs substantially. They are especially useful in all these experiments and demonstrations where relatively high current through a low resistance is required. Typical Lab applications are listed right below whereas some simple demonstrations are described in the last part of this instruction.

LIST OF SOME TYPICAL LAB APPLICATIONS

Lab experiment	*Function*
Ohm's Law	voltage regulator
Resistivity of Metals	current regulator
The Temperature Dependence of Resistance	current regulator
Measurements of Earth's Magnetic Field	current regulator
Superconductivity	current regulator
Measurements of Faraday's Constant (Chem. Lab)	current regulator
Electrolysis (Chem. Lab)	current regulator

Parts and Construction Blueprints

Part Name	*Quantity*
Voltage regulator LM317T	2
Resistors 10 OHM 0.5 W	2 pkg
Resistors 10 OHM 0.25 W	1 pkg
Predrilled board	1
Rheostat 20-OHM 1.2W	2
1/8" jacks	1 pkg
Toggle switch	1
Knobs 3/4"	1 pkg
Posts	1 pkg
Box	1
30-gauge wire – red	1
30-gauge wire – blue	1
Machine screws 40-4	1 pkg
Machine nuts 40-4	1 pkg
12VDC adapter 500mA	1

The blueprint below (Figure 1) shows how the electric circuit of the power supply looks like, and how it can be arranged on a half of the predrilled board (276-148). As usually a clean soldering with use of some sort of soldering paste like rosin soldering flux (64-021) is essential. Most constructional troubles are caused by wrong connections or bad soldering.

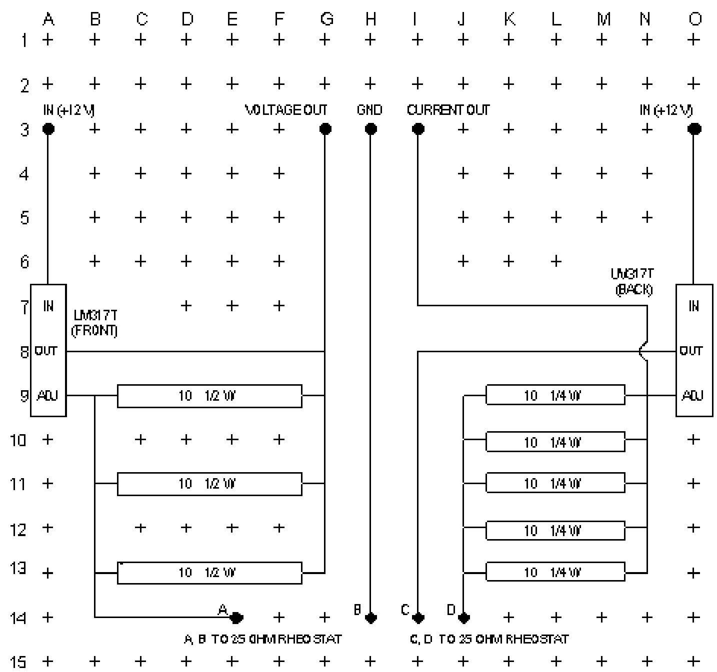

Figure 1

Additionally you have to make from an aluminum sheet two heat sinks for both LM317T (use of heat sink grease 276-1372). The Radio Shack heat sinks (276-1363) do not fit to the 270-233 box. Alternatively, you may use a larger box.

In Figure 2 a possible arrangement of controls, input and outputs is shown. Essential here is a firm fixing of potentiometers (rheostats). They should be prevented to turn around if somebody is trying to turn them too hard.

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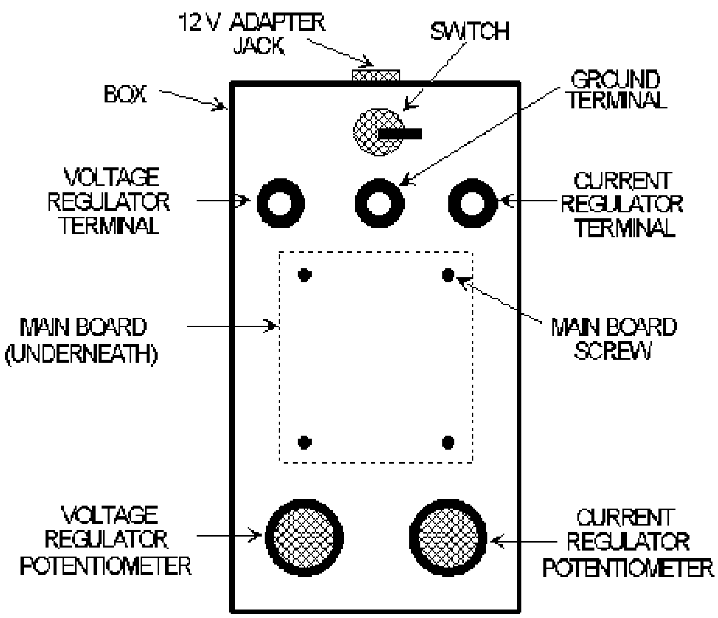
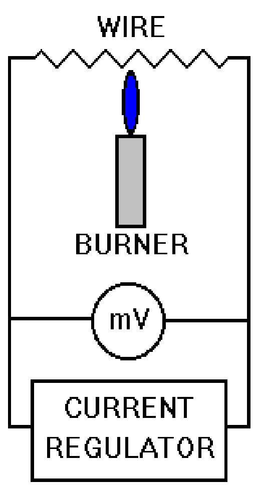
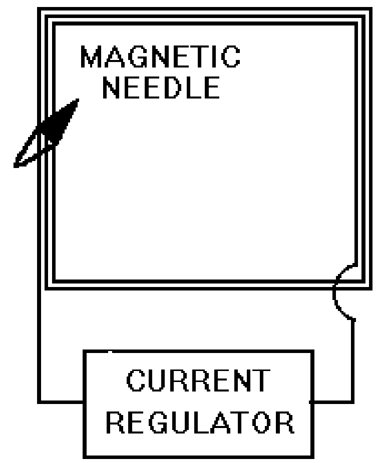


Figure 2

Two Simple Demonstrations



This diagram shows a quick demonstration of dependence of a resistance on temperature. The current regulator keeps a steady current through the wire. This current does not depend on the wire resistance. As the wire becomes hot its resistance increases and this in turn causes an increase of the voltage on the wire. For good results the wire resistance should be a few times greater than the resistance of the other electric connectors used in this experiment. A spiral made of a thin iron wire (gauge 30) will do the trick.



This is a copy of the Oersted's experiment revealing a magnetic field around conductors with electric currents. The left side of the triple wire loop should be oriented along the magnetic needle direction when the current is absent. The needle should be as close to the wires as possible. Increasing the current gradually we will observe the magnetic needle turning away from its initial direction. This experiment can be mounted on a plexiglass plate and demonstrated to large classes with help of an overhead projector.

Source:
http://www2.dsu.nodak.edu/users/edkluk/public_html/nslab/lspowsup.html

Other non-standard laboratory experiments in Physics may be viewed at:
http://www2.dsu.nodak.edu/users/edkluk/public_html/nslab/labshare.html

A TRIADIC MODEL FOR DEVELOPMENT AND DISSEMINATION OF PEDAGOGIC INNOVATIONS

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INTRODUCTION

Indenting inert educational systems with firmly entrenched practices is a complex task. Alternate programs demand new structures, resource materials, teaching strategies, instruments for assessment, mechanisms for dissemination and pilot trials. Such wide scale changes cannot be affected in isolation from the key players: the students and the teachers who cannot but operate within the academic and administrative framework of the organization.

At University of Delhi, teaching of undergraduate courses is delegated to several constituent colleges, all prescribing a common course of study and terminal examination. Teaching programs operate within the dyadic framework of traditional lecture and laboratory. These place few cognitive demands on the student. Periodic changes in curriculum do occur. However, the locus of reform is invariably the content. Rarely is an effort made to embed the curriculum in what may be perceived as good pedagogical practice and evolve effective methods of instruction. Although these problems are not unique to our system, they are more serious because unlike developed countries where periodic waves of curriculum innovation have been enabled by well-deliberated policy initiatives, in India there are abysmally few institutional reviews or funding programs for research in education at the tertiary level. Then, most teacher innovations tend to be on a limited scale and rarely constitute a comprehensive course package to merit attention. Inasmuch as import of curriculum packages, resource materials, experimental kits and equipment, however proficient, cannot fill the lacunae in individual programs, indigenous solutions become imperative.

THEORETICAL FRAMEWORK

There are essentially three steps in curriculum development. These entail:

1. *Innovation*: getting from an idea to the concrete curricular product which could be an instrument for teaching, a teaching strategy or a complete curriculum;
2. *Accommodation*: getting all the stake holders to formally endorse and accept the innovations as part of the formal curriculum; and last but not the least,
3. *Assimilation*: getting the teachers to implement curriculum innovations in letter and in spirit in the actual classroom.

This triadic model (Jolly, 2002) proposed for a learning organization follows closely the process of cognitive change in a learning individual. As is well known, each of the above evolutionary stages brings its characteristic challenge and necessitates development of unique instruments and process skills.

ELABORATION

Student Projects as Instruments for Innovation

Since the initial stages of our work that began from the confines of a single classroom, we have used student projects as tools for curriculum development and pedagogic innovation. Guiding students has also provided a tremendous opportunity to us, as teachers, for life long learning.

Context: Although the scope of investigations is unlimited, we have looked for student project ideas from within the existing curriculum or such frontier areas that ought to be included in the formal curriculum (Jolly et. al., 1987.) To make a beginning, we targeted the existing laboratory programs, identifying three major lacunae:

- there are few well crafted setups for demonstration of physical phenomena which can help students visualize the physics they are learning and enhance qualitative understanding;
- there is a lack of emphasis on reproducing the result of a physical measurement quantitatively to a sufficient accuracy; this is responsible for diminution of skills and consequent loss of confidence in the use of hands; and
- the measurement techniques are outdated and do not reflect the technological advances in instrumentation or exploit befittingly the potential of microelectronic devices and microcomputer-based technologies.

As an end product, the projects have attempted to generate ideas and resource material to fill these shortcomings.

Development of effective teaching-learning strategies: Projects provide the perfect framework for constructing a learning environment where the process of discovery is, both, hands-on and minds-on. A post hoc analysis of the project activities suggests that the model of learning that has evolved is one of cognitive apprenticeship (Collins, Brown, and Newman, 1989). In the initial stages the teacher, like an expert craftsman, models the problem, provides coaching and scaffolding to the student who moves forward through a sequence of increasingly complex tasks. As the student learns to negotiate these tasks entirely by herself, the teacher gradually fades out.

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By carefully balancing teacher guidance and self-paced inquiry, we have tried to ensure that open-ended projects, in addition to enhancing procedural and conceptual skills of students, also yield outputs utilizable by the formal system.

Development of Resource Materials: The know-how from student projects has led to formulation of a radically different laboratory curriculum (Jolly, 1994). The salient features of this course are its modular structure; introduction of familiarization exercises, laboratory tutorials and group discussions designed to enhance procedural and conceptual skills; and implementation of modern day measurement techniques. Iterative improvements on traditional physical measurement setups have also led us to develop indigenously a comprehensive low-cost microcomputer-based laboratory with appropriate data-acquisition hardware, software and curricular materials (Jolly, 1997; Jolly, Verma and Raghavan, 1999). An important requirement of most projects is development of hardware. The students whose projects involve a component of electronics instrumentation are required to package their working circuits and contribute these to the project laboratory for use by others. Considerable effort is expended in perfecting soldering skills, planning component layout, chassis mounting, art work and finally, in testing, debugging and calibrating. Students learn to optimize aspects such as the overall cost, technical features, ease of use, aesthetic appeal and robustness. The final designs conform to the blueprint accepted by the whole group so that work produced by different student groups can ultimately be branded together as a commercial prototype.

Accommodation of Pedagogic Innovation

The federal structure of our university and inherent democracy in discourse, in principle, gives the teaching community immense power to set its own academic agenda. Evidence shows that whenever a sufficiently large number of college teachers want a change in curriculum, endorsement by the formal system follows intrinsically. Then, before any major curriculum reform meeting, we have found it expedient to circulate background papers, hold discussions with teachers in individual colleges, conduct teacher training programs and use feedback to fine tune proposals. Such grass root level canvassing has played an important role in the formal adoption of the new laboratory curriculum for the honors program in Physics. However, acceptance of new curricular ideas invariably depends on a diverse set of factors. It is often because a change is long overdue; no other concrete alternative proposal is available; on academic grounds it would be politically incorrect to reject the ideas put forward. Indifferent acceptance can, however, cause significant distortions in what is proposed. In the case of new undergraduate laboratory curriculum, despite the training programs, we found many teachers systematically put aside all the novel features on which the pedagogic success of the course depended. Without the innovative units, techniques and teaching strategies, the curriculum accepted in principle, stood defeated on ground.

> ***It is relatively easier to usher changes in curriculum where teachers who develop the alternatives have the freedom to implement these in the class.***

At the undergraduate level where teaching is distributed over a large number of colleges, the dynamics of diffusion of innovation are complex.

Classroom Research as an Instrument for Assimilation of Innovation

Effective transfer of pedagogic innovation from the local and well-defined environs of the developers' laboratory to the widely differentiated ambience of actual classrooms is the most difficult stage to negotiate.

> ***Assimilation of educational innovation depends critically on teachers' understanding of how the specific instrument is to be employed.***

Then rather than concentrate on propagating merits of use of specific instruments, it is necessary to address the root cause of the impediment; the teacher's epistemological beliefs about the process of teaching-learning itself.

We have found routine short duration teacher training programs to be singularly unsuccessful in affecting a deep-rooted change in perspective. Using insight gained from our work with students, we have floated a unique training program that aims to build a community of thinking teachers who can commingle the roles of curriculum developers and education researchers. It does so by introducing them to current findings of physics education research and its methodology by directly engaging them in a classroom research project (Jolly, 2000.) It also provides a hands-on introduction to select innovative instructional strategies that have been successful the world over.

Context: While the scope of classroom research is all encompassing, the program deliberately keeps the teacher's classroom projects time bound, limited in scope and thus, sharply focused. After an initial introduction to what classroom research is, the participants are asked to form a collaborative group, design a single concept based instrument to collect data on students' learning of a single topic and administer it to large sample populations of students from across the university at the most opportune moment during instruction. This exercise provides the context for reading about earlier research where it exists (McDermott and Redish, 1999.) The challenge lies in designing a suitable instrument, analyzing students' responses, looking for patterns in students' thinking, interpreting these and making

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Working Group 3: *Physics Education and Science Education Research*

1. Research projects on physics education should include the participation of college teachers, secondary school teachers, and researchers from other areas of physics.
2. Educational systems – national, regional, and local- should provide opportunities, *e.g.*, fellowships - for secondary school teachers to participate in physics education research projects as researchers.
3. Physical societies and physics departments should encourage speakers to talk about physics education research in their meetings, seminars, and workshops, and to provide a space for presenting research papers on physics education in these events.
4. Physical societies and physics teachers associations should publish research journals in physics education and provide a space for research papers on physics education in their journals. They should also publish journals for teachers in which research findings in physics education can be communicated to the target audience.
5. Research papers on physics education and instructional materials resulting from this research should aim at high quality standards as the best way of gaining full acceptance and recognition from the physics and the educational communities.
6. Research journals in physics education must be fully refereed even when they are published only electronically.
7. The physics teaching and learning process itself should be an object of study in physics education research, as well as questions regarding the nature of science, the relationships among physics, technology, and other sciences, the use of methods and procedures typical of contemporary research activities, the historical, social, and cultural aspects of science.
8. At least the equivalent to a one semester course on research in physics education should be included in the curriculum of physics teacher preparation.
9. Educational institutions, governments, and physical societies should provide support (or help to obtain support) for visits between physics education researchers in different countries.
10. Research projects in physics education should be reviewed only by experts in physics education and on research in physics education.

Working Group 4: *The Preparation of the Physics Teacher*

Create a virtual network for the formation of physics teachers, to serve as a reference for profesors, teachers, researchers and others. The network will be configured having two sections: Initial formation and Continum Formation. For this, it is neccesary to:

- Support translation of materials into three lenguages (English, Portuguese and Spanish)
- Link with other regional websites
- Put this network on the home page of the Conferences

Working Group 5: *Informal Education in Physics*

1. To promote:
   - Exchange meetings between researchers, science popularizers, teachers and media previous to each IACPE.
   - The recognition, by all national research systems, of the importance of science popularization.
   - The participation in educational scientific projects.
2. To develop:
   - An information exchange network of Physics popularizers aimed at increasing the interest in Physics.
   - Ad hoc strategies to measure the political and social impact of Science popularization.

Working Group 6: *The Preparation of a Physicist*

- Both physicists and physics teachers (to the extent they are different) must be exposed to hands-on basics and advanced experimental techniques.
- Majors must have real contact with active physics research, whether experimental or theoretical, as early as possible in the course of study.
- The use of computational tools (as in virtual experiments and simulations) must not be at the expense of true experimentation; instead, use of computer technology should complement experimental skills such as data acquisition and analysis.
- Physicists must assure ethical treatment of undergraduate and graduate students and postdocs: they should be treated as real, valuable partners; they should get proper publication credit (no padding of coauthors); and results should not be rushed to early publication without consultation with coauthors.
- Physics departments in all the Americas should emulate the REU program (Research Experiences for Undergraduates) with exchanges across national boundaries.

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suggestions on how students' learning difficulties could best be overcome. To ensure quality, each collaborative group is required to produce a report and present the findings of the classroom research at a Seminar.

Achievements: This program has been fairly successful in, one, sensitizing teachers to need for reflecting on their teaching practices; two, focusing their attention on pedagogic issues. It has also led to development of new instruments for objective assessment of learning outcomes and generated a wealth of research-based data on patterns of student's learning through specific studies. More importantly, the program has catalyzed the formation of teachers' collaborative groups and a community of teacher learners, significantly large in number. This network has successfully permeated classrooms across the university as concept tests have been administered to large populations of students across many colleges. Even teachers who have not been active participants in this program have out of curiosity provided access to their classrooms. Training in the methodology of classroom research has empowered the participating teachers to undertake research-based curriculum innovations using their own classroom for data collection and field-testing of ideas. We hope the endeavor would lead to sustained action research by the collaborative network. It is the latter that can impact the praxis of instruction.

SUMMARY

The model proposed herein is essentially cyclic (Figure). It provides a mechanism for implementing the process loop for curriculum innovation, accommodation, and assimilation into the actual classroom. This entails

- identifying select lacunae in domain knowledge in the existing courses;
- initiating student projects for developing, one, a better understanding of the domain; two, resource material for new areas of instruction; and three, a new ethos in teaching-learning with greater emphasis on innovation and active mental engagement;
- identifying select lacunae in the pedagogic content of the existing courses;
- initiating teachers' classroom research projects for, one, sensitizing teachers to need for reflecting on their teaching practices; two, developing new instruments for objective assessment of learning outcomes; and three, establishing processes for large-scale development of research-based curriculums.

While experiments in education reform are long drawn and difficult to validate, the necessary steps outlined in this study have provided us milestones against which efforts can be evaluated.

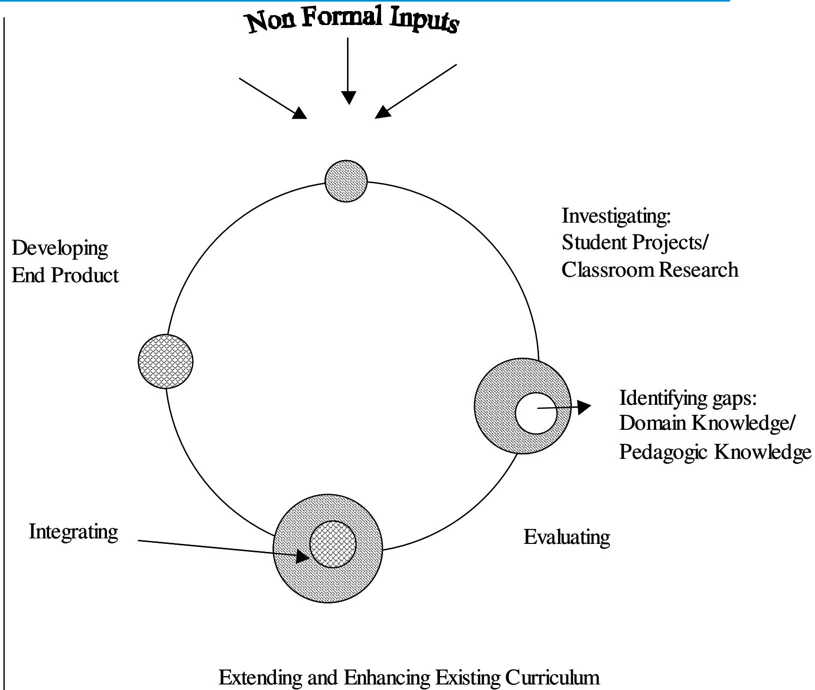

Figure. *Model of Curriculum Reform: Process Loop for Curriculum Innovation and Accommodation*

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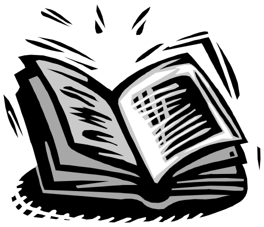

Excerpts from *Physics Now*

Introduction

Jon Ogborn

This collection of reviews of the state of the art in physics is an updated version of a collection edited by Paul Black, Gordon Drake and Leonard Jossem, to mark the beginning of the new millennium. Several years on, physics has moved forward and it is time once again to take stock and to look a little into the future.

The first collection arose out of discussions at a meeting of the Council of the International Union of Pure and Applied Physics in 1998. The Commission on Physics Education, C14, had raised the question of whether IUPAP would arrange any special activity to celebrate the millennium. It was decided to ask the chair of each IUPAP commission to contribute a short article to explain recent major advances in their field, and suggest how it might develop in the next few years.

The authors were asked to write for physicists who are not specialists in their commission's field, aiming at physicists - including high school teachers - who might use the material to enliven their classes. Many of the contributions rise nobly to this difficult challenge. Browse amongst them to see which appeal to you and your students. However, the special strength of the collection is that each piece is authoritative - written by recognised international experts in the field with a passion for their particular part of it. Thanks are due to the original authors for their willingness to contribute to the collection, and to those in the new commissions who undertook the revisions.

The pieces are presented in the order in which the IUPAP commissions happen to be numbered. There are many links between these fields, and sometimes some overlap. As editor, it has been my privilege to read each contribution several times, and this has led me to note a number of trends across the various commission, which give a hint of how physics as a whole is changing and developing.

One such trend is towards increasing interdisciplinarity. More and more, physicists are working with others to develop ideas at the boundaries of different fields, including chemistry and biology. In the work described by several commissions there is also a trend to tackle more complex and realistic systems, evidenced for example by the interest in 'soft matter'. Going along with this is a widespread theoretical interest in non-linearity, in complexity, critical phenomena, and the renormalisation group.

Several commissions report the growing importance of miniaturisation, of manipulation of matter at the nano-scale, together with recognition of the importance of phenomena at the meso-scale. Instruments and sensors are rapidly getting smaller, as well as more accurate. It is notable, in many reports, how optics has regained its importance and value for a range of new applications in many areas of physics.

Finally, the computer now plays a central role in the work of most physicists. It has become an indispensable tool of research, both experimental and theoretical. Computational modelling of physical systems, allied to the rapid growth in computer power and speed, thrives in very many areas. Sophisticated image processing is vital in many areas of both fundamental and applied physics. It seems safe to predict that uses of computing in physics will grow in the future, notably in those areas such as astrophysics, statistical physics and particle physics that already make heavy demands on computing.

Such changes in character of physics deserve to be brought to the attention of students, amongst whom is the next generation of physicists. In particular, it is important that high school physics courses reflect these changes, so that students can make better-informed choices of the subjects they will study. Reading and editing these pieces has been a pleasure. Taken together, they expand ones vision of physics and show that the subject is very much alive, still full of intriguing surprises, worthwhile problems and fascinating promise.

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INTER-AMERICAN... *from page 8*

The VIII IACPE concluded with a plenary session on the working groups' recomendations. Costa Rica will be the venue of IX IACPE.

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ICPE Chair's Corner

C 14, the International Commission on Physics Education, is very happy to present another issue of our Newsletter, edited by one of our Associate Members, Professor Talisayon.

During the time since our last meeting, in Noordwijkerhout in the Netherlands, the update of our "millennium book" *Physics 2000*, as it *Enters a New Millennium*, has been carried out. The new book *Physics Now* has been available on the web since the end of last year. We are grateful to our member Jon Ogborn who carried the burden of collecting the texts from all commissions as well as editing the contribution of our own commission. Thanks are due to the authors from the different commissions for updating the articles from the earlier publication. During this year *Physics Now* will also be available in paper form, most probably printed in India.

ICPE is very proud of having been involved in one of the Varenna "Enrico Fermi" summer schools in 2003. For the first time in the 50-year old history of this prestigious school, physics education research was the topic. Our present member Matilde Vicentini from Rome and the former secretary of **C14** E.F. Redish from University of Maryland acted as planners and directors of the course.

Our next annual meeting will take place in Durban, South Africa, directly after the IUPAP supported international conference "What Physics Should We Teach?", organized jointly by ICPE and the South African Institute of Physics, SAIP. The main organizer is Diane Grayson from the University of South Africa, also member of **C14**.

Physics Education is certainly an issue that is still very urgent and **C14** hopes to contribute globally to encourage the different actors in the field. Teacher training, both initially and in-service, physics teaching at all levels and with modern equipment and not forgetting teaching the items which stem from physics and astronomy research of today, as well as physics education research, are all included in this sphere and deserve our close attention.

The role of many other agents in physics education should be observed very carefully and possibilities for collaboration taken care of. In particular, the national and regional physical societies must be our partners in this context. As is well known, some of these devote impressive efforts to the issues in question. However, we should also note, with great regret, that at least one very active partner has had to stop working in the field, due to the fact that no more resources were made available. I think of the European Network for Physics Education, EUPEN, whose important activities, led by Professor Ferdinande of Gent University in Belgium, lost their funding last October.

On the other hand, in the United States, two initiatives deserve our attention, namely PhysTEC (Physics Teacher Education Coalition), described by Ingrid Novodvorsky in our October Newsletter 2003 and the initiative where 250 American physics departments pledge to play a role in "improving the science education for future K-12 teachers". These projects would be well suited as patterns for initiatives in other parts of the world.

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EXCERPTS... *from page 10*

Commission 8 - Semiconductors *Bo Monemar*
Commission 9 - Magnetism *Roger Cowley, Michael Coey and Dominique Givord*
Commission 10 - Structure and Dynamics of Condensed Matter *Rudolf Klein*
Commission 11 - Particle Physics *Peter I.P.Kalmus*
Commission 12 - Nuclear Physics *Willem T H van Oers*
Commission 14 - Physics Education *Jon Ogborn*
Commission 15 - Atomic, Molecular and Optical Physics *W.A. van Wijngaarden*
Commission 16 - Plasma Physics *Abhijit Sen*
Commission 17 - Quantum Electronics *Hans-A Bachor and Richart Slusher*
Commission 18 - Mathematical Physics *David J. Rowe*
Commission 19 - Astrophysics *Virginia Trimble*
Commission 20 - Computational Physics *Janos Kertesz, Giovanni Ciccotti, Alex Hansen, Peter Borcherds, Peter Drummond, Gemot Muenster & Juergen Hafner*
Affiliated Commission 1 - Optics *Pierre Chavel*
Affiliated Commission 2 - General Relativity and Gravitation *Werner Israel & Robert Wald*
Affiliated Commission 3 - Acoustics *Lawrence A. Crum*
Chairs of Commissions 2003

NOTE: COMMISSIONS NOT INCLUDED
Commission 1 is an administrative Commission, responsible for finances
Commission 7 Acoustics has become Affiliated Commission 3 Acoustics
Commission 13 Physics for Development is being re-organised

It is available free on the web at the URL: http://web.phys.ksu.edu/icpe/Publications/index.html and can be formatted for printing either in A4 or 8.5 x 11 size (159 pages) or can be downloaded directly from http://web.phys.ksu.edu/icpe/Publications/PhysicsNowText-A4.pdf

Capacity Building Activities of ICPE: Commission 14

The International Commission of Physics Education (ICPE) has the mandate "to promote the exchange of information and views among the members of the international community of physicists in the general field of Physics Education, including information concerning education in the physical sciences at all levels, as well as information relative to the assessment of standards of physics teaching and learning". In addition, the mandate contains "a recommendation of giving help to physics teachers at all levels and in all countries".

The Commission tries to fulfill this mandate by supporting conferences on physics education. Recent examples are the ones in Cuba in 2003, "*Teaching Physics for the Future*"; in South Africa in 2004, "*What Physics Should We Teach?*"; and in India in 2005, "*World View on Physics Education in 2005*". It is noteworthy that the geographic distribution of these conferences is worldwide, with special emphasis on developing countries. ICPE also contributed actively to one of the 2003 International Schools of Physics "*Enrico Fermi*" in Varenna, Italy, under the heading *Research on Physics Education*, as well as a conference in Udine, Italy, entitled "*Quality Development in Teacher Training and Education*".

For many years ICPE has published a Newsletter, twice a year. The editorial policy is "to publish articles relevant for a wide audience on issues in physics education at all levels and to report on ICPE activities, including details on the outcome of its annual meetings".

In 2003, ICPE published *Physics Now*, an updated version of a book containing reports from all IUPAP Commissions. It is available for downloading from the web but will be printed in a paper version during 2004.

Following a decision of the 2003 ICPE annual meeting, a working group has been established to look into the possibilities of helping teachers in developing countries in accessing publications on physics education research.

Close contact has been built up with one of the global physics competitions, International Young Physicists' Tournament, a team contest where open discussions take place among students from the last pre-university grade, in front of an internationally composed jury. It is expected that this year's event in Australia will see teams from all continents.

An ICPE medal for physics teaching was first awarded in 1980 and has since then been presented to a total of 14 recipients. It recognizes excellence in contributions to international physics education and is one of the oldest awards for excellence given under IUPAP auspices.

Finally, ICPE is in close contact with UNESCO Programme in Physics as well as with the activities of other international organizations working with the same aims.

GUNNAR TIBELL
ICPE Chair

Contributions to ICPE Newsletter

Physicists, physics professors, lecturers and teachers, and physics education researchers are invited to contribute to the ICPE Newsletter.

Contributions may be: news of physics education activities, seminars, conferences; research articles; write-up of unique student experiments/investigatory projects; description of teacher demonstrations, improvised equipment and accompanying student experiment; book reviews; and novel physics problems and test items.

Text (including pictures) of contributions is limited to 1-3 pages, single-spaced. Your contributions should reach the editor by mail or e-mail, at the latest by **end of February for the April issue or end of August for the October issue.**

IUPAP – ICPE
International Commission on Physics Education
International Union of Pure & Applied Physics

Visit the ICPE Homepage: www.phys.ksu.edu/icpe

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The International Newsletter on Physics Education is a bi-annual publication of the International Commission on Physics Education.

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