GIREP newsletter

Groupe international de recherche sur l'enseignement de la physique
International Research Group on Physics Teaching
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girep
Groupe International de Recherche
sur l'Enseignement de la Physique

GIREP committee proposes a logo for our association. We hope that our members will like it. Please tell us your opinion about it

GIREP HOME PAGE: http://www.pef.uni-lj.si/girep

INSTITUTE OF PHYSICS PROJECT FOR PHYSICS 16 - 19

The Institute of Physics is putting half a million pounds of its own money, which it expects to match with other funds, into a radical re-think of the Physics curriculum for age 16-19. "We need courses which offer students more of what they want, universities and employers more of what they need, and which reflect the variety and importance of Physics as it is today", saysthe newly appointed Project Director Professor Jon Ogborn. The Physics community, in schools, universities and industry will be fully involved in reaching a new consensus on Physics 16-19, over the coming three years to the millenium.

Why now? In recent years, fewer and fewer young people have chosen to do A-level Physics; amongst them only a tiny proportion of girls. And for years, the numbers graduating in Physics have been small compared to those in other sciences or engineering. Of them, few go into teaching. The result: a dangerous situation in which Universities consider closing Physics departments; the shortage of good Physics teachers gets worse; yet more students abandon the subject at school. It does not help that the Physics curriculum is a pale shadow of Physics as it is in the modern world.

Why the Institute of Physics? The Institute reflects the interests of teachers, academics, researchers, and industrialists, and intends to harness their enthusiasm and expertise in undertaking the task of re-thinking the curriculum and providing new and exciting resources for teachers and students. As the Learned Society for Physics, the Institute of Physics believes that it can be a natural focus for building a new consensus on the way forward.

What needs to be done? The keynotes are variety, modernising and focus on essentials. Students deserve a course which satisfies a variety of interests, from practical uses to the origin of the Universe. They deserve a course which develops a variety of skills, from using mathematics and working with instruments to thinking and learning for oneself. Universities and employers need a course which guarantees solid competence in essentials - including mathematics - and which has also sparked the enthusiasm to go further. Physics courses fail to reflect the many new careers open to Physicists; they also fail even to hint at fundamental recent developments. Most important of all is to develop courses which can change in the future, keeping up to date and being refreshed with new ideas. The Institute of Physics wants its revolution to be a continuing one.

Jon Ogborn - Professor of Science Education at the University of London Institute of Education - is widely respected and internationally known for his work in science education, going back to the Nuffield Foundation Advanced Physics project. He says, "This job cannot be done without bringing together schools and universities. School Physics teachers have to feel it is theirs. Universities and employers have to feel that it is what they need. And while we are about it, it needs to lift all our spirits".

The goal of the new Institute initiative is to have a widespread, long-term and continuing influence on the physics curriculum for 16-19 year olds. The aim is two-fold: to determine the shape of a thoroughly up to date Physics 16-19, reflecting Physics as it is today, and to make the subject much more attractive to young people, worth studying whether or not they will continue to use it in later stages of education.

What strategy should the project adopt? The thoughts below suggest some initial general ideas from which to start. They do not tell us what the project should do, but they do suggest what it will need to think about.

* A rethought curriculum needs to be much more appealing to 16 year olds, especially girls.
* A re-thought curriculum (for England and Wales) must have a component which offers real broadening opportunities, if more pupils are to choose it.
* Any initiative will have to provide a lot of support for teachers. It should try to contribute to making teaching physics more attractive.
* An effective physics curriculum will have to identify exactly what mathematical thinking it needs, and plan to provide much of it within the physics context.
* A new curriculum ought to be much more respectful of the technical aspects of the subject, and it ought to give a better picture of the way physics is used in a variety of careers.
* A re-thought curriculum needs to reflect both modern pure, and modern applied, physics much more strongly than at present. The quantum world view, as important for condensed matter as for particle physics, has become essential.
* A re-thought physics curriculum ought to be a consciously and visibly varied feast, each part attractive to some, and plainly seen as valuable to all. It has not only to respect students' interests, but also, actively, to seek to create interests.
* The re-thought two year physics curriculum has to find a way for a new approach to first year studies, representing a viable and attractive choice for more students but also forming a basis on which to build a more specialised second part /Part 2.
* The 16-19 initiative has to bring together school and university teachers, with a strong and clear possible architecture for a course, leading to detailed plans for feasible and desirable course components. This needs to be built on a wider agreement with Universities, Examination Boards, Learned Societies, and Industry about a way forward.

We will have to be radical, in subject matter, in ways of teaching, in opportunities for learning. For example, we had better find out very soon if - or how - quantum physics and relativity can be managed at the right level. And we have also to start collecting rich sources of information on up-to-date uses of physics. All this together with keeping a firm place for essential ideas - often classical - and with making a strong and visible place for mathematics in physics.

Institute of Physics, UK

PHYSICS EDUCATION IN SWEDEN

1. The schoolsystem

The first nine years (classes 1-9) of the Swedish school system is compulsory. Its Swedish label is "grundskola" (ground school) and the parents decide whether the children start at the age of six or seven. Since the population of Sweden is only 8.5 million, it is natural that the whole country has a common school curriculum. After the compulsory nine years, the students may continue to the upper secondary school (in Swedish "gymnasium). The pupils get grades in the two last classes of the ground school, which is the basis for the acceptance to different programs in the secondary school. In 1995 about 98% of the pupils leaving the compulsory school continued to some of the programs in the upper secondary school (classes 10-12).

After these twelve years in the normal school the students can apply to a university or college (in Swedish "högskola", high school). Currently, about one third of the students graduating from upper secondary schools will attend a university within three years of graduating. They are distributed between six large, full-scale universities (Lund, Uppsala, Stockholm, Gothenburg, Umeå and Linköping) and quite a few, new and smaller colleges.

2. The first nine years

There is no physics taught in the first six classes of the ground school, but the students do already in the first few classes encounter some natural science education. This is a combination of biology, chemistry, physics and technology. In the first six year they encounter no problemsolving. The teachers in the ground school are either specialized in natural science or social science. The intention is that each class should have one teacher of each kind. There are also two levels of teachers, with quite different education. One specialized in the first seven years (often labeled a 1-7 teacher) and the other kind in the forth to ninth year (a 4-9 teacher). The intention, when the new education system for teachers was started (1988), was a smooth exchange of the class from the 1-7 teacher to the 4-9 teacher, somewhere between the forth and seventh class. They could even work together for some time during this period. Tradition, however, seems to play an important role and the changeover is usually after the sixth year. In most cases the students have two 1-7 teacher for the first six years, and then two 4-9 teacher for the last three years of the ground school.

In the last three years, the students have 4x40 minutes per week of natural science. This includes laboratory work and some problemsovling. Many investigations in Sweden have shown that the pupils in the ground school are not prepared for logical reasoning or problemsolving in physics, in spite of the fact that the schools are rather well equipped with experimental material. Lately, there has been a tendency among the teachers to use more "open" experiments, where the pupils themselves have to observe and write small reports. This is a change from the earlier tradition where almost all reports were of the "fill-in" kind, where the pupils only had to fill in some results in an already written report. An investigation from 1995 indicated that abilities in mathematics had improved somewhat in comparison to 1980. However, the difference between the students with strong abilities and those with weaker abilities has become greater. The increase in mathematical abilities among students in the upper secondary schools varies greatly between the different programs.

One problem area involves the students knowledge of natural science subjects. It may be that the learning process is hampered by the gap between the students everyday thinking and the scientific thinking that the schools are attempting to instill. According to several studies most students can not apply various fundamental natural scientific principles. It is only those students who are interested in or attending the natural sciences program in the upper secondary school that have clearly developed knowledge. We therefore want more pupils from the ground schools to take the natural science program at the upper secondary schools. It looks as if the new teacher education, with rather well educated natural science teachers already from the first school year, will raise the interest. As a matter of fact, the last three years the percentage leaving the ground school and starting at the natural science programs at the upper secondary schools has increased every year.

3. The upper secondary school

The upper secondary school has many different programs. The only one that has physics as a separate subject is the natural science program, which is followed by about 20% (1997) of the pupils from the ground school. We would like many more to chose this program, but the fact that it is considered the hardest program might scare away many students. Physics is considered to be the most difficult subject, and feared by most students. In the natural science program, the students have about 3x40 minutes per week of physics. The subject was recently divided in to two courses, Physics A and Physics B (more advanced). The students first take course A and then continue with course B. In contrast to the earlier system, with only one course of physics, it is possible for the students to only take part of the physics curriculum. So far, almost all students take both courses, but there is a fear among physicists that some university educations (such as medicine, teaching, dentist an some engineering) only will use the first course as a prerequisite. In that case the students will miss important physical fields (such as magnetism, alternating current, nuclear physics, solid-state physics and part of waves and optics). Most of the physics community was therefore against splitting the physics in two courses, but the politicians had the final words and decided to implement it. There are rather many occasions for the students to get involved with laboratory work and the standard of equipment in the Swedish upper secondary school is good.

For the pupils not attending the natural science program there is no pure physics course. There is a small obligatory course in natural science, with no problemsolving but some experimental work. Natural science at this level tends to be almost solely biology and some chemistry. Physics is considered too difficult.

4. University studies in physics

Physics studies at university level varies between the different universities. At Lund University the education, with physics as the main subject, can start either with a one-semester course in physics or a one-semester course in mathematics. To continue with a second semester of physics, you are required to take at least two semester of mathematics. A masters degree requires four years of study, including at least two years of pure physics and at least one year of mathematics.

5. Teachers education

The natural science program of the upper secondary school is a prerequisite for all the physics teacher education. In 1988 we started the new teachers education for the ground schools in Sweden, where we introduced the two types of teachers mentioned above, specialized in social science or natural science, for two different levels, 1-7 or 4-9 classes. It is fair to say that the 1-7 teachers are well educated in physics, for that level. The 4-9 teachers also have a good education, where they study not only mathematics and physics at the university, but also chemistry and biology. Practical work in the school and pedagogic is also included in the education. The education is 4.5 years. For physics teachers of the upper secondary school, the education starts with 3-4 semesters of mathematics, followed by 4-3 semesters of physics. Since practical work in the school and pedagogic takes one year, this is also a 4.5 years education.

6. Responsibility and control

The parliament (Riksdag) and the government (regering) define curricula, national objectives and guidelines for public sector schooling in Sweden. The national budget includes grants to the municipalities for their various activities. Subject to the goals and frames defined by the parliament and Government, each individual municipality is free to decide how to run its schools. An education plan has to be adopted, describing how school activities are to be funded, organized, developed and evaluated. The head of each individual school has the task of drawing up the local working plan based on the curricula, the national objectives and the education plan. This responsibility must be discharged in consultation with teachers and other staff. Earlier (up till 1991) the schools were under direct control of the state. There was a certain amount of money for every school according to how many pupils they had. After the municipalities has taken over the physics teachers fear for the future. The head of the school and the politicians in the municipality, who are responsible for the economy, do not always understand that the expensive laboratory work is essential for the proper understanding of physics. There is a syllabus for the physics courses but it contains much freedom (which is good for the physics teachers). It is therefore easy for people outside the school, in deciding positions to decrease budget for the schools and move the money to other fields.

7. Discussions about the future

There is a discussion going on just now of making it possible for the teachers in the upper secondary school to go back to the university and start a research education. They should work half time in the school and half time at the university. The research can also be in physics didactics. In combination with some theoretical courses in physics this would give us better educated teachers in physics (Ph D) at the upper secondary schools. The education would take 8 years and the teacher should keep his or her salary during the education. When ready with the research studies such a teacher could be the head for the laboratories. The purpose is also to inspire the other physics teachers in the school. But maybe the most important thing is that such a teacher would raise the interest for physics among the students. This education is not only meant for physics teachers. We look forward to this possibility of raising the competence of some teachers. The teachers union really pushes for it and I think many teachers want it.

Per Olof Zetterberg,
Department of Physics, Lunds University

CREATIVITY IN PHYSICS EDUCATION

Report from Chinese-Hungarian-Japanese Physics Teachers Meeting

The Roland Eötvös Physical Society organized the first Chinese-Japanese-Hungarian physics teacher conference in Hungary, in Sopron from 19th to 23rd August 1997. UNESCO, IUPAP, ICPE, OMFB and MATÁV were the supporters of the conference. The chairman of the organizing committee was the chairman of the Roland Eötvös Physical Society, the member of the Hungarian Science Academy, Professor George Marx.

The Japanese-Hungarian Physics teacher meeting in 1992 went before this conference. The Japanese experiment makers club called Stray Cats Academy visited Hungary then. Hungarian physics teachers were fascinated by their creativity, ideas, enthusiasm about physics teaching. They endeavoured to maintain relations with their Japanese colleauges. The Japanese teachers' experiments were published in the Hungarian Physical Review, they became widely used.

In the last few years the chinese students won almost all the international competitions. Therefore it was a great pleasure for us having 30 of our Chinese colleagues here in Hungary making their succesful methods known.

According to international surveys Far Eastern and Central European students are the best at science subjects. It is an interesting problem, what determines the success of some countries students. Are this the social circumstances, teacher's methods, syllabus selection, students' motivation, educational system or economic situation of country?

Professor Tae Ryu presented the Japanese culture and educational system, Zhao Kai Hua, the professor of Beijing University demonstrated the Chinese culture and educational system, Professor George Marx presented Hungarian. Sophia Fei Hu, a Hawaiian teacher gave a comparative analisys experienced the eastern and western educational system as a teacher and a student. The present status of the western culture isn't favourable for the science. The students and the society pay attention to different things, the motivation is weak. Prof. Herbert Pietschmann referred to this phenomena in his lecture title as well: Science in an anti-science society. Art Hobson quoted the worries about the future scientists' notice and called teachers' attention to their responsibility in his lecture with the title Physics that will make the 21st century. Future generation will inherit problems from us and it has to find the way to solve them. The best we can do: prepare them for this.

Workshops took place in the midst of great interest. New experiments and methods changed hands. Characteristically in addition to the announced workshops some spontaneous workshops came to existence to demonstrate experiments for more people. Several times the participants carried on with their collective work far into the night. Hiroshi Kawakatsu's Creative Experiments workshop — where we launched 2-stage rocket made of coke bottle, we could see Leuwenhoek's microscope showing the cells of onion skin made of mineral water flacon — was followed with attention. Xing-Kai Luo's "Experiments for the New Physics" and John Lewis' "Key skills in science education" workshops also had a great success. Because of the large audience some people watched Eszter Tóth's "Nuclear demonstrations" workshop sitting on the floor. Janchai Yingprayoon's workshop "Physics of Toys" was repeated by public demand. The programme contained a lot of things, from the cheapest teachers creativity based experiments to present day INTERNET physics teaching. There weren't left out the creative problem solvings, Peter Gnadig the professor of Eötvös University demonstrated his problems written for this conference.

The participants visited the 1st school of Hungary in the thousand years old Pannonhalma abbey, they saw Estherházy palace in Fertõd, they tasted the well known sorts of countyside wine. Especially interesting about the meeting was the Chinese secondary school teachers' numerous participation. Physics teachers and professors of 30 countries from 5 continents came together and worked together for 5 days. Árpád Göncz, the president of Hungarian Republic addressed the conference by an official letter. Finally representatives of 7 nations spoke about the future of the physics teaching. The feel of the conference, the cooperation and agreement developing through physics explained the optimistic remarks. Everybody agreed that studying physics and sciences gives the young important, useful, interesting and enjoyable knowledge.

Sandor Ujvari
deputy secretary of Roland Eötvös Physical Society

Distribution of the members of GIREP

According to the database of the treasurer at the end of September 1997 GIREP has 235 members. This number includes also that ‘members’, which have not paid their fees since 1994. The distribution of members in different countries is: Italy (51), Germany (19), Slovenia (17), USA (17), UK (14), Poland (12), Israel (10), Portugal (9), Spain (8), Austria (5), Belgium (5), Denmark (5), Hungary (5) Switzerland (5), France (4), Greece (4), Japan (4), Brazil (3), Chile (3), Netherlands (3), Romania (3), South Africa (3). There are 22 further countries with only two or one member. **GIREP is really international!** There seems to be a ‘hard core’ of perhaps 100 members since more than ten years. The other part changes always. Every year there are about 20 new members and about the same number disappear. I cannot say this more precisely, because the database does not contain all these datas.

Several members have asked me that they would like to have a list of all members (name, address, e-mail). We have discussed this in the committee and would like to ask herewith all members, whether they have objections against this idea. We want to send the list in a printed form with the next newsletter (spring 98). We do not want to publish this list on our homepage in the WEB, even not with a password. The disadvantages seem to be greater than the advantages. **That members who do not want to have their name and address on this list, should please send a short notice to the treasurer.**

Another interesting point not only for the treasurer is money (paying fees). According to the database there are 4 Honorary members, 1 member has paid until the end of the year 2005 (!), 10 members until 2000, 9 until 1999, 37 until 1998, 95 until 1997, 43 until 1996, 11 until 1995 and 25 until 1994. **I would like to ask all members who have not yet done this, to pay now their fees.** Otherwise they will be removed from our members list according to our statutes. The members who have not paid for 1995, can not get the proceedings from the conference in Udine and that members who have not paid for 1996, can not get the proceedings from the conference in Ljubljana.

Christian Ucke/Treasurer of GIREP

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Groupe International de Recherche sur
l'Enseignement de la Physique

Fachbereich 10
Physik - Technologie
Sektion Didaktik der Physik

Gerhard Mercator
Universität · Gesamthochschule
Duisburg

International Conference, August 23 - 28, 1998, in Duisburg/Germany
’Hands-On Experiments in Physics Education’

Important steps towards the attainment of a general education in sciences are looking at something, thinking about it and working with it. Simple, easily performable hands-on experiments are a valuable help in encouraging these steps. Especially physics lessons in school and at the university, but also Science Centers, museums and media institutions, such as television, can make use of hands-on-experiments; frequently they can also serve as an alternative to traditional lessons.

In demonstrations or practical training hands-on experiments form a sort of counterbalance to complicated experiments. They are usually easy, cheap and able to be performed quickly. They stimulate creativity and improvisation. Even in the computer age hands-on experiments via computer are possible when, for example, with few resources a sensor with a simple interface is connected to the computer. Low-cost experiments are closely connected to this theme. In addition, more demanding hands-on experiments for advanced students are also conceivable if a researcher prepares a demonstration for a lecture using only a few of the materials available to him from his highly equipped lab.

It is the goal of the conference to present hands-on experiments in various categories as well as to show how these can promote the educational and learning processes and be brought into a balanced relationship with other learning aspects.

Physics toys should be regarded as closely connected to hands-on experiments. They form a natural reservoir of experiences for children - and also for adults. They come from a long tradition (tops, cartesian divers, soap bubbles, optical toys) and also present modern aspects (memory alloys, holograms, liquid crystals, modern magnets, etc.) For all levels of experience with physics (nursery school, school, university, etc.) there are fitting toys which can serve as motivation vehicles for further questions. In addition to hands-on experiments, the conference will also cover the meaningful inclusion of the possibilities offered through toys in the entire learning context.

Lectures and discussions by and with established experts are planned. Experimental and theoretical short lectures, posters, video presentations, workshops, exhibitions of equipment and literature complete the program.

The main groups the conference is aimed at are physics teachers and didactics from highly industrialized countries, where there is a danger of forgetting simple methods, and especially those from developing countries, where many hands-on experiments and toys can be constructed with simple, locally available resources. Co-operation with various institutions (schools, universities, media institutions) should be promoted. A distant goal is the development of a network through which a collection of hands-on experiments can be made available to anyone interested.

Participation in the conference is open to anyone who is interested. The language used at the conference is English. The number of participants is limited to 300.

Costs: Registration fee is USD 120. The local organizing committee will arrange student appartments and hotels for a favourable price.

Deadlines: March 13, 1998 Submission of abstracts for papers and/or posters
May 15, 1998 Registration without presentation

Preregistration Form can be downloaded from the conference homepage

Conference homepage:

http://www.uni-duisburg.de/FB10/DDPH/girep/girepeng.html

This page will be updated always.

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This image is the official logo of the conference ‘Hands-On Experiments in Physics Education’.

A Greek boy is playing yo-yo. The image comes from an old vase decoration found in Apulia in Italy and dates from 450 B.C. In the original the boy is drawn with a red-brownish colour on a black background. The original vase is in the Antique Museum (Antikenmuseum) in Berlin, Germany.

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FEES

The accounting year runs from January 1 to January 1. Fees paid after September in any year will be credited on the following year, unless the applicant specifies otherwise.
The current fee (1996) is 12 GBP (GBP = British Pounds Sterling) or USD 18, preferably paid into the following account:
Christian Ucke, Postbank (GIRO) Muenchen, Account No. 355 28-808, BLZ 700 100 80.
BLZ (= Bankleitzahl) means a special sort of code for the Postbank in Germany.
Please do not pay into other accounts.
The members should pay their own bank charges and mailing costs. At the same time, please send a note (by letter, fax or e-mail) to the Treasurer, confirming how much money you sent and when and for what years.
In some countries, it is possible to transfer money from the national **Post**bank with EUROGIRO free of charge (Belgium, Germany, Japan, Luxembourg, Switzerland, Spain) or with a small charge (Denmark, Finland, France, Great Britain, Netherlands, Austria, Sweden).
If you send a EUROCHEQUE filled out in DEM, there are no expenses at all for the Treasurer. If you send a cheque filled in your local currency, there are DEM 3 expenses for the Treasurer. Please do not send cheques drawn on a bank from your country (except UK) but filled out in GBP (horrible expenses then).
It is also possible to pay by credit card (EURO-/MASTERCARD or VISA; no others). Please write or fax to the Treasurer your full card number, expiration date and the amount. Add 5% expenses to the amount. The Treasurer will convert that amount into DEM and then charge your credit card account in DEM. It is not recommended to use e-mail for sending credit card numbers.
If you prefer to reduce bank expenses, you may pay several years fees in advance.
In cases of real difficulty to arrange payment, please contact the Secretary or the Treasurer who are ready to advise whether special arrangements can be made.
The last General Assembly of GIREP members in Udine (August 1995) accepted the following supplementary new article for the GIREP statutes:
Each year in October, those members who have not paid for the previous two years will be removed from the membership list.
Italian members: There is no more special arrangement for Italian members because of the new possibilities.