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George Marx, Physics Education Pillar, Passes Away

Prof. George Marx from Hungary, Vice President of IUPAP International Advisory Board from 1993-1996, and Professor Emeritus, Institute of Education, University of London, died of cancer at the age of 76 on 2 December 2002 in Budapest.

He served the international physics education community in many ways: member of ICPE in 1975-1978, 1978-1981, Vice-Chair in 1987-1990, 1990-1993, and Editor of the ICPE Newsletter, 1988-1994. He had a long involvement with GIREP as its President in 1992-1995.

In addition, George Marx became famous around the world-in Europe, the Americas, China, Japan, India and other Asian and African countries-for his lectures, research work in physics and his work as a teacher, author, and editor.

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Two Women Receive 2002 ICPE Medal

Professor Lillian Christie McDermott from the University of Washington, Seattle, U.S.A. and Professor Tae Ryu from Sophia University, Tokyo Japan received the 2002 ICPE medal.

Apart from her continuing leadership in physics education research, Prof. McDermott earned the ICPE medal for: conducting researches on understanding student difficulties in learning physics, developing research-based physics curricula, promoting and making physics education research within the community of physics and throughout the world comprehensible.

Professor McDermott also led the education research community in adapting the idea of the demonstration and problem solving interviews developed in cognitive psychology in understanding how students think about physics. In addition, she extended what was learned in such interviews with individuals to large groups of students through testing with open-ended questions.

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In this issue

Italy Hosts 2nd GIREP Seminar on Quality Development in Teacher Education and Training

Groupe International de Recherche sur l'Enseignement de la Physique (GIREP) will conduct the second international seminar in the University of Udine, Italy on Quality Development in Teacher Education and Training on September 1-6, 2003.

European Physical Society (EPS) - Division of Education, International Commission on Physics Education (ICPE), European Physics Education Network (EUPEN), with the cooperation of the Austrian and Slovenian Sections of GIREP, International Centre for Mechanical Sciences (CISM), National Italian Conference of the University Centres for Research in Education are among the groups organizing the seminar.

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Further, she broke new ground in demonstrating how to create high quality curricular materials based on research knowledge.

Professor Tae Ryu is awarded the ICPE medal for her remarkable contributions to physics education. Her international contribution in physics education started when she organized a workshop based on her experience in the Summer Institute of Harvard Project Physics in 1972. The workshop had influenced college and highschool teachers who participated and published a Japanese version of "Project Physics". This evolved into the Association for Physics Education in Japan, which has been one of the most active and creative groups of physics teachers in Japan. She created profound impact on physics education in Japan. The most remarkable effect was that after the ICPE conference in Japan that she organized, many Japanese high school teachers started to attend meetings such as ICPE, GIREP, ASE (UK), NSTA (USA).

In addition, she performed joint international research work such as Physics Problems for University Entrance Examinations with Professors P. Black and G. Marx, et al. The report from this work was later published as part of a UNESCO book "Science and Technology Literacy" by UNESCO Project 2000. She also, wrote "The Factor Affecting High School Students' Choice of Science Courses" with Professor Woolnough, and participated in the UNESCO-PAC W3 working group activity.

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The seminar aims to (1) bring together physics teacher trainers to share their ideas on "how physics teachers teach physics in schools"; (2) consider the practices, resources and support that encourage and enable physics teachers to achieve, maintain and enhance good quality teaching throughout their professional lives; and (3) bring together teacher trainers, scientists from universities and industries, researchers in education, and school teachers to improve the quality of physics education.

The activities of the seminar include plenary lectures, round tables, panel sessions and workshops with the following themes: (1) Teacher Education and New Technologies, (2) Initial Teacher Education, (3) In-Service Teacher Training and Teacher Training at a Distance, (4) Contribution of Research to Teacher Training, and (5) The Universities and the implementation of Sorbonne and Bologna agreements; the role of universities in teacher education and training; and the training of university teachers.

The topics covered in the plenary lectures are: Training teachers as a challenge for achieving quality in science teacher; Initial teacher training and the improvement of science teaching; A worldwide moving on teacher training; Teachers' competences and professional autonomy; Indications for teacher training from real life experiences; Toys in teacher training; New languages for a new science curriculum integrating research and training for conceptual change; Epistemological aspects in the formation of science teachings; and Contribution of associations and thematic networks to the training of science teachers.

The following outcomes are expected:

1. A collection of papers on issues connected to quality development in teacher education and training for all grades in school from kindergarten to pre-university level.

2. A collection of papers on innovation in physics teaching.

3. A final document written with indication and recommendation on how to:

   - promote co-operation between schools and universities;
   - produce papers useful for teachers and to help teachers to produce papers themselves;
   - write criteria for supporting teachers in documenting their own work; and
   - enhance the contributions of institutions to the improvement of teacher training.

George Marx and International Physics Education

Professor Emeritus, Institute of Education, University of London

by Jon Ogborn

The Danube Seminars

I well remember standing with George Marx in Visegrad, where the Danube makes its huge bend to the south, looking across to what was then Czechoslovakia. George had chosen this historic place for the second Danube Seminar, the first of many Danube Seminars on Physics Education held in Hungary. Why the title, "Danube Seminars"? George Marx wanted the countries of Eastern Europe, then frozen in the Soviet bloc, to come together to invent for themselves new ways of thinking about teaching physics in the school. And he wanted to ignite that fire with flames taken from the best and most recent work and thinking in other countries. I was there as one of the matchsticks in his matchbox. At that time, in 1975, it was not at all trivial to arrange such a meeting.

Colleagues from Eastern Germany, Poland, Czechoslovakia, Yugoslavia could travel to Hungary fairly freely, but had almost no money. Visitors from England needed not only a visa, but also a "pre-visa" which requested permission to issue a visa. With determined effort, George overcame all these problems. Only one problem he did not solve: Hungarian forints once bought could not be changed back into English pounds. So we had to spend them all in Hungary. But such was George's generosity that we never managed to spend any at all! So we went back home with unusable currency. Perhaps this too was part of his plan: it made it more likely that we would return!

The first Danube Seminar held in Vienna in 1974 with the help of Roman Sexl, was about the teaching of wave mechanics in schools. The second, at Visegrad in 1975 was about teaching statistical mechanics. Together, the report on the two seminars, titled "Atoms in the School" showed ways of teaching about the structure and nature of atoms, and about the statistical consequences of the atomic/molecular hypothesis. Already it showed George Marx's deep vision: to reform physics education, tackle first the essentials of modern physics. Get the big and difficult things right, and maybe the smaller ones will follow.

There followed many further Danube Seminars. The third Seminar was on the teaching of Newtonian mechanics, "Momentum in the School". From that Seminar I remember the taste of a breakfast of milk and salty bread bought at a rail station, and learning the Hungarian word for the number 3. George had arranged for me to see his colleague Eszter Toth teaching some statistical mechanics at her school in Budapest. Leaving Visegrad in the dark at 5.00 am, Eszter and I travelled by train and bus to Budapest to arrive just in time for the first lesson of the day, breakfasting on delicious bread and milk on the way.

Eszter and her class, using some ideas we had developed in the UK, studied the distribution of molecules in two halves of an empty box. Throwing a die, they chose one of six "molecules" (numbered bits of plastic) to move from one half to the other. The students soon saw that 3 in one half and 3 in the other is the most probable distribution. "Harum - harum" they said. Slowly the meaning dawned on me. I could at last count beyond 2 in Hungarian!

By the time of the fourth Seminar, "Structure of Matter in the School", in 1979, participation was truly international, with contributions from Australia, Austria, Bulgaria, Czechoslovakia, Denmark, East Germany, Finland, Holland, Italy, Poland, Japan, and the UK, USA, and USSR. This may have been the seminar at which, during an evening dinner at a Czarda, the Russians present demanded that everyone sing a national song. Nervously, I realised that I was the only person from the UK. "Do I have to?", I asked George. "When a Superpower says 'sing', you sing!" was his answer. I sang, badly.

Events had been moving fast in Hungarian physics education. By 1977, the Hungarian Academy of Sciences, led by George Marx, had developed a proposal for curriculum reform in the sciences, in the General and in the Grammar School. Drawing on George's vision, the proposal started from the broad scientific world picture, and showed how to develop its essentials in a co-ordinated way across the sciences. At one International Conference I showed a slide picturing the "leaders" in science education, USA and UK, as runners looking behind them at another nations, waving them on. "Come, follow us". So, looking backwards, they did not see a small country, Hungary, running ahead of them with its own excellent programme. George was very very proud of this compliment.

It was at these Danube Seminars and later meetings in Hungary that I learned from George the essential gaiety and vivacity of Hungarian life. The Seminars were at a high intellectual level, but were always serious without ever being solemn. George's own lectures were masterpieces of wit as well as of clarity. In the evenings we danced and sang, George foremost amongst us. And anyone whose birthday

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it was found themselves being serenaded by gypsy violinists. We all wondered how George knew these birthdays so well. Simple: his conference registration forms always had a mysterious official looking section in which one had to write one's date of birth!

IUPAP, ICPE and GIREP Meetings

By the early 1980's George Marx had built up strong links with the International Union of Pure and Applied Physics (IUPAP) and its International Commission on Physics Education ICPE. They began supporting the Danube Seminars, which went from strength to strength. In 1981 a Seminar, on Nuclear Physics and Nuclear power, was held in the lake-side town of Balatonfüred. The collection of essays "Quantum Mechanics in the School" in the same year drew together much of the previous work, now bringing in contributions from such as Sir Nevill Mott and Victor Wiesskopf. Similarly the Danube Seminar teasingly entitled "Disorder in the School" (1983) built on earlier seminars about statistical mechanics, but began to go beyond them. George Marx, with his wide and eclectic circle of friends and colleagues all round the world, was one of the first to see that the emerging ideas of self organisation in complex systems, might well be important for school education. For myself, I first heard and first failed to understand the word "autopoiesis" (selfcreation) beside the Lake Balaton at this meeting.

Future seminars revealed yet more of the breadth and generosity of George Marx's thinking about science education. He was among the first to grasp the importance of the microcomputer revolution for Science Education. In 1985, as Vice President of GIREP, he organised an international meeting on Microcomputers in Education, again by the Lake Balaton where he also had a small family country home. Welcomed there for barbecues in the evening, we spent the days looking uncertainly into the future. But for George, the importance of computers had long been clear. At one of the earlier Danube Seminars, he had introduced me to a school student who had, at George's suggestion, programmed for a small home-built computer the "quantum shuffling" game. This was a game we had previously developed in the UK to simulate the Boltzmann distribution of energy quanta amongst atoms in an Einstein solid. However, this student, as well as building the computer, had programmed the whole thing himself in hexadecimal code. To tell the truth, I didn't believe it. But I noticed a small error in the way the averaging of numbers was done (a trap we had ourselves fallen into). The student returned two hours later with the game re-programmed and correct! I learned that George Marx was far from being alone in his Hungarian qualities of determination, self-belief and brilliance.

George's thoughts about the use of microcomputers always turned around the idea of making models with the computer, to get insights into how Nature might behave. These thoughts were reflected in his charming and wide-ranging collection of examples entitled "Games Nature Plays".

A word here about GIREP and ICPE, and George Marx's involvement in them. Founded in 1966 by Prof. W Knecht, GIREP (Groupe Internationale pour la Recherche sur l'Enseignement de la Physique) is and was a quite small European "club" of people interested in changing Physics Education. Its subscription was small, its membership conditions very open, and its meetings informal. It was a place where school teachers and university educators could talk on terms of considerable equality. As President of GIREP in 1992-95 George Marx helped to make sure that this friendly atmosphere continued. And Paul Black, President before him, recalls how it was George who, when plans for a GIREP meeting failed, stepped in and organised one himself - and made it an excellent one too.

The involvement with ICPE was over an even longer period. Between 1978 and 1981 George Marx served as a member of the Commission, returning in 1987 to 1993 as Vice-Chair. He was also a vice-president of IUPAP between 1993 and 1996. It was George who had originally proposed that ICPE award a medal for outstanding services to the teaching of physics, with an international dimension. In 1997 the Commission awarded George Marx himself the medal whose existence he had initiated. The citation read:

> *Throughout his long career Professor Marx has devoted himself to advancing the cause of science and of physics education. Both in his research work in physics, and in his work as a teacher, an author and an editor he has made seminal contributions to the literature. He has catalysed the organisation of numerous international conferences and projects in physics education. Always, and in all ways, George Marx has been a trusted advisor and a highly valued friend of physics teachers the world around, and through his continuing and tireless efforts on their behalf has earned their deepest respect, affection and gratitude.*

In 1987, George Marx organised another meeting at the Balaton, now supported by ICPE and GIREP, on non linear phenomena. Once again, his depth of vision had taken him beyond the then current concerns of Physics Educators. He saw, long before most, that non-linearity and chaos, with their connections to selforganisation and perhaps to the nature of life, pose huge but fascinating

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problems for Science Education. Again, the conference had one of his teasing titles, "Chaos in Hungary". There is a story about this. Some months later, he was telephoned by a high security official to say that East Germans, possibly subversives, had been seen in Berlin carrying bags labelled "Chaos in Hungary". It was understood that Professor Marx might be responsible. George laughed down the telephone. After a pause, the security man laughed too. George told me that this was one of the clearest concrete signs he had that the old political regime was changing.

In 1989 another conference, supported by GIREP, IUPAP, ICPE, UNESCO and the International Atomic Energy Agency, and introduced by the President of Hungary and the Director General of UNESCO, turned to a different topic, now central to George Marx's concerns. This was Energy and Risk Education. After the 1986 Chernobyl accident, public opinion had turned sharply against nuclear energy. George was deeply concerned that this reaction, while understandable, was not based on a real understanding of the issues. He had been impressed how, in Hungary, the public - educated with a school programme including aspects of nuclear energy - had been much less panic-stricken that in neighbouring countries. He saw that it was essential to support education both about nuclear energy, and about the assessment and understanding of risk. That concern continued: his last paper for the UK journal Physics Education on the occasion of the award to him of the Institute of Physics Bragg Medal for outstanding services to Physics Education, was entitled "Life in the Nuclear Valley". It showed how fundamental to all of life, including its very genesis and survival, have been nuclear processes. The "Nuclear Valley" of the title is the "potential well" formed amongst nuclei of every possible combination of neutrons and protons, due to their binding energy.

George had introduced us all to the idea at an earlier Danube Seminar. He was now delighted that we in the UK had taken it up in our recent work, and he was thrilled to be taken by us on a computer generated flight over "his" valley, plotted in three dimensions.

Later, in 1992, he found the Hungarian village of Matraderecske, where natural radon levels in houses were very high. Here was a place for very practical nuclear education, touching people's lives. George and his colleague Eszter Toth, together with her high school students, set about a programme of measurement, and practical education. The students learned by teaching the villagers. The last Danube Seminar "Planet in our Hand; Atoms in our Hand" at Eger in 1995 drew on this important experience.

Being Hungarian

You cannot understand George Marx's vital contributions to Physics Education internationally without first understanding that he was, above all else, intensely and passionately a Hungarian. This feeling shone through everything he said and did. It is at its most striking in his book, "The Voice of the Martians", which takes its title from a line by Isaac Asimov":

"A saying circulated among us that two intelligent species live on Earth: Humans and Hungarians." and from Leo Szilard's reply to Fermi's question whether extra-terrestrial beings were already on Earth: "They are among us, but they call themselves Hungarians" His book records and celebrates the multitude of examples in science of "Martian-Hungarians", speaking a language nobody else understood, invading and in many cases taking over whole areas of science and technology, besides seeding many new ones too. George was deeply proud of the achievements of Hungarian writers, poets, musicians and artists. He was even prouder of the many Nobel prizes won by Hungarian scientists, and of their profound contributions to science. He felt in his heart that all these people were very special, sharing what was for him a special Hungarian quality of excellence. He believed it his duty and privilege as a Hungarian to do everything possible to continue this flowering of talents into the future. People from his small nation had in the past changed the world many times over; George wanted to help that to go on happening in the future.

Your next mistake would be to imagine that this passionate belief in Hungary and Hungarians, which led him to stay and work there when many others had left, was in any way a narrow kind of nationalism. As a distinguished physicist of the first rank, George Marx was a strong internationalist. He had connections with physicists and educators all over the world, and sought always to learn from them and to enjoy what they had to offer. Visits to Hungary at his invitation by Richard Feynman, Eugene Wigner, Victor Weisskopf, Nicholas Kurti and many others gave him deep pleasure. He perhaps reserved his greatest admiration for two fellow Hungarians: John von Neumann and Leo Szilard. It was very clear to him, as it had been to Lorand Eotvos when he founded the Hungarian Physical Society, that Hungarians could only do work of world rank if they knew and understood deeply what the best people of every other country had to offer. Obvious in physics (though still not always observed everywhere), this view of things extended for George to other cultures, religions and ways of life. For him, there was something to be learned from everybody. His open mind and broad sympathies worked on every scale, from a love of Japanese green tea to an appreciation of the genius of Chinese culture. He hated the Soviet domination,

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but he knew, respected and learned from their great physicists, particularly Yakov Zel'dovich. It was a thought from Zel'dovich that led George Marx and Sandor Szalay to propose that a small neutrino mass could explain the "missing matter" in the Universe. If only neutrinos had turned out to be a bit more massive than they actually seem to be, a Nobel Prize might well have been his. If it had, he would have planted his own tree with pride in the garden he established with trees planted by every Nobel prize winner he could tempt to visit Hungary.

One thing George Marx never believed: that the path to creativity and excellence lies in a quiet life. He felt sure that the turbulent times that Hungarians have had to survive stimulated many of them to originality and brilliance. For this reason he was always himself looking eagerly for the next new thing; for the coming idea or challenge. That was what kept him alive.

George Marx in Japan, China and Africa

George Marx's fascination with and respect for all cultures gave him a wonderful and wide view of the development of knowledge throughout the world, and through history. In a chapter "Shortcut to the Future", written in 1994 for a volume to honour the memory of one of his heroes in physics education, Eric Rogers, he memorably evoked the whole history and geography of knowledge. Paying tribute to the gifts to our heritage of the cultures of China, India, Islam, Israel, Japan and the USA, he asked the question how to keep knowledge alive and on the move in post-industrial society. With this large vision and tolerant understanding of others, George Marx was able to help and encourage scientists and teachers in India, Japan, China, and Africa to see and invent for themselves new paths into the future for their science education.

In the 1980s and 1990s George made many visits to China, Japan and Africa. He also went to India in 1984. A long visit to China in 1983 was followed by a series of further visits, as he was invited back again and again. This in itself is testimony to the value Chinese people put upon his ideas and experience. A similar long series of visits to Japan started in 1986. In all these visits, George expounded his vision of a science education based on the deepest and most general elements of the scientific world picture, and designed to develop the creativity and talent of all students.

I can recall George, in London with us after his first visit to China, speaking with awe of the huge scale of educational problems in a country of more than a billion people. In Hungary, with 10 million people, you could get all the high school teachers of physics in the country into one big hall or maybe stadium, and speak with them of a new vision. But in China, to organise any change at all means influencing millions of teachers, not thousands. Even so, George established a close rapport with his Chinese friends, and between them they found close and sometimes surprising bonds between China and Hungary.

Some of the most fruitful outcomes of George Marx's work in Asia came in 1992 when he brought about one hundred Japanese physics teachers to Jaszbereny in Hungary, where they exchanged ideas about teaching physics with Hungarian teachers, and again in 1997 when he organised a conference "Creativity in Physics Education" in Sopron, jointly with the Chinese Physical Society and the Japanese Association for Science Education. In many respects, George opened the borders of their countries for Asian teachers, as he had done before for teachers in Eastern Europe.

Starting in 1987, with the support of the International Centre for Theoretical Physics headed by his friend Abdus Salam, George Marx began a long series of workshops on the use of microcomputers in science and mathematics education. Between 1987 and 1993 he took his ideas, and his personal charm and warmth to Egypt, Ethiopia, Kenya, Ghana, Zimbabwe and Uganda. George was never there merely to teach. Above all, he tried to leave behind a sense of possibility, of personal creativity in every participant.

I was with him on the first of these visits, which was to the Sudan. He had been asked to lead a team introducing uses of microcomputers in education. Not without difficulty, we carried our electronic equipment through the Sudanese Customs. We gave, and often improvised, talks. But what I remember best is a drive out into the Sahara desert. Of course the truck got stuck in soft sand and we had to dig it out. There was emptiness as far as you could see, or even imagine seeing. Truth to tell, I was scared. But nothing new and strange ever scared George. With his permanent sense of adventure, he loved every moment of this, as of any new experience.

Paths made by walking

I hope that I have shown how the many contributions George Marx made to science education internationally sprang from deep within him. He lived for the adventure of new thoughts. So I can best end with the short poem by Antonio Machado which George himself chose to end his chapter in honour of Eric Rogers:

Traveller! Here there is no path.
Paths are made by walking.
When you look over your shoulder,
You see a path you'll never walk again.

Citation for the Presentation of the ICPE Medal

to Professor Lillian Christie McDERMOTT,
University of Washington, Seattle, WA, USA

Professor Lillian Christie McDermott is awarded the ICPE medal for her continuing leadership in physics education research on three fronts: for her research on understanding student difficulties in learning physics, for her development of research-based inquiry curricula, and for her tireless efforts to further the acceptance and understanding of physics education research within the community of physics and throughout the world.

Her research into student difficulties with learning physics spans 25 years and almost all of the topics in the introductory physics curriculum from kinematics to modern physics. She led the education research community in showing how to adapt the idea of the demonstration and problem solving interviews developed in cognitive psychology so as to make it effective in understanding how students think about physics. In addition, she showed how to extend what was learned in such interviews with individuals to large groups of students through testing with open-ended questions.

In addition to elucidating and documenting student difficulties with particular topics of physics, she broke new ground in demonstrating how to create high quality curricular materials based on research knowledge. Her developmental model used research techniques to continually refine her materials in a cycle of research, development, and instruction that produce materials that are highly effective in building physics concepts for a large fraction of students, and that are demonstrably transferable. Her curricula, *Physics by Inquiry* and *Tutorials in Introductory Physics* have not only been widely adopted, they have become models for numerous other successful curricula developed by others.

Finally, Lillian McDermott has been the most visible advocate of the value of physics education research to the physics teaching community world-wide. Since 1979, she has given more than 300 invited talks, colloquia, seminars, and workshops at meetings, conferences, and universities around the world. In addition, she has served as mentor for dozens of students, teachers, and researchers who wanted to learn to do and use physics education research. Her research group has provided a model for education research within a physics department that has led a change in the way that physics as a profession interacts with education and education research.

Prof. Dr.-Ing. Juergen A. Sahm,
Chairman of ICPE
August 2002

Citation for the Presentation of the ICPE Medal

to Professor TAE RYU
Tokyo, Japan

Professor Tae Ryu, born February 24, 1934 is awarded the ICPE medal because her remarkable contribution to physics education has been outstanding and international in scope and influence, and has extended over a considerable period of time.

She graduated from Ochanomizu University in 1957 and started her career in education as a science teacher in a secondary school. In 1961 she became an assistant in the Physics Department of the College of Arts and Sciences, University of Tokyo. Then she moved to the Physics Department of Sophia University and served as lecturer and later associate professor.

She served as member of the board of directors of the Physics Education Society of Japan and as member of the Physics Committee on the Science Council of Japan, as well. In the international arena, she was a regular member of the IUPAP Commission 14, i.e. the International Commission on Physics Education (ICPE) in 1993-1999, and a member of the Working Group on Physics Education of the UNESCO Physics Action Council from 1994-1997.

Her international involvement in activities in physics education started when she partici-pated in the Summer Institute of the Harvard Project Physics in 1972 in the USA. On returning to Japan, she organized a workshop based on this experience. The college and high school teachers who participated in this workshop continued meeting periodi-cally and published a Japanese version of "Project Physics". This group of physics teachers grew into the Association for Physics Education in Japan, which has been one of the most active and creative groups of physics teachers in Japan. In 1980, she attended Nuffield Physics & Science in Society at Worcester College and Chelsea Col-lege in the UK, obtained certification for the teaching of Physics in UK, and introduced the Nuffield physics curriculum to Japan. Continuing to keep abreast with curricular developments, recently she was instrumental in introducing the new "IOP Advancing Physics" program to physics teachers in Japan.

Since her first ICPE conference in Edinburgh in 1975 she has attended many ICPE, GIREP, and other meetings on physics education and facilitated exchange of informa-tion between Japan and other countries.

Professor Ryu was also an active member of organizing committees of many interna-tional conferences and workshops on physics education. The first of these was the 1986 ICPE Tokyo

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Towards a Lack of Science Teachers

France, like the majority of western countries, has seen lately its students drifting away from university scientific studies. The reasons for this disaffection are certainly deep, since this tendency reaches countries having very diverse educative systems. If nothing is done, the shortage of scientific managers and teachers of science will be dramatic when, within a few years from now, it is necessary to renew the generation of baby-boomers leaving for retirement.

A recent study required by the French ministry of education indicates that the number of candidates per open teaching position has decreased, during the past five years, from 7 to 4.5 in mathematics and from 9 to 3.5 in physics and chemistry.

* This paper appeared in the French Newspaper Le Monde on February 7th, 2003 by Pierre Arnoux, Professor of Mathematics at the University of the Mediterranian, Marseille Claudine Robert, Professor of Mathematics at the University Joseph Fourrier, Grenoble Jacques Treiner, Professor of Physics at the University Pierre et Marie Curie, Paris, C. Robert chairs the Group of Experts Ministry of Education, High School Programs for Mathematics.

Our society certainly needs scientists and science teachers in the future.

According to an inquiry recently led by senator Glenn, USA maintains their policy of massive immigration of young people from asian countries and Russia at undergraduate or graduate level. Other countries do not have the same power of attraction set against with USA, and begin to experience a drastic lack of science teachers. Because of the public system of education which is extremely centralized, it opposses a certain inertia and retardation effects, but this may only be a matter of time. One may therefore conclude that these evolutions reflect an international division of university training: rich countries would orient their youth towards economy and finance, emergent countries providing young scientific students. What can one do, were the wave so profound ?

It is important for a government to decide whether or not there is a problem, and now is the proper time to do so, in view of the relevant time scale : it takes 4 to 5 years to produce a teacher. If there is problem – and we think, together with a number of people involved in the education system – then simple measures, easy to quantify, can be taken, which would send a clear message to students finishing high school.

More than 20 years ago a number of students interested in teaching were pre-hired after one year in the university. The system was called : « Instituts préparatoires à l'enseignement secondaire » (IPES). The candidates would take the screening test, applicants who qualified in the test will receive allowance to pursue their studies provided they committed themselves by contract to teaching during 10 years (the years of studying were included in the 10 years).

Teachers for primary school were recruited through a competitive test at the level of baccalaureat, and would then go to a special school called "Ecoles Normales d'Instituteur". They would

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CITATION, TAE RYU (Continued from Page 7)

meeting on "Trends in Physics Education" held in Sophia University. Many well-known physics education researchers from many countries attended this conference. It gave a big impact on physics education in Japan. The most remarkable effect was that after this conference many high school teachers started to attend ICPE, GIREP, ASE(UK), NSTA(US) meetings ,etc.. It also led to three US-Japan-China Conferences organized by Professors T. Ryu, L. Jossem, K. Zhao, and Y. Yun. She also organized conferences and workshops in collaboration with colleagues from the UK, Hungary, Poland, and China. Furthermore she made associa-tions with Asian countries as Philippines and Korea, and promoted exchange of ideas on physics education between these countries.

She was chief editor of the ICEC Newsletter of the Physics Education Society in Japan which publishes papers on physics education written in Japanese translated into English.

In addition to many physics education research projects in Japan, she performed joint international research work such as "Physics Problems for University Entrance Exami-nations" with Professors P. Black and G. Marx, et al. The report from this work later was published as a part of a UNESCO book "Physics Examination for University Entrance" (UNESCO Document Series 45). She was the group leader of the "Interna-tional Forum on Scientific and Technological Literacy for All, Project 2000+" by UNESCO. She also wrote "The Factor Affecting High School Students' Choice of Science Courses" together with Professor Woolnough.

In summarizing Tae Ryu's activities, she may be characterized as the link for physics education between the East and the West. Her long-time activities have had a remarkable influence on the development of physics education and friendships among the peoples concerned.

Prof. Dr.-Ing. Juergen A. Sahm,
Chairman of ICPE
August 2002

Conservation of Mechanical Energy in a Simple Pendulum

Purpose

After doing this activity, you should be able to:

- Show quantitatively the law of conservation of mechanical energy using a simple pendulum; and
- Determine the relationship between variables from the graph.

Materials for Activity

Improvised simple pendulum equipment
C-clamp
Graphing paper
Carbon paper
Manila paper
Scotch tape

Simple Pendulum Equipment*

Materials for Pendulum Equipment

Piece of plywood (1/4 in) 47 cm x 30 cm
Piece of wood (30 cm x 7 cm x 2 cm)
2 small pieces of wood (4 cm x 2.4 cm x 2 cm and 2 cm x 2 cm x 2 cm)
40 cm long GI wire (size 10)
Wood glue
Metal ball or marble with a diameter of 2-3 cm

Procedures

1. Assemble the plywood, small pieces of wood and straight wire as shown in Fig. 7.5.
2. Bend the lower end of the wire (about 2.5 cm) into a right angle (Fig. 7.5).
3. Drill a hole at the center of the metal or plastic ball. Make sure the wire can fit into the hole easily, Fig. 7.6.

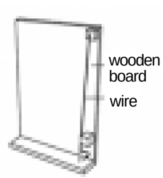

Fig. 7.5

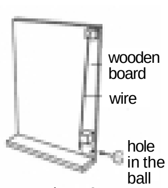

Fig. 7.6

4. Insert the ball into the lower end of the wire, Fig. 7.6.
5. Test the equipment by raising the ball to a higher position and then releasing it. Does the ball leave the wire when it reaches its lowest point and the stopper stops the wire? If not, then make the hole of the ball slightly bigger.

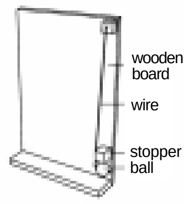

Fig. 7.7. The improvised pendulum equipment.

Procedure for Activity

1. Tape a piece of graphing paper to the wooden wall of the pendulum set (Fig. 7A.1). Mark the lowest point (B) of the ball. Draw horizontal lines at every 1.0 cm from point B.
2. Clamp the pendulum equipment on the edge of the table. Measure the vertical distance (H) between point B and the floor. (See Fig. 7A.2.)

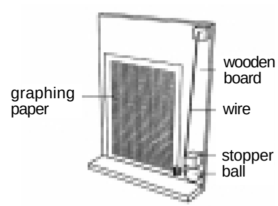

Fig. 7A.1. The experimental setup

3. Spread the manila paper on the floor, and fix it by a piece of plastic tape. Mark point O on the paper. (See Fig. 7A.2.)
4. Release the ball from a height of 1 cm from point B. (Fig. 7A.3.)

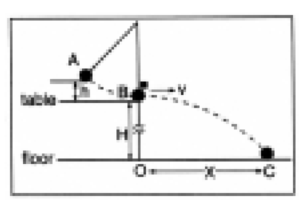

Fig. 7A.2

5. Put the carbon paper on the ball's landing position on top of the manila paper. Measure X and record in the data table.
6. Repeat Steps 4 and 5 at h = 2.0 cm, 3.0 cm, 4.0 cm until 10.0 cm. Make sure the marks on the paper are aligned. If one mark deviates greatly from the line, then repeat for that particular height.

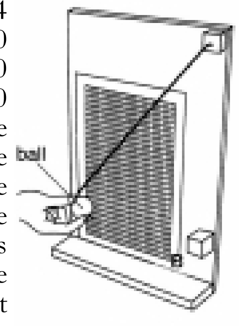

Fig. 7A.3

7. Graph h vs. X^2.

Table 7A.1. Data table

H(cm)	X(cm)	$X^2(cm^2)$
1.0		
2.0		
3.0		
4.0		
5.0		
6.0		
7.0		
8.0		
9.0		
10.0		

Analysis

1. What are the variables involved in this activity?
2. What form of energy do the vertical distance h and the horizontal distance X represent?
3. What does a longer horizontal distance traveled by the pendulum indicate about the kinetic energy of the ball? What does a higher position (h) of the ball indicate about its potential energy?
4. What do you observe of the values of X as h increases?
5. What does the shape of the graph, h vs. X^2, indicate about the relationship between h and X^2?
6. What is the slope of your graph? What quantity does this slope represent?
7. Can you conclude from your data that mechanical energy is conserved? Support your answer.
8. What is the degree of accuracy of your experimental data? How do you check it?

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* Practical work in high school physics: Sourcebook for Teachers. (2002). Quezon City: UP NISMED developed by the Science and Mathematics Education Manpower Development Project (SMEMDP).

Seeing Infrared

by Ernie McFarland and Tom Kehn

There are many technological devices used today for which the underlying science is a complete mystery to students and the general public. One such device is the remote control, which is used for televisions, CD players, etc. This article describes a demonstration that shows what a remote control is doing, and how the signals from it are coded.

A remote control is pointed at an IR-sensitive silicon solar cell. The output from the solar cell is connected directly to an oscilloscope, and the signals produced by pressing the various buttons on the remote control can be viewed easily on the oscilloscope display.

Virtually any oscilloscope available in a high school, college, or university should be capable of displaying the signals. To store and print the signals, we used a Tektronix TDS210 digital real-time 60-MHz oscilloscope with the time setting at 2.5 ms/division. The peak voltage depends on the particular remote control used, how far it is held from the silicon cell, and the sensitivity of the cell. The peak voltages with our apparatus were a few tenths of a volt.

Figure 1 shows the oscilloscope display when the “9” button is pressed on a Sony VCR remote control. The signal consists of 13 pulses; the first is a 2.4-ms header pulse that activates the VCR. The remaining 12 pulses constitute a binary code (1s and 0s), with a “1” having a longer duration (1.2 ms) than a “0” (0.6 ms).

The 1s and 0s are separated by time intervals of 0.6 ms, during which the IR burst is off. The code after the header pulse in Fig. 1 is 000100001000. Figure 2 shows the display when the “play” button is pressed on the same remote control; the code after the header is 010110001000.

The pulses representing the 1s and 0s appear to be of roughly constant amplitude in Figs. 1 and 2. However, decreasing the time/division setting on the scope reveals that the amplitude is modulated at a frequency of 40 kHz. The receiver is designed to respond to signals at this frequency so that interference will not be produced by other IR sources such as ordinary lightbulbs.

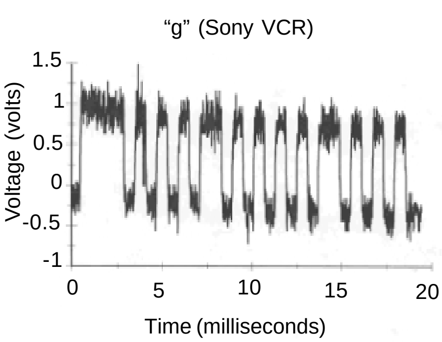

Fig. 1. The “9” signal from a Sony VCR remote control

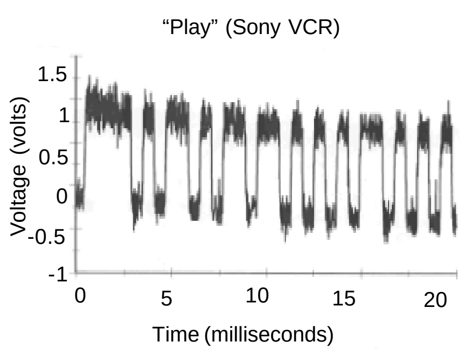

Fig. 2. The “play” signal from a Sony VCR remote control

Device Coding

Why doesn’t a Sony TV respond to the signal from a Sony VCR remote control? To answer this question, we looked at the signals from three Sony remotes: VCR, TV, and CD-player. The results are presented in Table I; for easy reading, each 12-digit code is presented in four three-digit bunches. A careful perusal of the table shows that the last six digits in each code identify the device for which the remote is designed. For example, all signals for the Sony VCR end with 001000. The first six digits specify the button that is pressed. A particular button often gives the same first six digits for each of the Sony devices; for instance, “1” is coded by 000000. However, “play” is 010110 for the VCR, but 010011 for the CD-player.

Not all manufacturers use the same type of coding. In one common example, the duration of the *spaces* between the pulses is used to indicate the 1s and 0s. In another, a “0” is indicated (after a pulse) by having the IR be off for a period of twice the pulse duration, and a “1” is indicated by the IR being off for thrice the pulse duration. More information about coding is available in a paper[2] in the *American Journal of Physics*.

A Related Demonstration

Modern video cameras and digital still cameras use light sensors that can detect infrared light. If a remote control is pointed at such a camera, and any of the buttons is pushed, a white flash of light can be seen on the camera monitor.

See next page

SEEING (Continued from Page 10)

Table 1. Infrared codes for various devices.

Device	Button	Code
Sony VCR	1 8 9 play	000 000 001 000 111 000 001 000 000 100 001 000 010 110 001 000
Sony TV	1 8 9	000 000 010 000 111 000 010 000 000 100 010 000
Sony CD-player	1 8 9 play	000 000 010 001 111 000 010 001 000 100 010 001 010 011 010 001

Acknowledgments

We wish to thank our colleague Chuck Fischer for useful assistance and advice.

References

McFarland, E., & Kehn, T. (2000). Seeing infrared. *The Physics Teacher 38*(5), 314-315. (Reprinted with permission from the authors)

Huebner, J. S., & Sundaralingam, N. (1998). *American Journal of Physics 66*(6), 544-547.

Announcement

The IUPAP will get a UNESCO/ROSTE contract to fund two follow-up project proposals:

1. Initiate a pilot program to fund the attendance of women from developing and eastern European countries at regional conferences and schools this fall. The proposed funding is for 12 -15 women at a maximum cost of $800 each. This would require $9000.
2. Sponsor special sessions on women in physics and the results of the Paris meeting at major conferences. The proposed teams of three women organize sessions at five conferences. Each of the 15 women involved would receive up to $600 to attend the conference and present talks and information. This requires $9000.

Submit applications for these grants on or before September 22, 2003. IUPAP Working Group on Women in Physics Education will notify immediately the chosen recipients. Interested applicants should reply immediately.

Feel free to share this information with other women in physics. For grants of type 1, only women physicists from Eastern Europe or developing countries may apply.

Applicants for type 1 grants, the requirements are:
- Your complete contact information
- Brief description of the conference or workshop you wish to attend
- Brief statement of how attending the conference or school will enhance your career
- Letter of recommendation from one colleague
- The amount of money (up to $800) required to attend

Applicants for type 2 grants, the requirements are:
- Complete contact information for the two or three women that will arrange and present the special session
- Brief description of the conference where the session will be presented
- Brief description of the session that you will organize
- The amount of money (up to $600) that each of you will need to attend

For more information and inquiries, consult Jackie Beamon-Kiene, on or before September 22, 2003.
e-mail: beamon@aps.org

TOWARDS (Continued from Page 8)

also receive a salary, as future state employees.

In those days, depending on the particular year, between 25000 and 30000 persons were paid to study. More than 10000 positions were open each year. University Institute for Teacher Training (UITT) were created in 1990-91 for both primary and secondary school teachers. About 11500 persons received a salary while studying to become a professor, and a little less than 6000 positions were offered each year.

Any form of salary was suppressed during the year 1994-95.

Within 25 years, the duration of studies has increased on the average by 2 years, and one has simply suppressed any form of financial help from the State and any form of long term commitment from the students. In 1977, the IPES salary (for secondary level) was by 71% larger than the official minimum salary, called SMIC in France. The salary for primary level was by 43% larger than SMIC. In 1991, a student studying in a IUTT would receive a salary by 27% larger than SMIC. Today, the society values the teaching profession. There is a state policy that offers scholarship to students who want to pursue such profession.

There is some urgency to do something, it is easy to put back a system similar to IPES, actually much easier than to perform structural changes. This would indicate to our youth that the transmission of knowledge is viewed as an important mission.

The only real problem could be the economic cost of such a measure. Pre-hiring 10000 students per year, giving them 15000 euros per year, for three years of study, amounts to 450 millions of euros per year, i.e. 1% of the present budget of the French ministry of education. Who will believe that France has weakened in such a way that it cannot afford now what it could afford in 1975?

The openend positions should be shared among the various disciplines, according to the needs anticipated over several years. The attribution of the salary should be linked to the success in the various exams, in order to attract students really interested in the field they choose. We are convinced that a salary would not alter their enthusiasm ! One would thus introduce in the class a group of highly motivated students, which would give an impulse also to the necessary reforms in the curricula and the methods of teaching.

To ask the State to implement a pluriannual policy of recruitment does not seem to be fashionable nowadays. To ask a young person to commit him(her)self for 10 years is no more fashionable. Fashion is in mobility and social zapping. However, certain questions cannot be treated on a daily basis. Those concerning society as a whole should be delt with in the medium or even the long term. Environmental questions are of this type, as well as the demography of medical doctors and nurses. Teaching is another such issue.

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