HOPE annual forum 2014
Inspiring young people to study physics

Programme and Abstracts

Helsinki, Finland, August 27-30, 2014,

Scope of HOPE project

The overall aim of HOPE (Horizons of Physics Education) is to enhance the impact of physics within the European socio-economic area. HOPE is a European project with a total budget of 1.1 million euros, of which nearly 53% is financed by the European Commission (project number 540130-LLP-1_FR-ERASMUS-ENW). Coordinated by Nadine Witkowski of Pierre et Marie Curie University in Paris, together with Ivan Ruddock of the University of Strathclyde, Glasgow, and Marisa Michelini of Università degli Studi di Udine in Udine, this three-year project (2013-2016) is based on the collaboration of 71 partners from 27 countries of the European Union along with Norway, Serbia, Switzerland and Turkey. As well as universities, they include CERN, the European Physical Society, the Italian Physical Society, the International Association of Physics Students and two private companies. The collaborating physics departments range in profile from research intensive to those focusing on physics education research and the training of physics teachers. Additional associated partners from European and non-European (USA, Brazil, India) complete the network.

HOPE is effectively the physics education thematic network for the European Higher Education Area and is the sixth in a series of large networks beginning in 1995 with EUPEN (European Physics Education Network, 1995-2004) and its successors STEPS (Stake Holders Tune European Physics Studies, 2005-08) and STEPS TWO (2008-11). The network will research and share good practice within four themes conducted by four Working Groups: the factors influencing young people to choose to study physics; physics graduates' competences that enable them to contribute to the new needs of the European economy and society including innovation and entrepreneurship; the effectiveness and attractiveness of physics teaching in Europe's university physics departments and their competitiveness in the global student market; strategies for increasing the supply of well-trained physics school teachers and for developing links between university physics departments and the teaching of physics in schools.

Hope is an academic network funded within the Life Long Learning Programme (2007-2013) whose overall objective is to encourage the best use of results, innovative products and processes and exchange good practice in order to improve the quality of education and training.

"Inspiring the young to study physics"

Identifying good practice, surveying the provision of physics outreach activities and identifying inspirational factors behind the decision to study physics, are the main priorities of Working Group 1 "Inspiring young people to study physics". To pursue these objectives, actions within the network are forseen :

- Creating a questionnaire on inspirational factors to be distributed largely to first year students at partner universities.
- Interviewing pupils, students, media personalities and others on the topic of "Inspiring Young People to Study Physics"
- The collection of national data on recruitment trends in physics across the partner countries
- inventories of good practice in school-university cooperation and students' competitions using questionnaires for teachers and secondary school students on activities that inspire young people to study physics

Methodology, preliminary results and good practices within the scope of WG1 will be presented in Helsinki during the HOPE Annual Forum 2014.

Agenda

Wednesday 27th Aug

Hotel Arthur - Helsinki

Introduction

15:00 Registration - Hotel Arthur - Coffee and refreshments

17:00 Welcome from University of Helsinki - Ismo Koponen
Structure of the First Annual Forum - Ismo Koponen
Nadine Witkowski, Pierre and Marie Curie University, France
Main themes, programme, guest speakers, excursions, participants, proceedings

17:15 ***First Guest Speaker***
Pekka E. Hirvonen, University of Eastern Finland, Finland
LUMA-Suomi program - Horses for school physics courses

18:15 Flash Poster presentations
Short (1-2 minute introduction to poster)

18:45 **Session devoted to the memory of Laura Tugulea**
HOPE - Antecedents, Context and Relevance:Lessons from the past, messages for the future with particular emphasis on the contributions of Laura Tugulea; with contributions from
Hendrik Ferdinande, University of Ghent, Belgium
Gareth Jones, Imperial College London, UK
and Nadine Witkowski, Pierre and Marie Curie University, France

19:30 End of the first day

19:45 Reception and buffet at Hotel Arthur

Thursday 28th Aug

University of Helsinki - Physics department - Exactum, B123 (Gustaf Hällströmin katu 2 B)

Session 1: Introduction to Hope, WG1 and other WGs

9:00 **Introduction to the HOPE project - Nadine Witkowski**
Pierre and Marie Curie University, France

9:20 **Introduction to Working Group 1 - Marek Trippenbach**
University of Warsaw, Poland

9:40 **Introduction to Working Group 2 - Hay Geurts**
Radboud University, The Netherlands

10:00 ***Second Guest Speaker***
Peter Main, Institute of Physics, UK
Increasing the number of physicists: breaking the vicious circle

11:00 Coffee break - Entrance Hall, Exactum building

Session 2: Reports from Working Group 1 of HOPE

11:20 **Student questionnaire - Gareth Jones**
Imperial College London, UK

11:50 **Interviews - Ornella Pantano**
University of Padova, Italy

12:20 Lunch - Dynamicum building

13:40 **Student Statistics - Simonetta Croci**
Italian Physical Society, Italy

Outreach - Marek Trippenbach
University of Warsaw, Poland

14:10 **University - School Cooperation**
Templates of good practices and competitions - Barbara Rovšek
University of Ljubljana, Slovenia

Talent student questionnaire - Marisa Michelini
University of Udine, Italy

Stakeholders questionnaire - Ovidiu Caltun
Alexandru Ioan Cuza University of Iasi, Romania

14:50 **Discussion on results, coordination and priorities for future work**

15:15 Coffee Break - Entrance Hall, Exactum building

Session 3: Inspiring the young

15:30 ***Third Guest Speaker***
Rolf Hempelmann, Saarlands University, Germany
German Schülerlabor - Development, position today, impact

16:30 **Round Table Discussion 1 : Inspiring the young**
Chair : Nicola Vittorio
University of Rome "Tor Vergata", Italy
Antonio Gandolfi
Associazione per l'insegnamento della Fisica, Italy
Matthias Zimmermann
International Association of Physics Students, Germany
Stamatis Vokos
Seattle Pacific University, USA
Rita Van Peteghem
University of Antwerp, Belgium
Barbara Rovšek
University of Ljubljana, Slovenia
Guillaume Trap
Palais de la Découverte, France

17:30 **"Pop-up Heureka", Pop-up science theatre show**
Ilkka Hendolin, University of Helsinki, Finland

18:00 End of the second day

18:30 Tour of Helsinki (see practical informations)

19:30 Dinner - Iha-Lines Cruise

Friday 29th August

University of Helsinki - Physics department - Exactum, B123 (Gustaf Hällströmin katu 2 B)

Session 4: From School to University

9:00 ***Fourth Guest Speaker***
Paula Heron, University of Washington, USA
Broadening participation and deepening engagement: an agenda for research on student interest in physics

10:00 **Stamatis Vokos, Seattle Pacific University, USA**
The complex interplay between student epistemologies and student interest in physics

10:20 **Nathalie Lebrun, Lille 1 University Sciences and Technology, France**
Magiphy, how to engage high school students in Physics ?

10.40 **Inese Dudareva, University of Latvia, Latvia**
A physics bridge between high school and university: Young Physicists School at University of Latvia

11:00 Coffee Break - Entrance Hall, Exactum building

11:20 **Michael Grove, University of Birmingham, UK**
Samantha Pugh, University of Leeds
Tackling the School-University Transition into STEM Higher Education

11:40 **Maria Isabel Hernández Rodriguez, Autonomous University of Barcelona, Spain**
The REVIR Project: an approach to bridge the school-university gap in Science

12:00 **Joan Borg Marks, University of Malta, Malta**
Synergy of a science club: setting up Planet Walk in Malta

12:20 Lunch - Dynamicum building

Session 5: Promoting physics

14:00 ***Fourth Guest Speaker***
Mick Storr, Formerly CERN, Switzerland
CERN's outreach activity and how it inspires and educates physics teachers and physics students world-wide (to be confirmed)

15:00 **Edouard Kierlik, Pierre and Marie Curie University, France**
The column "Idées de physique" :
from science popularization to TV shows and experimental conferences

15:20 **Ilkka Hendolin, University of Helsinki, Finland**
Basics physics in mass media

15:40 Coffee Break - Entrance Hall, Exactum building

16:00 **Round Table Discussion 2: University Outreach and Widening Participation**
Chair Urbaan Titulaer
Johannes Kepler University Linz, Austria
Peter Main,
Institute of Physics, UK
Sonia M. Gomez Puente,
Eindhoven University of Technology, The Netherlands
Ovidiu Caltun,
Alexandru Ioan Cuza University of Iasi, Romania
Ana Milinovič,
International Association of Physics Students, Croatia
Mikko Myllykoski,
Finnish Science Centre Heureka, Finland
Jukka Hatakka,
Science teacher, Ressu Upper Secondary School, Finland

Session 6: Poster session

17:00 **Entrance Hall, Exactum building**

18:30 End of the third day

19:30 Dinner - Paasin kellari

Saturday 30th August

University of Helsinki - Physics department - Exactum, B123 (Gustaf Hällströmin katu 2 B)

Session 7: Final reflexions

09:00 **Integration among the 4 Working Groups**

09:30 **Preview of WG3** - Eamonn Cunningham
Dublin City University, Ireland
Preview of WG4 - Aleš Mohorič
University of Ljubljana, Slovenia

10:30 Coffee Break - Dynamicum building

11:00 **Conclusions from discussions**

11.30 **Summary and Thanks - End of Meeting**

12:00 Lunch - Dynamicum building

13:45 Optionnal Excursion : Suomenlinna Fortress
(10 euros collected in front of lecture Hall B123)

List of participants

Last Name	First Name	Country	Contact Email
Andreeva	Natalia	Russia	andreevanv_3@mail.ru
Androic	Darko	Craotia	dandroic@phy.hr
Arenas Villarroel	Jose	Chile	joarenas@udec.cl
Birch	Marion	UK	marion.birch@manchester.ac.uk
Borg Marks	Joan	Malta	joan.borg-marks@um.edu.mt
Braskén	Mats	Finland	Mats.Brasken@novia.fi
Bunoiu	Madalin	Romania	madalin.bunoiu@e-uvt.ro
Caban	Pawel	Poland	P.Caban@merlin.phys.uni.lodz.pl
Caltun	Ovidiu	Romania	caltun@uaic.ro
Carnicer	Jesus	Spain	jesuscarnicer@gmail.com
Chisleag	Radu	Romania	Radu.Chisleag@physics.pub.ro
Cosleou	Jean	France	Jean.Cosleou@univ-lille1.fr
Cosmelli	Carlo	Italy	carlo.cosmelli@roma1.infn.it
Croci	Simonetta	Italy	simonetta.croci@unipr.it
Cunningham	Eamonn	Ireland	eamonn.cunningham@dcu.ie
De Almeida	Maria J.	Portugal	ze@fis.uc.pt
De Ambrosis	Anna	Italy	anna.deambrosisvigna@unipv.it
Dikcius	Gintaras	Lithuania	gintaras.dikcius@ff.vu.lt
Hieckmann	Ellen	Germany	hieckmann@physik.tu-dresden.de
Drozd	Zdenek	Czech Republic	zdenek.drozd@mff.cuni.cz
Dudareva	Inese	Latvia	inese.dudareva@lu.lv
Egri	Sandor	Hungary	egris@science.unideb.hu
Farstad	Vegard	Norway	vegard.farstad@simplicatus.no
Ferdinande	Hendrik	Belgium	hendrik.ferdinande@ugent.be
Forsyth	Robert	UK	r.forsyth@imperial.ac.uk
Galano	Silvia	Italy	galano@fisica.unina.it
Gangolfi	Antonio	Italy	a.gandolfi@aif.it
Geurts	Hay	Netherland	hay.geurts@science.ru.nl
Gomez Puente	Sonia M.	Netherland	s.m.gomez.puente@tue.nl
Grove	Michael	UK	m.j.grove@bham.ac.uk
Haagen	Claudia	Austria	claudia.haagen-schuetzenhoefer@uni-graz.at
Hämäläinen	Ari	Finland	Ari.Hamalainen@helsinki.fi
Hatakka	Jukka	Finland	jukka.hatakka@edu.hel.fi
Hemmer	Sabine	Italy	sabine.hemmer@pd.infn.it
Hempelmann	Rolf	Germany	r.hempelmann@mx.uni-saarland.de

Hendolin	Ilkka	Finland	ilkka.hendolin@helsinki.fi
Hernández Rodriguez	Marsabel	Spain	mariaisabel.hernandez@uab.cat
Heron	Paula	USA	pheron@uw.edu
Hirvonen	Pekka	Finland	pekka.e.hirvonen@uef.fi
Iacobescu	Gabriela E.	Romania	gabrielaiacobescu@yahoo.com
Jarosz	Jerzy	Poland	jerzy.jarosz@us.edu.pl
Jende	Konrad	Switzerland	konrad.jende@cern.ch
Jones	Gareth	UK	w.g.jones@imperial.ac.uk
Karenauskaite	Violeta	Lithuania	violeta.karenauskaite@ff.vu.lt
Kierlik	Edouard	France	edouard.kierlik@upmc.fr
Koponen	Ismo	Finland	ismo.koponen@helsinki.fi
Laherto	Antti	Finland	antti.laherto@helsinki.fi
Lazauskaite	Romualda	Lithuania	romualda.lazauskaite@leu.lt
Lebrun	Nathalie	France	nathalie.lebrun@univ-lille1.fr
Lee	David	France	d.lee@eps.org
Leone	Matteo	Italy	matteo.leone@unito.it
Lorenzi	Marcella G.	Italy	cird@uniud.it
Main	Peter	UK	peter.main@iop.org
Mannella	Riccardo	Italy	erasmus@df.unipi.it
Meli	Kalliopi	Greece	astronom83@hotmail.com
Michelini	Marisa	Italy	marisa.michelini@uniud.it
Milinovič	Ana	Croatia	ana.milinovic@iaps.info
Mohorič	Aleš	Slovenia	ales.mohoric@fmf.uni-lj.si
Münger	Peter	Sweden	pemun@ifm.liu.se
Myllykoski	Mikko	Finland	mikko.myllykoski@heureka.fi
Nancheva	Nadezhda	Bulgaria	nancheva@uni-ruse.bg
Naudts	Jan	Belgium	jan.naudts@uantwerpen.be
Pantano	Ornella	Italy	ornella.pantano@unipd.it
Pettersson	Sune	Sweden	sune.pettersson@tp.umu.se
Pfnür	Herbert	Germany	pfnuer@fkp.uni-hannover.de
Pugh	Samantha	UK	s.l.pugh@leeds.ac.uk
Pustynski	Vladislav Veniamin	Estonia	vlad.pustynski@gmail.com
Raganová	Janka	Slovakia	janka.raganova@umb.sk
Rogiers	Joseph	Belgium	jos.rogiers@fys.kuleuven.be
Rovšek	Barbara	Slovenia	Barbara.Rovsek@pef.uni-lj.sl
Ruddock	Ivan	UK	i.s.ruddock@strath.ac.uk
Ruiz	Diego P.	Spain	druiz@ugr.es
Saarinen	Pia	Finland	pia.k.saarinen@helsinki.fi
Salonen	Jarno	Finland	jarno.salonen@utu.fi

Sánchez	Ignacio	Spain	isanchez@ugr.es
Schollaert	Rudi	Belgium	rudi.schollaert2@telenet.be
Sosnowska	Izabela	Poland	Izabela.Sosnowska@fuw.edu.pl
Steinbauer	Erich	Austria	erich.steinbauer@jku.at
Stephan	Elzbieta	Poland	elzbieta.stephan@us.edu.pl
Stojanovic	Maja	Serbia	maja.stojanovic@df.uns.ac.rs
Storr	Mick	UK	mick.storr@cern.ch
Suurvarik	Pavel	Estonia	pavel.suurvarik@ttu.ee
Titulaer	Urbaan	Austria	urbaan.titulaer@jku.at
Trap	Guillaume	France	guillaume.trap@universcience.fr
Trippenbach	Marek	Poland	matri@fuw.edu.pl
Tüzemen	Sebahattin	Turkey	stuzemen@atauni.edu.tr
Vähä-Heikkilä	Kalle	Finland	kalle.vaha-heikkila@huittinen.fi
Valanides	Nicos	Cyprus	n.valanides@frederick.ac.cy
Van Peteghem	Rita	Belgium	rita.vanpeteghem@uantwerpen.be
de Vocht	Miikka	Finland	miikka.devocht@helsinki.fi
Vitoratos	Evangelos	Greece	vitorato@physics.upatras.gr
Vittorio	Nicola	Italy	nicola.vittorio@uniroma2.it
Vokos	Stamatis	USA	vokos@spu.edu
Witkowski	Nadine	France	nadine.witkowski@upmc.fr
Yordanova	Korneliya	Bulgaria	spasova2011@gmail.com
Zappia	Alessandro	Italy	zappia@fisica.unina.it
Zimmermann	Matthias	Germany	matthias.zimmermann@iaps.info

List of abstracts

Guest speakers

Oral contributions

Poster contribution - Science in school

Poster contribution - Promoting physics

Poster contribution - School university cooperation

Poster contribution - Outreach activties and initiatives

Poster contribution - Initiatives relative to other WGs

GS1 : LUMA-Suomi program - Horses for school physics courses

P. E. Hirvonen[*]
University of Eastern Finland, Finland

ABSTRACT

LUMA Centre Finland was established in November 8th 2013 as an umbrella organization for the ten LUMA Centres in the different Universities across Finland. The aim of Luma Centre Finland is to inspire and motivate children and youth in mathematics, natural sciences and technology through the lastest methods and activities of science and technology education. The aim is also to support the life-long learning of teachers working on levels of education from early childhood to universities, and strengthen the devlopment of research-based teaching.

Finland is well-known for its excellence in PISA surveys and modern and well organized teacher training programs. However, recent national and international studies indicate that Finnish student's motivation to study mathematics and natural sciences is remarkably low and students' learning achievements are also diminishing. Based on the presented observations, the Ministry of Education and Culture announced an open call to apply funding for a national research-based development program. The LUMA Centre Finland was selected as a realiser of the EUR 5 million programme.

The aim of the LUMA-Suomi programme is to motivate and inspire children and youth (from ages 6 to 16) into mathematics, natural sciences, and technology. The content and implementation of the programme follow the national curricula of mathematics and natural sciences and it will be published in Finnish and Swedish. In April 17th the leading group of the programme asked all Finnish LUMA Centres to submit their innovative proposals to the programme. At the moment, the leading group is analysing the proposals and composing framework programmes that integrate different natural sciences. The main guidelines of the framework programme will be composed before the summer 2014 and introduced in the HOPE conference in Helsinki.

[*] pekka.e.hirvonen@uef.fi

GS2 : Increasing the number of physicists: breaking the vicious circle

P. Main[*]
Institute of Physics, UK

ABSTRACT

Most countries in the developed world are reporting shortages in the number of graduates in the physical sciences and engineering, which they see as a serious problem for future growth. In particular, there have been many initiatives to increase the proportion of girls studying physics and engineering but, despite these efforts, the ratio has remained depressingly low. The shortage of graduates with a physics background means that there are fewer of them that enter teaching, which in turn means that students are not taught be experts and are not enthused to continue with the subject. This vicious circle has proved very resistant to change.

In this talk, I shall concentrate on measures taken to increase the numbers of physics students in England. Essential to the process is an understanding of the issues and I shall describe the results of a number of research projects and reports undertaken by social scientists and the Institute of Physics looking into the reasons why students, particularly girls do not choose physics. These results indicate that most of the initiatives to date are likely to have been ineffective and some made have made the situation worse; for example, no intervention to increase the number of girls is likely to succeed unless the effects of gender identity and stereotyping are taken into account. The measures I shall describe will include supporting non-specialist teachers, via the Institutes Stimulating Physics Network, increasing the number of specialist teachers, and specific projects to increase the number of girls taking physics. All measures are evidence based and undertaken in partnership with government, which has provided significant funding. The merits of these measures relative to more traditional approaches will be discussed.

[*] peter.main@iop.org

GS3 : German Schülerlabor -development, position today, impact

R. Hempelmann[*]
Physical Chemistry, Saarland University, Saarbrücken, Germany
LernortLabor Bundesverband der Schülerlabore e.V., Berlin, Germany

ABSTRACT

Schülerlabors (casually called school labs or informal science labs) as out-of-school hands-on laboratories for school students represent a STEM educational movement in Germany and neighbouring German-speaking regions which has developed bottom-up, starting approximately 15 years ago, and which now comprises more than 300 laboratories. The Federal Association of Schülerlabors (1) as a kind of coordinator organizes annual meetings and edits the "LeLa magazine", a journal dedicated to Schülerlabor issues.

Among the innumerable mostly short-term STEM initiatives in Germany the schlerlabors form a large well-visible block. However, users, educational administration, potential suppor-ters and educational scientists cannot always reliably appreciate the effect of schülerlabor visits, because at a first glance the schülerlabor scenery looks comparatively heterogeneous. One aim of the present contribution is to outline the mission and the general concepts of the entirety of schülerlabors and to elaborate that meanwhile several clearly defined categories of schülerlabors have evolved (2), which internally are amazingly homogeneous.

At many universities, Schülerlabors have meanwhile been integrated into the education of teacher students, but only recently it has been realized that they also represent powerful platforms for empirical educational research (3). Studies of this kind allow well-grounded statements about the impact of schülerlabors.

In summary, university-based schülerlabors operate at the interface between school and university; the strategic relevance of this position is presently being recognized more and more, also in view of the ever increasing lack of skilled technical personal in the economy.

(1) www.lernort-labor.de
(2) O.J. Haupt, J. Domjahn, U. Martin, P. Skiebe-Corrette, S. Vorst, W. Zehren und R. Hempelmann, MNU 66/6, 324-330 (2013)
(3) W. Zehren, H. Neber, R. Hempelmann, MNU 66/7, 416-423 (2013)

[*] r.hempelmann@mx.uni-saarland.de

GS4 : Broadening participation and deepening engagement: An agenda for research on student interest in physics

P. Heron[*]
University of Washington, USA

ABSTRACT

In some educational systems, a course in physics is part of a program of study leading to almost any degree in science, medicine or engineering. Therefore many university students, even those who are not planning to study the subject further, take physics courses. A small fraction of these students may be motivated by interest in the subject itself. In secondary school, it can be assumed that a similarly small fraction of students taking physics courses would do so if it were not required.

Many physicists have expressed concern about the perceived lack of student interest in physics, some motivated by the sense that overall participation is low, and some by the sense that physics has lost its attraction for the brightest students. Moreover, students who see a physics course as a barrier to be overcome in the pursuit of their true interests, may be disengaged during instruction.

Numerous explanations have been proposed for the relative lack of interest in physics. Empirical research has much to offer in helping us understand the reasons students choose to study physics or not, and offer insights that can be used to attract more students to the discipline.

In this talk I will discuss relevant research findings and propose an agenda for research that could lead to broader participation and greater engagement.

[*] pheron@uw.edu

GS5 : CERN's outreach activity and how it inspires and educates physics teachers and physics students world-wide

Mick Storr[*]
CERN, Switzerland

ABSTRACT

[*] mick.storr@cern.ch

OC1 : The complex interplay between student epistemologies and student interest in physics

S. Vokos[*]
Seattle Pacific University, USA

ABSTRACT

The number of undergraduate students who obtained bachelor's degrees in physics in the United States in 2010 reached an all-time high of 2017. However, the total number of bachelor's in science and engineering fields was over half a million in 2011, making physics a very small part of the total. The US continues to import foreign talent to meet its scientific and technological demands. The question remains: Why aren't more students pursuing physics? One answer may lie in student problematic views of what constitutes knowledge and learning in physics, namely student epistemologies. In this talk, evidence will be presented that traditional introductory physics instruction at the university level (including standard laboratory experiences) typically makes favorable student epistemologies decline in prevalence. It is hypothesized that this deterioration is also at play in earlier ages and has a pivotal negative effect on student interest and the formation of a physics identity. Of particular interest is the study of the rare counterexamples in which favorable views increase rather than decrease. Implications for instruction will be discussed.

[*] vokos@spu.edu

OC2 : Magiphy, How to engage high school students in Physics ?

N. Lebrun, J. Cosleou,P. Cacciani*
Physics Department, Universit Lille 1 Sciences and Technology, France

D. Droz
President of Magiphy, France

M.J. Gama
Inforsciences, Université Libre de Bruxelles, Belgium

O. Caltun
Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Romania

ABSTRACT

Magiphy (Magic Physics) engages secondary-school students doing physics in an extra-curricular environment. Students develop a project during 6 months with help of their teachers and researchers from the university. The aim of this school-university co-operation is to motivate students doing physics by playing the role of a scientist. A regional country-wide (north area of France) tournament is then organised at the end of the school year where students communicate about their scientific experiments and results to a jury composed of scientists. Magiphy differs from similar tournament by the presence of representatives of student teams in the jury. Moreover, winners of the tournament (named ambassadors) present their project to some schools and science events.

The first Magiphy tournament with 5 participating teams took place at the university Lille 1 in 2002. Because of very positive feedback, Magiphy was held annually until 2013 and was extended to Belgium via a European project (Science and Society Programme). Magiphy was also implement in Romania (University of Iasi). Observers from Italy, Portugal, Bulgaria and Romania assessed Magiphy. They notice the enthusiasm with which the students present their work and the interest they demonstrate. This concept allows students to develop a real scientific method, recurring to experiments, observing critically the data obtained and interlinking different issues, develop on the students a real methodology which will be certainly useful for their lives, since they learn to be logic, rigorous and critic.

Recently, the concept was extended to other science domains and the tournament has been integrated in the French science competition"Faites de la Science" supported by the national committee of heads of science departments in French universities. The winners of the regional tournament then participate to this national competition. In 2014, more than 15 teams (of 6 pupils in average) applied to the regional contest.

* nathalie.lebrun@univ-lille1.fr

OC3 : A physics bridge between high school and university: Young Physicists School at University of Latvia

I.Dudareva, V.Kashcheyevs*
Physics Department, University of Latvia, Latvia

ABSTRACT

One of the challenges facing today‘s high school students and teachers, as well as university students and professors are different perspectives of physics content at school and university. Physicists of University of Latvia launched initiative with aim to creating a venue where high school and university perspectives on physics meet, overlap and interact.

Young Physicists School (since 2011) offers students (age 16 19) an opportunity for informal study of physics topics. Classes are prepared and run by active undergraduate, postgraduate, PhD students and young doctors of physics, in close cooperation with physics professors. Department of Physics and Physics Institutes of Latvia University provides material resources required to run experiments.

Students take on new information on a variety of interesting physics topics; take practical experiments and observe a variety of physical phenomena. Physics students help them to analyze and get an in-depth understanding of physical processes. The lessons were designed for school students (age 16 19), but the younger school students and physics teachers, who are interested in learning more about the various physics related topics, are welcomed.

What are the benefits of the involved participants?
1) Students have an opportunity to learn physics in a more exciting way, to explore live physics, thereby deepening their understanding of physical processes, to discover the spirit of university studies as well. Part of these students choose to study physics or engineering.
2) Undergraduate, postgraduate and PhD students of physics acquire the organizational, pedagogical and didactical experiences.
3) Physics professors have practice to talk simply about complex issues in physics and to advise students on issues that are out of traditional school and/or university physics courses.

All materials from these classes are posted on the Young Physicists School website: www.skolas.lu.lv/jfs

* inese.dudareva@lu.lv

OC4 : Tackling the School-University Transition into STEM Higher Education

M. Grove,[*]
University of Birmingham, UK

S.L. Pugh
University of Leeds, UK

ABSTRACT

Since 2005 there has been substantial university-led activity within the Science, Technology, Engineering and Mathematics (STEM) community to increase and widen participation amongst learners entering these disciplines within higher education. Higher Education Funding Council for England (HEFCE) initiatives such as Chemistry for our Future, moremathsgrads and the National HE STEM Programme have focused upon raising aspirations and providing equality of opportunities for learners from all backgrounds to facilitate their progression into higher education STEM study. While these programmes have undertaken significant activities within local schools and colleges, a key focus for their work has been on addressing the issue of transition, that is students making a successful adjustment from school/college to University-level study.

Within higher education, mathematics is known to be a barrier to progression within a range of disciplines and its effect is particularly prevalent as students make this transition to university study within the STEM disciplines of Physics, Mathematics, Engineering and Chemistry. While there are many reasons for this, universities have needed to implement a range of interventions within the first year of their programmes of study to ensure students are not disadvantaged by their initial lack of mathematical ability and fluency. Within this talk we discuss two such mechanisms that have been employed successfully: mathematics support and peer support. We will draw upon our own work and practice from across the sector, including the national sigma mathematics support network, with a view to showcasing how universities can implement institutional-wide measures to ensure learners can successfully adjust from school to university study. We will also share ideas and learning as to how universities may successfully support students prior to university entry using these approaches to encourage and inspire them to study Physics.

[*] M.J.Grove@bham.ac.uk

OC5 : The REVIR Project: an Approach to Bridge the School-University gap in Science

*M.I. Hernández Rodriguez,** *V. López*
Universitat Autònoma de Barcelona, Spain

ABSTRACT

REVIR project (http://crecim.uab.cat/revir/) is an initiative run by the Centre for Research in Science and Mathematics Education (CRECIM) from the Universitat Autnoma de Barcelona (UAB). Within REVIR project, secondary school students from Catalonia have access to a computerized laboratory located at the Faculty of Education of the university and work in small groups during four hours with specific instructional material for teaching and learning science. The aims of REVIR project are:
1) To make secondary school students familiar with ICTs to facilitate their learning of science.
2) To support teaching and learning of science by means of 4-hours long sessions in which students go in depth on a topic working cooperatively.
3) To support secondary schools, which are not always well equipped with digital tools (e.g. data capture systems, specific software), and science teachers, who have not always received adequate support and training in using such digital tools, providing enough tools and instructional materials covering topics included in the official science curriculum.
4) To make university closer to secondary school students and their families, fostering the attractivity to science studies.

The instructional materials that students use in REVIR sessions have been designed by researchers in science education and secondary school science teachers working in CRECIM. Moreover, the instructional materials are also tested and revised throughout several years to adapt them to students' needs. During the enactment of REVIR sessions, an expert teacher and several researchers from CRECIM monitor their progress and support students in the realization of the laboratory work.

The REVIR project has developed a total of 11 laboratory sessions on Physics (Kinematics, Dynamics, Energy, Sound, Electricity, Magnetism, and Modern Physics). We will provide further information on the impact of these sessions during our presentation in the HOPE Annual Forum.

* mariaisabel.hernandez@uab.cat

OC6 : Synergy of a Science Club: Setting up Planet Walk in Malta

J. Borg Marks,[*]
University of Malta, Malta

ABSTRACT

Synergy of a Science Club: Setting up Planet Walk in Malta "Doing Science" may sometimes be considered just as a classroom activity, but of course, it can mean much more.

Back in 2005, a group of 20 young people in Malta decided to form a Science Club. The aim of the club was to show that science can be done with a difference, while promoting it to the general public. The club focussed on Astronomy a topic which the members of the group were all enthusiastic about. Indeed, the club members felt that the wonder and mystery that are related to astronomy could be used to promote interest and motivation towards the learning of science. The club members came to know about "Planet Walk" from the advisor of the group. At that time, Planet Walk had not yet been set up in Malta. A strong interest was aroused amongst the group. The advisors enthusiasm was contagious. Thus group members started on their venture of setting up Planet Walk in Malta. Apart from participating in the usual club activities, the club members worked hard towards changing a dream into reality.

This presentation will look at the process, the difficulties encountered and the satisfaction experienced by the club members in creating Planet Walk in Malta. It will emphasise the synergy that can be sparked when students form part of a science club which motivates them towards doing science, making them conscious of their own potential.

[*] joan.borg-marks@um.edu.mt

OC7 : The column "Idées de physique": from science popularization to TV shows and experimental conferences

E. Kierlik, J.-M. Courty*
Faculté de Physique, Université Pierre et Marie curie, France

ABSTRACT

We try to promote physics in the society by showing first that physics is all around us and second that physicists have a rich and unique vision on the world. We would like to share our experiences and discuss how it may (or may not...) contribute to make physics attractive among young people.

The heart of our actions is since twelve years the writing of a two-pages montly column called "ides de physique" in the french edition of Scientific american. Without any maths but keeping numbers, taking advantage of events and news, we present a result or a concept of basic physics, illustrated with exemples from every-day life. Readers of this journal are mainly mature and educated people, including physics teachers. Our texts are used in high school classes and already provide resources for national examinations.

To expand our audience especially towards the young, we progressively varied the character of our actions.
- First, we propose conferences where we make live-experiments using both very simple objects that everyone has at home or more sophisticated scientific equipment (like IR camera). We hope that these approaches can make physics less intimidating since people may repeat experiments and have seen equiped scientists get out their labs but speaking the common language. (see http://www.espace-sciences.org/conferences/mardis-de-l-espace-des-sciences/la-physique-surprise).
- Second, we have been regularly invited in a TV-show "On n'est pas que des cobayes" on France 5 network. The show is quite popular especially among young around 10 years old : each of the three parts deals with a simple , funny or intriguing question ("may ice be melt in a microwave oven ?") which is answered experimentally. We play the role of scientific expert who gives clues to design the experiments.

JM Courty and E Kierlik, "Les lois du monde" (2003), "Le monde a ses raisons" (2006), "La physique buissonnire" (2010), "La physique surprise" (2013) Belin-Pour la Science

* edouard.kierlik@upmc.fr

OC8 : Basics Physics in Mass Media

I. Hendolin[*]
University of Helsinki, Finland

ABSTRACT

What does mass media want from physics and what physics has to offer ? How to fulfill the needs of both sides at the same time ? Who should present physics in the media, a physicist or a journalist ? What kind of physics interests the young audience ? The Mythbusters-style approach to science with big, exploding experiments has lately been quite successful, and abundant in the media. Cutting edge physics and the most intriguing questions such as the work of CERN and hunt for dark energy are also quite well covered. Quite surprisingly, a more uncommon approach of popularizing everyday physics and the making of science, has also proven successful in the Finnish media.

The author's work in popularizing physics has mostly dealt with simple experiments connected to everyday life. This is a great way to catch the interest of such audience who normally would not be interested in science at all. The experiments are kept as simple as possible to allow the audience to truly understand or possibly even evaluate what they have seen. This approach is much more approachable (and possibly more scientific) than the typical one, where physics is all too often presented as difficult, being far from everyday life and reserved for scientists only.

The authir is a physicist with a wide experience in presenting physics in media : For over five years, he has had a physics section in a Finnish science-TV-show and a weekly physics radio show on a national radio channel for youth. In addition, he has written a TV-show consisting of science experiments for kids and is a regular expert in a "ask a scientist" -section in the leading Finnish newspaper. The aforementioned activities have been well received in the media, and even hard-to-reach youth from13 to 23 years of age have shown interest in the programs.

Enlightening examples of media activities as well as typical discrepancies between physicists and science program producers will be discussed in the presentation.

[*] ilkka.hendolin@helsinki.fr

PC1 : Conceptual Laboratory of Operative Exploration

S. Challapalli,M. Michelini[*] *,L. Santi,A. Stefanel,S. Vercellati*
University of Udine, Italy

ABSTRACT

Conceptual Laboratories of Operative Exploration (CLOE labs) are Inquiry Based Learning Modules that provide informal contexts in which students, by investigating experimentally the analysis of the phenomenological aspects of physical phenomena, are stimulated towards conceptual reasoning by offering them experiential anchors to fasten the main steps in the construction of scientific knowledge starting from the exploration of everyday-like situations.

CLOE labs activities are research based activities carried out by a researcher on a specific topic in which open work environments are proposed through semi-structured interview protocols offering everyday life scenarios in which students explore physical phenomena by means hands and minds-on activities.

Experimental situations are proposed by following students sequences of reasoning. Research works focused on the construction of formal thinking through CLOE labs allowed to identify students' spontaneous ideas and conceptual paths into the evolution of reasoning in the interpretation of physical phenomena. Data were collected by using personal worksheets and recording of the activities to analyze:
1) how an operative exploration may help students to identified and organize the explored phenomena;
2) how the exploration and the comparison between phenomena is useful to help students in the interpretation of artifacts (i.e. everyday objects proposed as unknown objects that need to understand how they work);
3) how exploratory elements are reused by students in the interpretation of artifacts.
Topics addressed with kindergarten, primary and secondary school students were motion, fluids, thermal phenomena with real time sensors, electrical phenomena, circuits, magnetic phenomena, light and vision. While electrical transport properties of matter, Rutherford Backscattering, Time-Resolved Reflectivity, quantum concepts, superconductivity, mass-energy relationship were addressed with upper secondary school students.

[*] marisa.michelini@uniud.it

PC2 : Planetary Motion: Have we given justice to Kepler?

D. Sathe[*]
Retired teacher from Pune, India

ABSTRACT

While discussing the development of dynamics, Feynman has discussed the idea of an angel beating its wings behind a planet and thereby driving it forward around its orbit. This idea was popular in Keplers time but got eventually faded because of Newtons explanation of planetary motion.

The idea of angels role needs reconsideration because students show same idea unknowingly while answering questionnaire on the planetary motion. So, in my opinion, people interested in the curriculum development cannot simply label students answer as wrong because it is not Newtonian. On the other hand, they have to take proper notice of the similarity between students, so-called, wrong answer and Keplers idea of angels driving the planet. I discussed it first in the I.A.U. Colloquium on Teaching Astronomy, 162, July 1996, UCL.

Lastly, Aristotles ideas and Newtons ideas conflict with each other. However, when Newton was in early sixties, he had felt the need of reconsidering Aristotelian ideas. This feeling in Newtons mind led Anthony French to write a letter in American J. of Physics (January 1984) entitled: Did Newton forget his own laws of motion? This piece of history also requires us consider the question in the title.

[*] dvsathe@gmail.com

PC3 : Broadcasting training activities and Physics Degree organization in prospective/actual Physics students

I. Sánchez[*] *,D. P. Ruiz,F. González-Caballero,A. Schmitt,F. Cornet*
University of Granada, Spain

ABSTRACT

The Degree in Physics in the University of Granada is in the provision of degrees of the Faculty of Sciences, together which other twelve undergraduate studies. The volume of academic information generated by each of the twelve degrees is such that the information provided by the Faculty web is not so specific and updated as desirable. The need to disseminate information about collaborative works, teaching, etc. not only to the degree students but also to School Education Centers led to creating a specific action for improvement. Accordingly, this activity was integrated as an "Improvement Proposal" in the final report of the self-evaluation performed in the Degree in Physics. Among the targets of this project, it is needed an information/communication channel to allow the development of the following actions:
a) Promotion of Physics studies in School Centers through the development of new communication channels web-based to clearly show the admission profile information and administrative requirements of the future students in Physics.
b) Standardization of the administrative and management information of the Degree.
c) Development of a program for on-line consultation on activities and research results.
d) Plan for the dissemination of faculty research activities.
e) Development of a website for targeted discussion and teamwork.
f) Talks and conference proposals framed in the so-called "Current Topics" activities which may be offered to High School network colleagues through videoconferencing.

In this contribution, it is presented how to fulfill these objectives through two types of actions:
- Action on School centers through information and participation (video) in order to inspire motivated students to Physics studies.
- Action on website design and building with all the information regarding the above objectives.
The assessment and discussion of these actions is presented in this contribution, as well as new challenges related to these items.

[*] isanchez@ugr.es

PC4 : Workshops on photonics and optoinformatics for secondary school students

N. Andreeva, O. Andreeva,S. Chivilikhin,M. Khodzitskiy,A. Tcypkin,S. Kozlov*
Saint-Petersburg National Research University of Information Technologies, Mechanics and Optics, Russia

ABSTRACT

Workshops on photonics and optoinformatics are new and effective form of work with secondary school students. The program of such workshops was developed by specialists of Photonics and Optoinformatics Department of ITMO University. Lectures should attract attention of school students to area of activity connected with scientific and technical direction "Photonics and Optoinformatics" and to inspire schoolchildren to study this scientific and technical area. Practical classes should give school students practice of working with the devices that are used in modern laboratories of photonics and optoinformatics, and to demonstrate the possibilities of modern technologies in given area. All workshops are adapted to the level of school students knowledge.

"Terahertz optics and Biomedicine": the lecture will review the principles of generation of terahertz radiation, show mechanisms of interaction between terahertz radiation with biological objects. During practical class school students will take part in workshop on terahertz spectroscopy of biological objects and metamaterials. "Femtosecond optics and femtotechnologies": lecture presents the principles of generation of femtosecond pulsed radiation with wide possibilities of its use. Practical class will demonstrate how real setup on the analysis of food products really works.
"Applied holography": lecture gives an overview of holographic method of recording and reconstruction of information and the most perspective applications. At practical class each participant could receive pictorial hologram and take it as a present from laboratory.
"Quantum Informatics": lecture gives information about principles and applications of a new branch of science devoted to using quantum objects for processing and transmitting of information. During practical class each participant will have opportunity to send and receive secret message by setup of quantum cryptography and manually then compare the results.

* andreevanv_3@mail.ru

PC5 : Support for gifted young people at the JKU in Linz/Austria

E. Steinbauer,[*] *U. Titulaer*
Johannes Kepler University Linz, Austria

ABSTRACT

The implementation of the new physics curriculm for Italian high school requires that, starting from 2014-15, modern Physics, and in particular Quantum Physics, be taught in the last year of the high school (students age 18-19 years). For that reason a considerable effort has been done this year inside the National Project Piano Lauree Scientifiche to respond to schools requests of support both for helping teachers in deepening the content matter and for designing new approaches, adequate to students age and preparation. Moving from an established research line on the educational use of the sum over paths method, we worked with in-service and pre-service teachers with the aim of favouring a gradual and effective approach to quantum physics, starting from Feynmans picture of the photon. Classical experiments on the wave phenomenology of light, such as interference and diffraction, are reconsidered by using commonly available materials: measurements employ a video camera and the Tracker software; the sum over paths analysis of interference phenomena is introduced through GeoGebra simulations.

Then experimental evidence making both the purely wavelike and classical corpuscular interpretations of light untenable is discussed. Some of the experiments we consider are: "granular" interaction of light with matter (photoelectric and Compton effects); indivisibility of the photon; single photon interference. Stressing in particular the importance of the last point, we introduce the Feynman conception of the photon and the probabilistic interpretation of the sum over paths method. Modern experiments such as the Zhou-Wang-Mandel experiment are discussed to better characterize the peculiarity of quantum object behaviour, in particular the measurement problem. Finally the sum over paths method for massive particles and quantization are introduced. The sequence has been tested both with pre-service and in-service teachers in the perspective of implementing it in schools.

[*] erich.steinbauer@jku.at

PC6 : Quantum physics in high school through the sum over paths approach

A. De Ambrosis, M. Malgieri,P. Onorato*
Physics Department,
University of Pavia, Italy

ABSTRACT

The implementation of the new physics curriculm for Italian high school requires that, starting from 2014-15, modern Physics, and in particular Quantum Physics, be taught in the last year of the high school (students age 18-19 years). For that reason a considerable effort has been done this year inside the National Project Piano Lauree Scientifiche to respond to schools' requests of support both for helping teachers in deepening the content matter and for designing new approaches, adequate to students' age and preparation. Moving from an established research line on the educational use of the sum over paths method, we worked with in-service and pre-service teachers with the aim of favouring a gradual and effective approach to quantum physics, starting from Feynman's picture of the photon. Classical experiments on the wave phenomenology of light, such as interference and diffraction, are reconsidered by using commonly available materials: measurements employ a video camera and the Tracker software; the sum over paths analysis of interference phenomena is introduced through GeoGebra simulations.

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* anna.deambrosisvigna@unipv.it

PC7 : CMSE a university school cooperation promoting students subject specific competences and teachers professional development

C. Haagen, V. Rechberger,W. Knechtl,G. Rath,L. Mathelitsch*
University of Graz, Austria

ABSTRACT

Competencies in Mathematics and Science Education (CMSE) was established by the Regional Centre for Didactics of Physics at the University of Graz in 2010. The Austrian Ministry of Education set up several measures as reaction to the low results in international student assessment studies: On the level of systematic monitoring, one strategy was to implement educational standards to change the focus of the educational system from input to output orientation. Another initiative launched was IMST, a project to support Innovations in Mathematics, Science and Technology Teaching. CMSE a thematic programme within IMST - aims at the improvement of students subject specific competencies in Mathematics and Science subjects. The core idea is to simultaneously intervene at the teacher and at the student level by providing a support system of teacher trainers and science education researchers, which helps the participating teachers to address the concept of subject specific competencies in their teaching practice.

Classroom or schoolprojects proposed by the teachers themselves function as the vehicle for the sustainable changes aimed at the level of teachers and their professional development as well as at the level of students subject specific performance, interest and motivation.

On the student level these classroomprojects are designed to promote the progression of a clearly defined set of subject specific competencies within one schoolyear. However to also promote professional development, the teachers do not only carry out their projects as teachers, but they take a dual role as teacher and reflective practitioner conducting action research on their teaching interventions. Within this process, teachers work in small focus groups where they analyse and reflect their teaching guided by their coaches. The data collected on the level of students and teachers provide the data basis for educational research performed by the teacher trainers and science education researchers.

* claudia.haagen-schuetzenhoefer@uni-graz.at

PC8 : An example of nationwide school-university collaboration: the italian "Scientific Degree Project"

N. Vittorio,[*]
Physics Department, University of Rome "Tor Vergata", Italy

ABSTRACT

The "Scientific Degree Project"-PLS was born in 2005 as a collaboration of the Italian Ministry of Education, University and Research (MIUR), the National Conference of Deans of Faculties of Science and Technology (Con.Scienze) and the General Confederation of Italian Industry (Confindustria). The initial motivation was to provide structured training to high-school students interested in graduate courses in Chemistry, Physics, Mathematics, Statistics and Materials Sciences. The main PLS goals are from one hand to offer to high-school students the opportunity: to learn about issues, open problems and methodologies characteristic of these scientific fields; to autonomously check and consolidate their knowledge and skills in relation to what is required for these scientific degree courses. On the other hands, the PLS wants to improve the disciplinary and interdisciplinary knowledge of high-school teachers, as well as their ability to interest and motivate students with hands-on methodologies.

The PLS goals are pursued through "PLS" lab's: the planning, the realization and the evaluation of each PLS-lab are required to be done jointly by school teachers and university professors.

The PLS is based on a coordinated effort of 42 universities nationwide - 35 for Physics - and has reversed the negative trend of enrollments in italian scientific degree courses experienced at the end of the 90's. In the past 10 years, the PLS activities involved about 170,000 high school students. In the average, every year 800 schools and 2,000 teachers were involved, with lab.'s activities carried out in university Dept.'s.

The present contribution aims to give a review of the activities implemented at national level for Physics, showing specific examples of lab.'s activities recently realized, and to discuss points of strength as well as the weak points of the project, as they emerged by a monitoring of the PLS realized during the years.

[*] nicola.vittorio@uniroma2.it

PC9 : Petre Medvetchi a Moldavian regional competition in Physics

A. Balanici,S. Bancila, V. Abramciuc
Department of Physics, Alecu Russo University of Balti, Republic of Moldova

O. Caltun[*]
Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Romania

ABSTRACT

The contest is organized by "Alecu Russo" University of Balti in close cooperation with nine districts inspectorate from the north and north east region of Republic of Moldova. The name of the contest remember to the participants the activity of Petru Medvetchi former professor at University of Balti.

The contest is addressed to the low and upper secondary schools students aged between 8 and 12 years. In the organizing activities of the competition are involved both university staffs and secondary schools teachers. The contest is run in one stage at the university where the students and their teachers are invited for 2 days visit. In the first days the students know the university laboratories. Every year the number of the competitors is around 200 representing 0,1

[*] caltun@uaic.ro

PC10 : (PHI) Online Physics Contest

R. Perjoiu
National College Costache Negruzzi, Iasi Romania

L. Stoleriu, A. Stancu, O. Caltun[*]
Faculty of Physics and Carpath Center, Alexandru Ioan Cuza University of Iasi, Romania

ABSTRACT

The Romanian F (PHI) Online Physics Contest is organized since 2003 by the Alexandru Ioan Cuza University of Iasi and the Regional Centre of Excellence. Every year the PHI contest is organized in two stages. At national level the Contest is organized in local centers all over the country for secondary school students of 13 to 19 years old (7-th to 12-th grade). The contest requires solution to different problems specific for the age and grade level. The assessment items are available on-line for two hours in the same time for students of the same grade. After that, contestants of another grade enter the contest. The rankings for each grade are published and prizes are awarded. Every year more than 2,000 students from more than 60 local centres are involved in the competition. Diplomas are awarded to 25 - 30% of the participants.

The International PHI Contest follows the national one and it is addressed to the Romanian PHI contestants that received prizes at the national stage and to any international contestant willing to enrol the contest. Due to curriculum differences the age/grade grouping of students is no longer possible. Instead, there are four sections (topics) of the contest: Mechanics, Thermodynamics and molecular physics, Electricity and magnetism and Optics. All sections are opened simultaneously and the competitors must solve the problems of a section in 2 hours. The students can freely choose the section there is no age limitation except the fact that the contestant must be a student enrolled in a middle or secondary school. After the contest rankings are published for each section and prizes are awarded.

Organizing the contest is done collaboratively by high school teachers and university staffs. Topics, and difficulty of formulated items is decided by a national committee of the competition. The competition committee proposes algorithms for solving and correction scales.

[*] caltun@uaic.ro

PC11 : Outreach activities at Leibniz Universitt Hannover - Connecting scientists, teachers and students

*G. Friege, H. Pfnür**
Gottfried Wilhelm Leibniz Universität Hannover, Germany

ABSTRACT

Leibniz Universität Hannover is a middle-size university with around 23000 students and 2500 staff members. The university is aiming at creating the best conditions for scientists, excellent research and education and the support of the next academic generation. Outreach activities are therefore an important part at the university. Some of them are integrated in single projects, some are long-lasting activies of the university.

The faculty of mathematics and physics is engaged in many of these outreach activities for students and teachers. Examples are the Gau working group, the competition Club Appollo 13, the Winter University for high school students or the working group for education in mathematics, where mathematicians and mathematics teachers come together to discuss new developments in mathematics education. An overview about these activities will be given and two new outreach activities will be presented in more detail: the LeibnizJuniorLab, mainly driven by scientists from the solid state physics institute and a cooperation project between primary schools and the physics education group.

* pfnuer@fkp.uni-hannover.de

PC12 : Physics education at the University of Craiova - through cooperation with secondary schools

G.E. Iacobescu[*] *, R.D. Constantinescu*
University of Craiova, Romania

ABSTRACT

University of Craiova, through its Department of Physics, has a long and fruitful tradition in promoting science and science education, as well as in cooperating with high-school students and teachers. We shall illustrate some specific activities, conferences, workshops and contests, jointly organized with secondary schools in order to assess the competencies of students, to develop their skills in practical works and to enhance the attractiveness of exact sciences:
- We use each year various events or celebrations as Earth Hour or Researcher night, to organize educational activities seeking to raise the awareness of society on the impact of physics;
- There are two already traditional pupils contests in Physics organized yearly;
- In 2005 we coordinated the participation of the pupils in International Year of Physics, Craiova winning the first place in the world as city with the highest density of participants in the activity "Physics enlightens the world" organized by EPS (http://www.wyp2005.at/);
- We actively participated in the activities organized in 2009 under the aegis of International Year of Astronomy. We are the owner of one of the five radio-telescopes which will be connected in an EU network in the frame of the programme Hands on Universe;
- We focus on the improvement of the physics teaching at the high school level, offering to the teachers in-service training and other postgraduate programmes.

[*] gabrielaiacobescu@yahoo.com

PC13 : Physics laboratory works for upper secondary school students in the University of Turku

M. Montonen[*] *, J. Tuura*
University of Turku, Finland

ABSTRACT

The Department of Physics and Astronomy in the University of Turku provides laboratory works for upper secondary school students. This kind of collaboration brings real benefits for the students, schools and for the department.

Each year, approximately 60 individual students from nearby upper secondary schools use these practical works as a part of their schools optional laboratory work courses in physics. Students gain some experience in laboratory works and also gain knowledge for the matriculation examination. Furthermore the laboratory works done by the upper secondary school students are essentially the same laboratory works as the ones physics undergraduate students do as a part of their first year practical laboratory work courses. This has real advantages for the students: If they start studying physics in the University of Turku, they can transfer credits from completed laboratory works into the bachelor's degree laboratory work course.

The arrangement brings several benefits: for the upper secondary schools, it is a rather inexpensive way to organize laboratory work courses. The schools do not need to invest in their own laboratory facilities, and the Department of Physics and Astronomy even provides this service free of charge for upper secondary schools. From the upper secondary school teachers point of view, this also removes the burden of having to come up with laboratory works for students. Moreover, the estimated annual costs for the department consist of a six days' worth of salary for one member of staff. This can be seen as an economical way of promoting the department and physics in general.

[*] mjsmon@utu.fi

PC14 : Xperium : A new place to experience research and innovation with high school !

J. Cosleou,[*] N. Lebrun,S. Picart,P. Brivoal,J. Roche,P. Père,D. Tissoires
Physics department, Université Lille 1 Sciences and Technology, France

ABSTRACT

Xperium is a showcase of ongoing research, of partnerships between universities and innovation actors, particularly dedicated to students of upper secondary schools and companies. For the formers, the objectives are linked to policies for a successful transition from High School to University and an awareness of careers in research.

Xperium offers over 2 hours, a route in 7 steps, i.e. 7 experiments gathered around a single theme. Each of them is presented, performed, guided by a PhD specialist in the field, able to adapt and respond to questions of visitors. A global educational process is proposed to the students, beyond the visit itself. Before it, students are made aware by their teachers on the theme of the exhibition, on research activity, on jobs, The visit enables to watch the research experiment, listen to the doctoral students, ask them questions, ... Back to classroom, students comment and deepen the visit in relation with programs, jobs, social issues Teachers are accompanied throughout the process by the Xperium staff, who provides them a documentary kit.

Xperium also helps students discover the scientific jobs and give them a taste for science. University cursus are not presented because we believe that the student chooses the right training easier if he has a clear vision of what he wants to be or become professionally. It is why the end of the visit is systematically devoted to present the different jobs and opportunities, the cornerstone for a successful and motivated transition between high school and university.

The role of Xperium is also to promote research to all audiences across the Region. Experiments are thus adapted to mobility, with in addition a focus on research activity in relation with the current societal issues.

Xperium is the foreshadowing of future learning center dedicated to innovation, supported by the Lille 1 university and the Region Nord Pas de Calais (with european FEDER and Lille Metropole Communaute Urbaine funding).

[*] Jean.Cosleou@univ-lille1.fr

PC15 : How to grow physics? Creating a proper climate through cooperation between the University and the school

J. Jarosz[*]
Institute of Physics, University of Silesia, Poland

ABSTRACT

The widely understood mission of a physics teacher is not only to conduct exemplary lessons in the classroom. It is merely the last stage only the top floor of the pyramid of conditions, which must be fulfilled to provide the youth with proper education. At the base of this pyramid there are a conducive social climate, popularity of science in families and local communities, and an appropriate rank of physics at school and at the society. The university physics departments appear to be most appropriate places and the best allies that can support schools. Universities not only have laboratories and appropriate technical measures, but, above all, can play an invaluable role in creating a right societal climate and promoting the importance of natural sciences.

The programme which is offered to physics teachers in the Institute of Physics at the University of Silesia in Katowice is an example of vehicle which transfers no only the idea how to create interest in physics, but also provides teachers with the appropriate tools, competences and qualifications.

[*] jerzy.jarosz@us.edu.pl

PC16 : Stage@Tor Vergata University

N. Vittorio[*] *,D. Billi,L.M. Catena,A. Celletti,P. Proposito,O. Rickards*
Physics Department, University of Rome "Tor Vergata", Italy

ABSTRACT

The "Stage @ Tor Vergata" is a project involving high-schools and the University of Rome "Tor Vergata". The project foresees the participation of motivated, high-school students in Dept.'s research groups and the preparation by them of an essay - to be submitted to the national state examination - on the assigned research topics. In this respect, the project provides a unique tool for developing specific skills in a Physics or Biology lab., and for autonomously and critically elaborating the topics learned during the stage.

The project is based on laboratory experiments in physics, astrophysics, forensic anthropology and their communication. The topics are chosen by the Tor Vergata research groups, in connection with their scientific activities. Students is assigned to a lecturer of the Tor Vergata and to his/her research group.

The project is divided in two phases: a Summer Stage and Winter Stage - 5 full days each. This year we have 5 research groups for 5 modules of 30 hours each (10 of theory, 20 of lab.'s activities): Astronomical Techniques for Solar Physics; Optical Devices for ICT; Forensic Anthropology; Astrobiology; Scientific Communication and Public Outreach.

The original aspect of the project is to provide students with a methodology which step by step:
i) identifies a research question;
ii) uses an experimental activity targeted to answer the research question;
iii) analyzes experimental data to enable students to formulate a scientific conclusions.
Here we want to present some specific aspects of the laboratorial activities and of our self-evaluation of the "Stage@Tor Vergata".

[*] nicola.vittorio@uniroma2.it

PC17 : Promoting the interest in physics through cooperation activities between university and schools: A case study from Eindhoven University of Technology

S. M. Gómez Puente[*]
Eindhoven University of Technology, The Netherlands

ABSTRACT

In 2011 the Applied Physics department at the Eindhoven University of Technology made a clear choice to strengthen the cooperation between the university and the schools. In order to do that a vision on how to position teaching physics in the world of the students was defined with some specific features:
Small-sized education, and therefore, personalized;
Offering carrire perspective by educating students in the so-called high-tech region;
Providing opportunities for further fundamental research together with an ample spectrum of subjects to conduct applied research;
Promoting a hands-on and independent research-oriented in the master study programs;
Within this framework and in order to transform this vision in practical schemes, the Applied Physics department has developed a set of a activities to strengthen the cooperation between the university and the school. These activities are threefold:
To promote the interest on the technical application of natural sciences and physics among young students;
To upgrade the secondary physic teachers knowledge on physic-related themes; To inspire young students to study physics at the Applied Physics ;

To promote the interest of the students on the application of physics in technology some initiatives are developed such as Eureka!Cup, competition-based projects for secondary students. Having in mind societal challenges, e.g. water management, energy or space exploration, students are to propose solutions to problems formulated by the industry or research institutes. With regards to the support to the secondary physic teachers, the Bta Black Belt program is geared to enhance secondary education physic teachers' knowledge and skills. Through a 6-meeting lecture program refresh the university teachers and researchers the knowledge of high school teachers by showing current developments in the use of the theoretical base of physics in the experimental application and in the translation of those insights into education

[*] S.M.Gomez.Puente@tue.nl

PC18 : ADOPT Science and Art in Primary School Project. School and University cooperation in inspiring young people to study physics

L. Bertoli,A. Bertossi, B. Boccardi,S. Donati De Conti,F. Fabbri,T. Guerrini Rocco, G. Capponi Omaira,M. G. Lorenzi[*] *,M. Michelini,W. Moro,G. Parolini,P. Pavatti, A. Pratelli,R. Sartori,A. Stefanel,M. Torre,V. Tosoratti*

University of Udine, Italy

ABSTRACT

The cooperation between school and university contributes to the guidance, the motivation and formative success of young people when it achieves personal active involvement in the subject matters, mainly in the scientific activities and in physics in particular for learners at all school levels. In addition, in school-university cooperation, the active role of teacher as facilitator of the process of learning is fundamental. Thus, these collaborations must be designed integrating the contributions in each specific competency.

Many studies have pointed out that the high interest in science that pupil show in primary school is reduced during the following years and one of the causes is related to the informative educational modality based on textbooks reading.
Promoting a scientific education though by means of inquiry based learning (IBL) strategy, in which physics is a relevant part and teachers are specifically formed and motivated, is a challenge for motivating young people towards science.

The Adotta Arte e Scienza nella Scuola Primaria Adopt Art and Science in Primary School Project is at the crossways of these challenges and proposes a path-competition, in which pupils integrate art and science. The pupils perform scientific and artistic activities under the guidance of two teachers, cooperating in planning the teaching intervention project on didactical innovation in order to participate to the competition.

The science teacher are formed in a specific university workshop for IBL activities on the topic chosen for the competition, that for 2014 was “Light”. University is partner of the school and acts as a consultant for the school project, didactical experimentation and evaluation.
The collaboration involves different actors, levels and contents.
All of them are involved in the competition management and prize awarding. The project, originally promoted by Esplica in secondary schools, involves the best pupils in presenting their project in a joint school.

[*] cird@uniud.it

PC19 : Physics is my friend

M. Beniacikóvá, M. Spodniaková Pfefferová,J. Raganová[*]
Matej Bel University Banská Bystrica, Slovakia

ABSTRACT

Physics is my friend is a successful event of university-school collaboration running at the Physics Department of the Faculty of Natural Sciences, Matej Bel University Bansk Bystrica (SK) in 2012 2013. An idea to organise such event occurred as a result of the Bachelor theses of a physics teacher trainee Maria Beniacikova. She investigated attitudes of pupils at lower secondary schools towards physics and found a relationship between the popularity of physics and the frequency of experimental activities done at physics lessons. In the questionnaires children expressed their interests to do more experiments. So as a part of her Magister theses Maria decided to organise an event that would enable pupils from Banska Bystrica region to conduct experiments directly at laboratories of the physics department.

An invitation to the prepared event met a great interest of schools. Instead of originally planned one day the event had to be organised in four days with approximately 50 participating pupils each day. Classes of school pupils visited a lecture at first and then worked in five laboratories (Magic physics, Lets create it!, Optics by my eyes, Physics toys, Room of experiments) with a set of attractive experimental activities prepared.

The preparation an organisation, as well as the direct contact work with pupils, was completely in hands of physics teacher trainees, who worked voluntary. So, besides the addressing the lack of equipment at schools and children interest in physics experiments the event was an excellent way of future teacher training as well.

Evaluation questionnaires were used to gain a feedback from participating pupils and their teachers. Their analysis showed that children had learned a lot of new things, liked collaboration with university students very much and liked to work at university labs. As an additional benefit the teachers received good examples of activities that they can use in the classrooms.

[*] janka.raganova@umb.sk

PC20 : Magical Physics

K. Vähä-Heikkilä[*] *, J. Tuura*
University of Turku, Finland

ABSTRACT

Magical physics physics shows in pre- and primary schools For few years in the vicinity of Turku we have made several classroom visits to inspire young people to be interested in science and especially physics. These visits are based on either one specific subject of interest or general presentations of physical phenomena. For pupils point of view the presentation can be considered as magic as the selected demonstrations are usually against their preconception. Not only the pupils are astonished but also teachers usually share the amazement.

Doing magic shows in classroom with less than 20 persons is somewhat time consuming, if done in larger scale, but it has advantages that are unachievable for show presented for masses. First there is time for any question that will appear during show and second pupils can have that hands-on-experience on most of the "tricks". The emphasis is on understanding phenomenon on most cases and pupils can have a try on same experiment by themselves.

With a good show, also the teachers will be fascinated by the physics, which seldom have studied science. This can have an effect on teachers' personal view on science and so far this effect have been only towards positive view.

[*] jajupa@utu.fi

PC21 : Summer School on modern physics for talent secondary students.

M. Michelini, L. Santi,A. Stefanel*
University of Udine, Italy

ABSTRACT

In the upper secondary school is increasing the need to differentiate the curriculum, offering cultural significant educational activities, intellectual challenges able to enhance the excellence in parallel with tutorial activities for low ability students. The problem of the enhancement of excellence is a challenge that is also reflected in various international educational researches. The suggestion emerging is to offer activities that: 1) are not trivial and fragmented, 2) are structured in organic and targeted interventions, albeit temporally content; 3) effectively address issues of interest because they present culturally significant, relevant to the application level; 4) provide examples of typical research methods in modern physics; 5) are effective for the formative guidance.

To contribute and to gain competence in this field the University of Udine organizes in 2007, 2009, 2011, 2013 and 2014 five editions of a full immersion National Summer School (NSS) on the physics of the twentieth century for 30-40 students selected among 300 of the last two years of the Italian Upper Secondary School. The NNS School on Modern Physics is carried out in the framework of the Scientific Degree Plan (PLS) and in particular in the IDIFO project (Innovation in Physics Education and Guidance) of 20 Italian Universities coordinated by the University of Udine. By means of inquiry based strategy, in NNS Schools, students explore the conceptual foundation of quantum mechanics and relativity, analyze phenomena with large applicative implications such as superconductivity and perform crucial lab experiments for modern physics foundation.

The students reasoning and learning paths, monitored by tutorials, questionnaires, highlight positive learning curves and suggest way for talent students activities integrated in school work.

* marisa.michelini@uniud.it

PC22 : Physics and astronomy summer camp

J. Lamminpää[*] *, J. Tuura*
University of Turku, Finland

ABSTRACT

Department of physics and astronomy at university of Turku has arranged summer camp for children aged 10 to 12 for several years. Last three camps were offered via Children's University (Lasten yliopisto) of university of Turku. Camp is a day camp, so that children spend the evening and night at home. Annual camp is organized at the very beginning of June and the pressure to increase the amount of more organized camps is increasing. Day camp for physics and astronomy has ascended to the most popular camp organized by Children's university.

The aim of the camp is to build your own rocket which is launched at the last day during a visit to University's observatory at Tuorla. The rocket will be powered with steam, pressure or electromagnetic induction. Before children start to build their rockets, they are introduced to use these ideas when they build steam boat and air pressure car of their own. While aim is to build rocket the idea behind is to let children's imagination free when they plan their vehicles or solve problems experienced during construction.

Though camp has a strong background in physics, almost half of the camps program includes outdoor activities, so that campers have chance to get to know each other and to make new friends. This has developed positive image of the camp and the physics and astronomy department as well and hopefully for physics as an enjoyable subject.

[*] jajupa@utu.fi

PC23 : Science meets Arts- Experience inspires! A contribution to an interdisciplinary education

G. Pospiech, M. Niethammer, C. Schmidt,E. Hieckmann[*]
Institute for Applied Physics, Faculty of Science,
TU Dresden, Germany

ABSTRACT

The project "Science meets Arts - Experience inspires!" (NaKuP) is a co-operation between the chairs of didactics of physics and of chemistry of the TU Dresden on the one hand and the museum educational service of the Staatliche Kunstsammlungen Dresden on the other hand to develop one day courses for school students on interdisciplinary application of science and technology on objets d'art treasured in the Albertinum. A central motivation of the NaKuP project was to win young people, particularly girls, for physics and chemistry by utilising their well-known interest and preference to fine arts. The courses were developed by project staff as well as by teacher students in a series of optional seminars offered to all teacher students at TU Dresden. At first we had only participants from physics and chemistry, afterwards practically from all school subjects. The aim was to increase the competencies of teacher students for the development of a problem oriented and interdisciplinary school instruction. Therefore, the museum Albertinum served as a particular out of school learning place with exemplary but authentic courses. During these courses the school students for example have to assign a drawing to an epoch by chemical analysis of pigments, to guarantee for the climatic safety of a touring artwork by measuring and regulating parameters of the environment or, to find out the correlation between illumination and colour effects of a painting. The teacher students are involved in the planning, preparation, realization as well as in the evaluation of these courses. The data of the evaluation give hints that this project provides indeed an opportunity to increase interest of girls in science and finally also the number of female students in physics.

Acknowledgements are given to all NaKuP-contributors from TU Dresden and Staatliche Kunstsammlungen Dresden and, for financial support to the ESF.

[*] ellen.hieckmann@tu-dresden.de

PC24 : Physics and art: the role of physics in the theater, architecture and painting

*S. Stafeev,E. Bobritckaia**
Saint-Petersburg National Research University of Information Technologies, Mechanics and Optics, Russia

ABSTRACT

The University actively develops programs for the popularization of Optics as the Science of the XXI century. The science education museum of optics "Optimus" was created in the University in 2009. Since then it has been visited by hundreds of groups of pupils and high-school students each year. The permanent exhibition in "Optimus" was recognized as one of the best in the world by the optics community.

University ITMO in conjunction with the Academy of Theatrical Arts designed the course "Optics and Art" for students of the Academy. The result of course was the exhibition of art installations created by students on the basis of the knowledge of physics and physics application in the field of art.

In April 2014 Olympiad on the art science "Art Olympus 21" was held for schoolchildren at the Museum of Optics by the University ITMO in conjunction with the St. Petersburg Academy of Postgraduate Education. The chouse of the Museum of Optics for the final round of the Olympics due to the theme - "Unreal reality." Schoolchildren offered to find out the relation between the art and science, which give opportunities for creativity scientific discoveries as to whether the artist's imagination to open new horizons for science. They had to explore the halls of the museum, find artifacts that have launched various fields in the arts, to understand how their work, and in the limited time to create their own creative projects.

Work resulted in an interactive performance shadows composition "Color Dreams", a painting by fluorescent dyes , silhouettes illustrating the works of L. Carroll's "Alice in Wonderland" , color and music composition , 3D images for anaglyph glasses and a stereoscope.

It turned out that science and art are not so far apart as sometimes seems to schoolchildren. Work at the Museum of optics allowed participants Olympiad project go beyond objectivity and open new opportunities for creativity, self and try to create a new experience this unreal reality.

* andreevanv_3@mail.ru

PC25 : IAPS member international and interactive projects in physics outreach

M. Zimmermann, A. Milinovic[*] *, A.M. Tan*
International Association of Physics Students, France, Philippines

ABSTRACT

This poster presents several activities of the International Association of Physics Students and the UP Physics Association (UPPA), the physics student association at the University of the Philippines Diliman, which are intended to inspire young people to study physics, in hope of building a quality physics society for a better future of physics.

It was an amazing journey, that of physics through ages, yet physics history and famous physicists are not considered to be an integral part of general knowledge. In efforts of reaching the general public, IAPS is currently collaborating with EPS on an interactive web project "Grand Physicists - Living for Science" where everyone can explore biographies of famous physicists in a fun way. General information about those famous physicists will be presented and are accompanied by a quiz, where everyone can improve his or her knowledge about the grand physicists.

UP Physics Association (UPPA) has a variety of programs to offer: from lectures to competitions. Physics Month is a month-long celebration designed to attract students who are not yet affiliated with the National Institute of Physics to take up a degree in Physics through the events held like Lab Tours and Career Talks. PISIKAalaman is an inter-high school physics quiz, open to all secondary schools in the country. Competition gives the participants a new perspective of physics but also opens a dialogue between parents and teachers about physics education in Philippines. Through the years, it has evolved to be one of the largest physics competitions in the Philippines and a place for top physics students in Philippines. They also organise Philippine Young Physicists' Tournament, event like the International Young Physicists' Tournament. SCIENCYE is an event for secondary school students where UPPA visits other schools to demonstrate fun and interesting experiments that promote physics by providing an experience where learning and enjoyment perfectly meld together.

[*] ana.milinovic@iaps.info

PC26 : IAPS European efforts in physics outreach

M. Zimmermann, A. Milinovic[*] *, A. Kozuljevic, A. Tebben, T.A. Vámi, K. Ligtenberg*
International Association of Physics Students, Croatia, Germany,
Hungary, The Netherlands

ABSTRACT

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[*] ana.milinovic@iaps.info

PC27 : Active Learning Suported By Mobile Computers

*S. Egri**
University of Debrecen, Hungary

ABSTRACT

It is well known fact that active learning helps students to understand basic concepts in physics. Making experiments and analyzing the measured data turned out to be an effective way to realize active learning. Some classic physical experiments need special equipment, measuring instrument or laboratory. Using mobile devices like tablets or smart phones can help students to observe and measure phenomena that appearing in technical or natural environment. These experiments can be used for example when the learning process is performed according to Inquiry Based Learning methodology at home as well as in the schools.

An android application was developed recently for collecting and analyzing data of the sensors which are embedded in tablets and smart phones. The application was used to examine certain phenomena in mechanics, like motion of the pendulum, damped oscillations of a cart, circular motion of a bike-wheel taking place in horizontal and vertical plane as well. Applying Inquiry Based Learning we successfully inspired teacher candidates and secondary school students to collect and analyze data with their own mobile devices. We think, this kind of activity could be a promising way to turn the attention of the pupils even at very young age towards learning physics.

* egris@science.unideb.hu

PC28 : Socio-physics may inspire those supposed to inspire young and old to study, apply and promote physics

R. Chisleag[*] *I.-R. Chisleag*
University "POLITEHNICA" in Bucharest, Romania

ABSTRACT

Natural sciences, studying matter, have been discovering the laws of nature, modeling material objects, phenomena, situations, to influence and forecast natural evolution and help humans to increase productivity.

The proportion of members of the society ensuring material needs of the mankind is continuously declining, Natural sciences target human society now. Due to the unity and some similarities in structures and in relationships between nature and human society, if there be considered that the society is being composed of many members (molecules), natural and/or legal persons, relatively similar one another, the principles of functioning of the given society may be offered by Socio-physics ("the study of social phenomena from Physics' perspective").

Socio-physics offers powerful tools to understand, find solutions, forecast social behaviors and contribute to promote and inspire Physics study itself.

Socio-physics uses mechanical models to explain social relationships (Jus-physics), thermodynamics models (Econo-physics), optical and quantum mechanical models (Socio-optics) to explain individual and human groups behaviors.

The simple Socio-physics models and the conditions for space, time, objects, resources and interactions, when applied to society, are relatively less rigorous than in Physics, but nevertheless objective.

Basic concepts in classical physics studied during school may be used by young and old to understand and explain social life. The authors mention their expertise in stimulating Socio-physical approach by systematically asking students taken courses in Physics to apply the newly got Physics knowledge to model social and even everyday life phenomena, eventually engaging in such activities other possibly interested colleagues.

Socio-physics is to be introduced in academic curricula for physicists. Post graduation programs in Socio-physics, for economists, jurists, journalists and politicians, up to master programs, might be offered by HOPE.

[*] Chisleag@gmail.com

PC29 : Games Experiments Ideas - GEI exhibit and its role in school university cooperation

D. Ceccolin,S. P. R .C. Challapalli, D. Da Rú,M. Franchini,L. Gallo,L. Marcolini, R. Maurizio,M. Michelini ,M. Sabadini,A. Sabatini,L. Santi,M. L. Scillia, A. Stefanel,S. Vercellati*

University of Udine, Italy

ABSTRACT

GEI aims to be a source of activities to try, to play with, and to experiment with, exploring ideas and using ideas to explore phenomena. It is intended as a cluster of tools (apparatuses for experiments, cards, booklets, animation, simulations) to be used, in school or in a more open environment, for analyzing and understanding phenomena at different age (5-16 year old pupils). In the GEI exhibit four kinds of written materials are available for each experiment: a) photographs of the experiments with captions, b) short and easy-to-read cards suggesting a first operational approach to each experiment, c) cards offering guidance to a thoughtful performance of the activities, d) articulated texts for a more formal school-based approach, containing tools for investigating the children's learning patterns. Experiments are organized in 7 monothematic sections on sun and its motion, force and equilibrium, fluids, light and vision, circuits, thermal, electrical, magnetic phenomena, but educational activities can be organized with different paths though the sections.

GEI encourages the user to make personal explorations, to perform simple experiments and to answer the questions posed by the accompanying cards. Thus it focus on both the playful aspect of individual discovery and the practical side of things, which are necessary for personal involvement and the learning of scientific subjects, especially in the formative phase of students basic knowledge, the period in which the maximum effort is required for the development of scientific culture. Operative learning environments on scientific topics and in physics in particular are suggested to teachers interested to rent gratis the materials. From 1994 to 2014 GEI was used for a minimum two hours by 240000 students during the exhibitions organized by Udine University and by 8500 students in school class activity. An informal link between 230 school and Udine University was created by GEI activities.

* marisa.michelini@uniud.it

PC30 : MUDIC-VBS-CV (Museo Didctico e Interactivo de Ciencias de la Vega Baja del Segura de la Comunitat Valenciana). A museum to motivate and learn science

J. Carnicer[*] *, G. Abellán, F. Bermejo*

Museo Didáctico e Interactivo de Ciencias de la Vega Baja del Segura
de la Comunitat Valenciana, Spain

ABSTRACT

The MUDIC-VBS-CV (www.mudic.es) is a didactic and interactive museum of science, ECSITE member, designed by an association of teachers and governed by the association in collaboration with the University Miguel Hernndez (UMH) and the town hall of Orihuela (Alicante-Spain).

At the MUDIC-VBS-CV, has always been addressed to work the training and research aspects of science teachers, participating in the "Master Teachers in Secondary Schools" with the seminar "Learning science in a museum" and directing a postgraduate course at the University Miguel Hernndez (UMH; www.umh.es) "Specialist in scientific literacy and science education in out-of-school and school contexts".

During the last years, the MUDIC-VBS has served as a hub of science in the region the Vega Baja del Segura, and more than 5000 students have visited it each year. The rooms Maria Sklodowska and Charles Darwin presented over 30 interactive modules covering all scientific fields. Most of these modules are designed and built exclusively for the museum by high school and college teachers, and are the subject of several studies and publications (for example: How Can "Weightless" Astronauts be Weighed, Phys. Teach. 50, 12 (2012)). Moreover, the museum has the room Einstein in which numerous workshops and interactive recreational science are developed, being this aspect one of the most innovative in the center.

Finally, there is a scientific garden, which displays numerous sundials and where activities related to astronomy and botany takes place. Moreover, the museum posses a staff of instructors who lead visits and conducting various workshops. The museum's pedagogical paradigm is based on cooperative learning in small groups, widely studied by the founders of it, within IBSE learning-teaching strategy. This latter aspect positions the MUDIC-VBS as a social research center, in addition to positively motivate children and youth to science and encourage them to study scientific careers.

[*] jesuscarnicer@gmail.com

PC31 : The Researchers' Night as an initiative to inspire interest for Physics. The experience in the University of Granada

D. P. Ruiz[*] *,I. Sánchez,F. González-Caballero,A. Schmitt,F. Cornet*
University of Granada, Spain

ABSTRACT

The Researchers' Night is a European science project framed in the PEOPLE Programme of the 7th Framework Programme of the European Union which takes place simultaneously in over 200 European cities since 2005.

The "Fundación Descubre" leads the Andalusian project in Spain and it holds in the Faculty of Sciences under the Research and Sciencific Activities Vicedeanship. Its main objective is the researchers bring citizens to know their work, the benefits to society and its impact on everyday life. The event begins holding micro-meetings with researchers, in which these and small groups of attendees can meet up close in a relaxed atmosphere. In this context, researchers introduce themselves, talk about them and their research in relaxed conversations, exchange questions and explain their scientific work in small meetings.

In the University of Granada there are several activities led by physicists who tried to excite and promote the interest for Physics. Among them we have the following micromeetings:
Researching the air we breathe: Assessment of air quality in an urban setting
Following the clouds to enhance the production of solar electricity
Looking under our feet, the use of ground penetrating radar
The recovery of the colors in the monuments
Experiments with ion traps and lasers
The sound of our lives: from noise pollution to sound spaces
Optics
The heart of the matter
Science and Technology Colloids and Interfaces
The hunt for cosmic rays
Star formation in galaxies
The phases of Venus
Atmospheric Exploration: Classic and new technologies

People attending these meetings are mainly school students and families. In this contribution we briefly describe how the micro-meetings are organized, the topics dealt with, the experience of some of the teachers participating in them and how these events can be used to motivate students to study Physics or Sciences in general.

[*] druiz@ugr.es

PC32 : IRRESISTIBLE - Engaging the Young with Responsible Research and Innovation

A. Laherto[*] *, et al.*
University of Helsinki, Finland

ABSTRACT

The goal of the EU-project IRRESISTIBLE (launched in November 2013) is to design educational modules that foster the involvement of students and the public in the process of Responsible Research and Innovation (RRI). RRI is a concept developed for bridging the gap between scientific research and other societal actors. RRI addresses the consistent, equal and ongoing involvement of society and societal actors, from beginning to end of the innovation process. It concerns assessment and effective priorisation of social, ethical, environmental, technical and commercial impacts, risks and opportunities.

In order to raise the awareness and interest in RRI, the project brings cutting edge research into classrooms and out-of-school environments. The topics cover, e.g., climate research, nanoscience and renewable energy. In each of the ten countries involved in IRRESISTIBLE, a Community of Learners (CoL) has been formed to develop a thematic module. These groups comprise of school teachers, education experts from universities, exhibition experts from museums / science centers and researchers from the thematic field. The material developed will be used by the CoLs teachers with their students. Additionally, the students will translate results of their learning project into a public exhibition.

This poster presentation will outline the idea and report the current status of the project.

[*] antti.laherto@helsinki.fi

PC33 : Popular physics lectures and demonstrations at the Palais de la découverte

G. Trap,[*]
Palais de la découverte / Universcience, France

ABSTRACT

Since 1937, the physics unit of the "Discovery palace" (Palais de la découverte) in Paris delivers daily tens of spectacular demonstrations for students and general audiences, in the spirit of Faraday's christmas lectures, in all the fields of physics (electricity and magnetism, geometrical and physical optics, solid and fluid mechanics, thermodynamics, acoustics, nuclear and particle physics). This poster will review these activities and their general impact.

[*] guillaume.trap@universcience.fr

PC34 : The Physics Teacher formation at the University of Concepción: the Chilean reality and the proposals to inspire young people to study science

A. Arenas-Villarroel et al.,[*]
Universidad de Concepción, Chile

ABSTRACT

This work presents the current formation of physics teachers at the Universidad de Concepción. In the next months, we will modify the curriculum for all the Careers at our Faculty to establish a competences-based formation, in particular, in Sciences and Physics. We discuss about the current state-of-the-art about the Physics in the National Education System which includes some preliminary topics of Science for pre-Basic School followed by "Natural Science" at the Basic School. At the High School, the students have Physics, Chemistry and Biology, separately. We also compare the Chilean System to the Latin-American Education System, the pros and cons. and how these topics influence the national curriculum.

The second part of this work presents different methodological and didactics proposals, done by students at the end of their Career, related to teach Science, in particular Physics, from Pre-Basic School to High School. Most of these proposals have been applied by the same students in different Educational Centers, with similar results.

These proposals include topics of:
- Physics for children (Science for children between 3 and 5 years old)
- A world full of Forces and movements (Basic School)
- Measuring the Universe with a ruler and a clock (Basic School and High School)
- Looking for the Equilibrium, Thermodynamics laboratories (Basic School and High School)
- Electromagnetism Laboratories using recycling materials (Basic School and High School)
- The Light; laboratories using simple and easy-to-get materials (Basic School and High School)
- TICS in physics (High School)

We conclude that these activities help to inspire young people to study science, because they are acquiring science knowledge beyond their curriculum.

[*] joarenas@udec.cl

PC35 : Physics and Astronomy projects at the B.M. Birla Science Centre

B. Sidharth,[*]
B.M. Birla Science Centre, India

ABSTRACT

During the Summer and Winter vacations the B.M. Birla Science Centre has organized Astronomy and Physics Camps for middle and high school students (10 years to 16 years).
The Camp focused on interesting Astronomical / Physics Lectures, video shows, power point presentations on curriculum based Physics topics, Solar System, Stars, Galaxies, End Products, Life in the Universe, Planetarium presentation, Sky Observation, Group discussion and presentations.
This apart 3 month programmes on Astronomy and Astrophysics for amateurs were organized.
For the senior college level students we organize Physics workshops. The topics include:
1. Astronomy
2. Gravitation and Cosmology
3. High Energy Physics
4. Nuclear Physics

Several eminent scientists like Prof. O.W. Greenberg from UK, Prof. Walter Greiner from Germany, Prof. Lucas Glinka from Russia and several others from Hyderabad Universities participated in these lectures.

The Physics Meet 2009 ended with a Panel Discussion "How to Revive Interest in Science" which was participated by more than a hundred faculty members, students and researchers, who expressed interesting and exciting ideas. While the students stressed that teaching methodology and syllabi should be changed in such a manner that science should be more fun and experimental rather than just memorizing equations and derivations, the teachers lamented that they are burdened with such heavy syllabus that they are unable to concentrate on outdoor learning or interactive experiments.

We also give away the B.M. Birla Science Prize for outstanding contributions in Physics for young scientists less than 40 years of age for their work in India. Several Physicists have received this prestigious award and have attained very high recognition in India and abroad.

All these activities have contributed greatly to create an interest amongst students and inspire some to take up Physics as a serious career subject.

[*] www.birlasciencecentre.org

PC36 : Tuning of "in service" physics teacher training (IS-PTT) and School - University cooperation

E. Vitoratos,[*]
University of Patras, Greece

O. Caltun
Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Romania

ABSTRACT

School - University cooperation in designing and implementing activities needed for in-service Physics Teacher Training (IS - PTT), is a very sensitive topic. The aim is to offer new tools to the teachers in order for them to improve the interest of their students in Physics. Indeed, successful "in service training" leads to continuing professional development and support, enhancing teachers' motivation as well as strengthening their self confidence in teaching Science. Questionnaire and interviews were used in order to obtain a precursor text useful for further investigation of the issue. Although in almost every European Country there is some kind of IS - PTT, there is a great heterogeneity in its structure! An effort is done towards the identification of the parameters of this procedure: the organizers, the duration, the form, the frequency, the structure-content, the designers of the content, the assessment, the documents of recognition, the accreditation. From the discussion emerged the need of a "tuning" of "in-service" Teacher Training in European level. Benchmarks for IS-PTT programs could be reached via HOPE network. Key point to this direction is the definition of a "unit or cycle of in service teacher training (C-ISTT)" and its parameters. For the effectiveness of this process the cooperation between University, School Administration and Education officers is beyond any doubt

[*] vitorato@physics.upatras.gr

PC37 : New skills for Physics teacher? They can contribute to increasing youth interest in physics and technology?

O. Caltun[*]
Faculty of Physics, Alexandru Ioan Cuza University of Iasi, Romania

ABSTRACT

Teacher training policies are at European level an open issue. Many initiatives and changes in the teachers training program is implemented whose purpose is to improve the quality of education systems and of initial and continuous teachers training. All of these take in consideration new competences or new level of the competences and skills that teachers must demonstrate in the clasroom or in their professional evolution. Teachers need support to assimilate new teaching, learning and assessment strategies through their own experience and practice or through best practices and models demonstrated by trainers and mentors. It is considered that in the year of 2025 the initial teacher training must change radically, so that European teachers be able to get a vision of education anticipating the future (forward looking). Organizational change, designing new forms of curriculum development for physics teacher education in initial and continuous training networks are necessary. All of these must be based on the broad shared picture of the new competences of future teachers. The paper discuss the generic and transferable competences of next decade future teachers. Special attention is given to skills related to the knowledge of the subjects continued renewed: chapter in modern physics, physics and evolution of information and communication technologies, nanotechnologies, macrocosmos and astrophysics. In terms of transversal competences are discussed ability to communicate science at different levels, long life learning skills, managing social and cultural projects skills, team working skill, promoter of students entrepreneurship and job literacy, etc. Some considerations will be made about how Physics initial teacher training programs could be designed and implemented in order to cope with major provocation and changes.

[*] caltun@uaic.ro

PC38 : Experimental activities in physics teaching: joined work with teachers

R. Lazauskaite[*] *, R. Zaltauskas*
Lithuanian University of Educational Sciences, Lithuania

ABSTRACT

In inquiry-based science education the experimental activities in school could be in different levels: confirmation inquiry, structured inquiry, guided inquiry and open inquiry. We developed 34 primarily confirmation and structured inquiries (traditional physics labs). In addition, twelve more complex interdisciplinary labs, which integrate knowledge in physics, chemistry, and biology, are created. The examples of such labs are presented, e.g. spectroscopic determination of chlorophyll in the plant extracts, investigation of transpiration, investigation of electrical conductivity of the soil. In our laboratory of didactics we trained about 80 physics teachers. The labs were tested and developed further together with teachers. The final labs recommendations are presented in the book for teachers.

[*] romualda.lazauskaite@leu.lt

PC39 : Embedding Enterprise in a Physics Curriculum

S.L. Pugh
University of Leeds, UK

M. Grove[*]
University of Birmingham, UK

ABSTRACT

The School of Physics and Astronomy engaged with industry on a series of 'live' projects, working with groups of level 3 students, to create a "Group Industrial Project" module that built upon existing practice. The School worked with a number of companies to develop realistic and feasible project briefs that students undertook as a project for the whole of the academic year. There was an excellent level of dialogue between the students and the company in each case, including site visits and presenting the work to company representatives (often at a senior level). This module gave students ownership of a project; the opportunity to become the experts over the course of the year, and work in a pseudo-business environment. They gained an appreciation of the commercial pressures that companies face, and how this must be considered alongside the scientific research.

The module introduces students to enterprise and business skills in a wholly authentic way that contains the discipline at the heart of any activities so that student develop both disciplinary awareness and enterprise skills; such an approach has been critical to achieving the engagement we have from both students and academic members of staff. Significantly, the development of these interventions has not been undertaken by staff alone; a key feature in their development has been the role of Industrial Advisory Board, which was established in parallel based upon a successful model elsewhere. The Industrial Advisory Boards consist of representatives from business and industry, with strong links to the University, who can advise upon and contribute to curriculum developments and enhancements Each of the module implemented in the School of Physics and Astronomy has been underpinned by the School's Industrial Advisory Boards, which provide a strong commercial input to the module and a constant supply of fresh ideas (http://journals.heacademy.ac.uk/doi/abs/10.11120/ndir.2014.00026).

[*] M.J.Grove@bham.ac.uk

PCXX : Inspiring Young People to Study Physics - two successful projects for high school students

Z. Drozd,[*]
Department of Physics Education, Faculty of Mathematics and Physics,
Charles University in Prague, Czech Republic

ABSTRACT

The Department of Physics Education, Faculty of Mathematics and Physics, Charles University in Prague, offers a lot of activities designed to promote physics to students of different types of schools. The poster introduces two successful projects - Experiments for high school students and Interactive physics laboratory. The activities mentioned are developed and tested at the Department of Physics Education using immediate and long term feedback reflecting the needs of teachers and students. Both projects are focused on physics experiments. First of them has a form of science show, the second one offers high school teachers and students complex experiments with various aids and devices even from advanced parts of physics, that are unavailable to ordinary high schools' laboratories.

[*] zdenek.drozd@mff.cuni.cz

PCii : MOOCs (Massive Open On-line Courses) at Sapienza University, Roma: a new teaching tool to transfer the main ideas of Relativity and Quantum Mechanics to an audience of 6'000 people

*C. Cosmelli,**
Sapienza Universit di Roma, Italy

ABSTRACT

MOOCs (Massive Open Online Courses) are open, distance learning courses, designed for a large number of students. MOOCs are realized on different platforms COURSERA started by Stanford University, EdX by Yale university - all sharing an ad hoc platform such as to receive up to 100 000 connections, to provide free and easy access to video, test, exams, and other sources of interactions among the students and the teachers. La Sapienza has been taking part in the MOOC challenge since 2013, offering the Course "The world view of Relativity and Quantum Mechanic" the first MOOC course offered in Italian - with Italian subititles; next year the course will be offered with subtitles also in English, Spanish and Chinese.

The course, at the level of high-school students, was attended by nearly 6 000 students, 53% not from Italy The course has been followed by different typology of students:

- from one 10 years old young person with severe learning difficulties to whom the course had been recommended as therapy, to full classes of high school students.
- high School teachers
- University students from non-scientific Faculties (Philosophy)
- Former university students
- Professionals of others disciplines scientific or not (Engineering, Informatics, Medicine, Psychology, Music).

Among the 6 000 students beginning the course we had 40% students ending the course. It is a very high value compared with the average of 10% for such a type of teaching. We had strong interactions with the students, with more than 850 e-mails exchanged between the teacher and the students, a blog created by the students, a list of alternative tests to deepen the knowledge or just to clarify some points. This turned the course from simple knowledge containers and providers into real collaborative learning environments. The experiment will continue offering courses to help the "bridge" from high school to university, for the technical faculty, offering "Precalculus" free courses.

* carlo.cosmelli@roma1.infn.it

PCiii : Enrolling students in physics in Lithuanian universities - success and failure

G. Dikcius[*] *,V. Karenauskaite*
Vilnius university, Lithuania

ABSTRACT

In Lithuania, two decades ago, student enrollment in physics shrank drastically, partially due to changes in national political and economic domains. Many research and high technology institutions - the main consumers of university physics graduates - downsized or disappeared. Additional wrong decission was made by higher education authorities transferring physics teacher-training programs from physical sciences to educational sciences, with consequent major reduction in financing. In addition, low teacher salaries confer little prestige on the profession. As a result, in the last two years not one student enrolled in physics teaching programs in all Lithuanian universities.

Vilnius university, the principal school of physics in Lithuania, took effective measures to restore the popularity of physics:

- Introducing new programs, including nonconventional, corresponding to the modern economic situation.
- Increasing international student mobility - via EMSPS, TEMPUS, ERASMUS, thus improving student motivation.
- Cooperating with secondary schools to bring young people to choose physics studies - as it is interesting, has good possibilities, no unemployment, and excellent possibilities to study abroad.
- Organising activities to connect young people with the academic community: Children's University (lectures, experiments and visits to research laboratories) on themes interesting for everyday life; mobile laboratory school visits to promote science research as a profession, provide information about the latest scientific topics, present research methodologies, help students develop scientific ideas; partnership agreements with gymnasiums, reciprocal visits, extramural training of pupils in problem-solving; summer camps combining physics, sport and relaxation.

Since 2000, student enrollment in the Physics Faculty has tripled, and is stable; competition to enter physics programs has also been restored.

[*] Gintaras.dikcius@ff.vu.lt

PCiv : SECURE project results - inspiring the young to study MST

B. Rovsek,[*]
Faculty of Education, University of Ljubljana, Slovenia

D. Sokolowska
Institute of Physics, Jagiellonian University, Krakow, Poland

W. Peeters
Dienst Katholiek Onderwijs vzw, Antwerpen, Belgium

J. de Meyere
Limburg Catholic University College, Hasselt, Belgium

ABSTRACT

Some results of FP7 project SECURE will be presented in view of the HOPE network meeting motto 'inspiring the young to study physics'. The focus of the SECURE project was on the MST (mathematics, science, and technology) curriculum for learners of ages up to 15. Different curriculum representations were studied, formal (written in official documents), implemented (by teachers) and perceived (by learners). The question, which was behind the research conducted by the project consortium of 11 partners from 10 EU countries was, what can be done to preserve the interest and motivation of learners for studying MST.

For example, teachers declaratively agree about the motivation, being itself an important goal of the MST subject, and also about the activities, which should be always interesting for their pupils, but according to their saying they do not do enough to accomplish these goals in practice. Significant discrepancy was also found between the answers of teachers and learners about the frequencies of various activities (teachers report they do far more often than learners report). We have detected some significant differences across MST subjects. Activities are the most important support of learners' interests for MST subjects for younger learners, for chemistry and for physics; topics are more important support of motivation for biology and geography. 80% of S/T teachers and 75% of mathematics teachers find their pupils interested in M/S/T, whereas only 59% of physics teachers share that opinion, and only 43% agree it is also easy to motivate their pupils for physics. Across the ages the motivation, according to teachers, decrease, but it seems it decreases more for mathematics (from 89% for 5 yo to 63% for 13 yo) than for S/T (from 84% for 5 yo to 73% for 13 yo). According to learners' responses a decrease of motivation for MST around the age of 10 was detected. It coincides with a decrease of reported activities (for example, going for lessons outside the school).

[*] Barbara.Rovsek@pef.uni-lj.si

PCv : Physics enrollment/ popularization at university of Zagreb

D. Androic[*] *, M. Furic*
Physics Department, Faculty of Sciences, University of Zagreb, Croatia

ABSTRACT

Physics Department at University of Zagreb has a half century long experience on the enrollment issues. We shall quickly expose the early problems and methods and then we shall sketch the current situation. After the WW2 studying physics has gained the popularity and information was spread by word of mouth. Soon the Department started promoting itself through Lectures addressing the high school students, advertised widely and delivered by prominent professors. Later, this was complemented with NASA movies on their space program. The enrollment became steady.

Recently, various methods are in use. We started to add spectacular public shows to the effort. One of such examples is the historical vacuum demonstration with horses pulling apart the metal sphere at the large Zagreb square. Another case is the Physics Express. Department volunteers travel across Croatia with minibus. They carry suitable experimental equipment showing unexpected event outcomes. Examples include LN2 effects, helium influence upon the inhaling throat etc. At the University yearly show of possible professions our students and assistants, at the guidance of the professor, display the advantages of our profession and a large spectrum of activities available to the physics graduates. This year, during the Day of Physics, 1000 visitors came to pass through our laboratories and Auditorium of the Physics Department learning on the entire spectrum of our activities and projects. The accompanying material is at http://www.phy.hr/video/.

The Department is also actively pursuing Physics Summer schools, participation in Physics Olympics and International Physics competitions. We have addressed many challenges and used different methods. We shall present documents and videos demonstrating the above activities and the conclusions to which one can arrive

[*] dandroic@phy.hr

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