HOPE annual forum 2015
Physics Studies in an Entrepreneurial and Innovative Global Perspective

Programme and Abstracts

Coimbra, Portugal, September 9 - 12, 2015,

Scope of HOPE project

The overall aim of the 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 euro, 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) organisations, 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 1996 with EUPEN (European Physics Education Network, 1996-2003) and its successors STEPS (Stake Holders Tune European Physics Studies, 2005-2008) and STEPS TWO (2008-2011). 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. The second annual forum organized in Coimbra, Portugal, focus on activities on "New competences for physics graduates fostering innovation and entrepreneurship - WG2" and on the "Improvements in physics teaching meeting future global challenges in physics higher education - WG3".

"WG2 - New competences for physics graduates fostering innovation and entrepreneurship"

The working group 2 activities focus on ways by which physics degrees can be enhanced so that the competences of graduates enable them better to contribute more effectively to new needs of the European economy and society, particularly through innovation and entrepreneurship.
This involves objectives on the analysis and sharing of examples of good practice already underway or planned by partners including

- the application of new physics knowledge and technology transfer to the market economy
- integration of physics studies with the world of work and (c) a better appreciation of how basic physics knowledge underlies and contributes to technological developments
- re-examination of existing physics competences (e.g. those from the EU's Tuning project and EUPEN) to take account of innovative teaching methods and new demands placed on physics graduates, and a reassessment of recently introduced unconventional physics-based degrees

"WG3 - Improvements in physics teaching meeting future global challenges in physics higher education"

The working group 2 activities focus on the improvement of the effectiveness and attractiveness of physics teaching in Europe's university physics departments to help ensure their competitiveness in the global student.
This is pursued through actions including

- a survey of third country students in physics departments and strategies to attract them,
- a study of the impact of ERASMUS MUNDUS programmes in physics
- an investigation into the use of innovative methods in physics teaching in a global context
- a study of the application of the results of research into physics education, and weaknesses in current methodologies

Wednesday 9th September

Hotel Tryp - Coimbra - (Alameda Dr. Armando Gonçalves 20, PT-3000 059 Coimbra)

15h00 Registration

17h00 Welcome to University of Coimbra by Prof. João Gabriel Silva, Chancellor of University of Coimbra
Structure of the Second Annual Forum
Ivan Ruddock, University of Strathclyde, UK and Isabel Lopes, University of Coimbra, Portugal
Progress of the HOPE project
Nadine Witkowski, Pierre and Marie Curie University, France

17h30 ***Guest Speaker***
Paulo Pereira da Silva, CEO, Renova, Portugal
Confessions of a physicist in the real World

18h30 End of day

19h30 Reception and buffet at Hotel Tryp

Thursday 10th September

Department of Physics, Anfiteatro Veiga Simão Polo/Campus I, Rua Larga, PT-3004 516 Coimbra.

Session 1: Graduate competences and Entrepreneurship : WG2 activities

Chair: Ivan Ruddock, University of Strathclyde, UK

9h00 **Report from Working Group 2**
Hay Geurts, Radboud University, The Netherlands
General overview WG 2
Vetle Nilsen, CERN, Switzerland
On the employers/alumni review

Isabel Lopes, Coimbra University, Portugal
On the departemental review

10h00 Coffee Break, Main Hall, ground floor

Session 2: Physics Studies in an Entrepreneurial Perspective

Chair: Jan Naudts, University of Antwerp, Belgium

10h30 ***Guest Speaker***
Jim Allen, Research Centre for Education and Labour Market, University of Maastricht, The Netherlands
Skills for the Future: Challenges for Higher Education

11h30 **Vetle Nilsen**, CERN, Switzerland
CERN Entrepreneurship Meet-up

11h45 **Urbaan Titulaer**, Johannes Kepler University, Austria
Furthering Entrepreneurship at the Johannes Kepler University

12h15 Lunch, Main Hall, first floor

14h00 **Royce Florian**, Pierre and Marie Curie University, France
Fab labs as academic tools

14h15 **Round table 1 : Where should students acquire professional and bf entrepreneurial skills - at university or in employment?**
Participants : Jim Allen, Research Centre for Education and Labour Market, University of Maastricht, The Netherlands
W. Gareth Jones, Imperial College London, UK
Hendrik Ferdinande, Ghent University, Belgium
Anca Jensen, Novo Nordisk, Denmark
José Basílio, CEO of "Intelligent Sensing Everywhere" and Professor of "Technological Entrepreneurship and Innovation", University of Coimbra, Portugal
José Paixão, Director of the Master Program in Physics, University of Coimbra, Portugal

Session 3: Poster Session 1 and Discussion

15h15 **Poster Session** and Coffee Break (16h00) Main Hall, ground floor

17h00 End of day's programme

17h-18h Time available informal discussions for HOPE activities
WG1 discussion (room D.7 first floor)
WG2 discussion (room D.8 first floor)
or visit to University of Coimbra's museum

19h00 Dinner - Clube de Memórias, Rua Alexandre Herculano 37, PT-3000 019 Coimbra

Friday 11th September

Department of Physics, Anfiteatro Veiga Simão Polo/Campus I, Rua Larga, PT-3004 516 Coimbra.

Session 4: Global Challenges : WG3 activities

Chair Evangelos Vitoratos, University of Patras, Greece

9h00 **Report from Working Group 3 of HOPE**
Eamonn Cunningham, Dublin City University, Ireland and Fernando Cornet University of Granada, Spain
Discussion on results, coordination and priorities for future work

10h00 Coffee Break, Main Hall, ground floor

Session 5: Physics Studies in a Global Perspective

Chair: Leopold Mathelitsch, Karl-Franzens-University Graz, Austria

10h30 ***Guest Speaker***
Dorothy Kelly, University of Granada, Spain
Internationalization: why is it a good thing ?

11h30 **Nathalie Lebrun**, University of Lille, France
Use of Physics Education Research (PER) tools in teaching and university professors' receptivity to PER in classical mechanics

11h45 **Hendrik Ferdinande**, Ghent University, Belgium
Improvements in European tertiary physics teaching in a global context - preliminary analysis and review

12h15 Lunch, Main Hall, first floor

14h00 **Sonia Gomez Puente**, Technical University Eindhoven, The Netherlands
Experiences with studio classroom and the integration of active and blended-learning methods to teach physics

14h15 **Round table 2 : Innovative teaching methods**
Participant : Fernando Cornet, University of Granada, Spain
Marion Birch, University of Manchester, UK
Tangui Aladjidi, University Pierre and Marie Curie, France
Sune Pettersson, Umeå University, Sweden
Agneta Balint, West University of Timisoara, Romania
Alessandro Zappia, University of Naples Federico II, Italy

Session 6: Poster Session 2 and Discussion

15h00 Poster Flash presentations WG3 activities

16h00 **Poster Session** + Coffee Break, Main Hall, ground floor

17h00 End of day's programme

17h-18h Time available informal discussions for HOPE activities
WG3 discussion (room D.7 first floor)
WG4 discussion (room D.8 first floor)
or visit to University of Coimbra's museum

19h00 Conference dinner : Hotel Quinta das lágrimas, Rua António Augusto Gonçalves, PT-3041 901 Coimbra

Saturday 12th September

Department of Physics, Anfiteatro Veiga Simão Polo/Campus I, Rua Larga, PT-3004 516 Coimbra.

Session 7: Reports on activities of WG1 and WG4

Chair Marisa Michelini, University of Udine, Italy

9h00 **Update report from Working Group 1 of HOPE**
Marek Trippenbach, University of Warsaw, Poland

10h00 **Update report from Working Group 4 of HOPE**
Leopold Mathelitsch, Karl-Franzens-University Graz, Austria

10h30 Coffee Break, Main Hall, ground floor

Session 8: Final Reflections

11h00 **Conclusions, Summary and Thanks**
Nadine Witkowski, University Pierre and Marie Curie, France

11h30 **End of the Forum**

12h00 Lunch, Main Hall, first floor

14h00 Optional excursion (details during the conference)

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List of abstracts

Guest speakers

Oral contributions WG2

Oral contributions WG3

Poster contributions - New Competences for Physics Graduate

Poster contributions - Improvements in physics teaching

In service training for lecturers in novel teaching methods

Innovation in teaching methods (global aspects)

Integration of innovation

Poster contributions - Inspiring young people to study physics

Poster contributions - Improvements in the training and supply of physics school teachers

GS1 Confessions of a physicist in the real World

P. Pereira da Silva[*]
CEO, Renova, Portugal

ABSTRACT

Paulo Miguel Pereira da Silva was born in Lisbon, Portugal. He was admitted to the cole Polytchnique Fdrale de Lausanne in 1978, where he graduated in Physics Engineering. During his University years he used some of his free time travelling through Europe, acquiring social and cultural skills that came to motivate his interests in the Arts and Humanities.
Mr. Pereira da Silva began his professional path in 1984, having initially developed a career in industrial operations management at Renova. At that time the company was making considerable investments in order to modernize its productive technologies and operations.
He was later appointed as Production Director, the highest industrial management ranking position at Renova SA. In 1991 he joined Renovas Board of Administration, having been ever since a strong advocate and main precursor of a responsible environmental company policy. During the nineties Renova also initiated its commercial operations in Spain.
Mr. Pereira da Silva was appointed President of the Board and General Manager of the Renova Group of companies in 1995, having had a decisive and profound effect on the company strategy, marketing and commercial guidance.
Having set the clear goal for Renova to become a strong brand, he is also responsible for the expansion of commercial operations into France, Luxembourg and Belgium, as well as for a major gradual transformation of Renovas corporate and products image, and for the current strong innovative reputation the company holds in the marketplaces, national and international.
During his career he has been honored with several awards as: Awarded the Grande Oficial da Ordem do Mrito Industrial, by the President of the Portuguese Republic (2006), Awarded the Merit Medal by the Economical County City Hall tribute for international development (2006) and Several professional awards in Portugal and Spain.

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GS2 Skills for the Future: Challenges for Higher Education

J. Allen[*]
University of Maastricht, The Netherland

ABSTRACT

Much is already known about the European labour market for HE graduates from the graduates' point of view from studies such as REFLEX and HEGESCO. Although these studies provide an indirect view of the employers' perspective that is quite rich and detailed, this view is strongly filtered through the viewfinder of the graduate, and may in some respects be biased or incomplete. There is a need for incorporating the perspective of employers into the picture, because it is the preferences of these employers for attributes of graduates that most directly shapes the labour market prospects of the highly qualified youth. However, what little research has been done that directly incorporates the employer's perspective is usually rather general in scope, and fails to discriminate between attributes of graduates that are regarded as merely desirable most employers will indicate that they would prefer to recruit graduates who are the best in every respect and attributes that are crucially important, or even indispensable. In order to obtain data in which such a distinction is made, a conjoint study was conducted among some 900 employers of HE graduates in 9 European countries. In this survey we simulated a selection process using vignettes with hypothetical job candidates, all HE graduates. The simulated selection process consisted of two steps, the first comprising the initial sifting of candidates to be interviewed based on educational qualifications, relevant work experience, etc. and the second comprising the final selection based on a "report on the applicants' skills" from an assessment centre. Using data from this study, we are able to not only provide an overview of the skills and other attributes employers are seeking in higher education graduates, but we are also able to dispense with a number of stubborn misconceptions, such as: "It does not matter what you study, it is the degree that counts"; "Employers always prefer the highest degree; This leads to a rat-race and diploma-inflation" and "The world is changing fast; We therefore need generalists instead of specialists".

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GS3 Internationalization: why is it a good thing

*D. Kelly**
University of Granada, Spain

ABSTRACT

Internationalization has become a buzzword on the European higher education scene: it is practically impossible to find a university mission statement which does not express commitment to it or a desire to improve performance. But what do we mean by internationalization? Why is it a good thing? What are students, staff, institutions and their societies to gain from policies directed to becoming more international? Does it have a downside? This address will offer reflections on these and other related questions, looking at different models of internationalization, some current trends in Europe and worldwide, and taking the stance that, on the whole, internationalization has a positive impact on higher education institutions, although unthinking international policies are not without their risks. It will further attempt to examine impact on STEM disciplines in particular.

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OC1 CERN Entrepreneurship Meet-up

V. Nilsen[*]
CERN

ABSTRACT

Starting in March 2015 the Knowledge Transfer group at CERN has been arranging a very low threshold entrepreneurship meet-up for staff, students and users at CERN. These informal meetings have an overarching topic, sometimes introduced by external guest speakers, other times by CERN people with extensive knowledge on a specific subject. These low threshold meetings have in a short time attracted quite a few people with the final session of the year attracting 60 people to watch members of the meet-up present their business ideas. In addition the meet-up has a mailing list now counting around 120 people. The most interesting thing about the meet-up is the relative low effort compared to the high interested and potential output. In my presentation I will explain how the meet-up came to be, how we managed to make them as success and the output we expect them to have in the coming years.

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OC2 Furthering Entrepreneurship at the Johannes Kepler University

*U.M. Titulaer**
Institute for Theoretical Physics, Johannes Kepler University, Linz, Austria

ABSTRACT

Furthering entrepreneurship is a strategic goal of the Johannes Kepler University. A central role is played by the Institute for Entrepreneurship and Organizational Development, founded in 2000 as an endowed chair and converted 2003 into a regular university institute. The Institute is active in teaching and research as well in supporting students, alumni and employees intending to found their own company. The teaching programme contains six 3 CP courses, workshops and seminars designed especially for or open to students from science and engineering; the courses on Entrepreneurial knowledge for students from Science and Engineering and Business development in the technological sector from innovation to marketability figure many guest lecturers, such as present and former start-up entrepreneurs, coaches from incubators and specialists in relevant areas of law and finance. In the Innovation Lab students evaluate business models and work on specific problems of real enterprises; Biz Kick, under the slogan Being an entrepreneur for one semester has students find a business idea, write a business plan and put it into practice up to generating the first revenues. Extra-curricular activities comprise a Start-Up Centre, where participants (at present about 65 in all) receive individual coaching in writing business plans and in the early start-up phase, Entrepreneurs Dialogue (entrepreneurs reporting to students on their start-up activities, as well as a Founders caf and a Founders Fair, two networking events in which (potential) entrepreneurs come into contact with other entrepreneurs and start-up consultants, or can visit information desks by consultants and institutions (Chamber of Commerce, banks, etc.; about 20 exhibitors in all), respectively. About 250 students visit each of these activities. Promising business plans in the high-tech sector can be supported, both by coaching and financially, by the incubator tech2b, established by the State of Upper Austria and the local Chamber of Commerce. The University further supports entrepreneurship by providing leaves of absence or temporary part-time employment to employees in the post-doc phase wishing to start their own company, and by a generous policy on the use of patents. In 1989 it founded the Software Park Hagenberg in a suburb of Linz, containing both university institutes, a University of Applied Sciednce and room for (start-up) companies in the IT sector, including a number of companies founded or co-founded by physicists. The University also offers a Master Programme Business and Law for Scientists and Engineers for students and recent graduates intending to go into industry. Many of the above activities are carries out in co-operation with other local post-secondary educational institutes, such as the University for Art and Design and Universities of applied Science, as well as the State of Upper Austria and the local Chamber of Commerce and Industry.

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OC3 Fab labs as academic tools

R. Florian[*]
University Pierre and Marie Curie, France

ABSTRACT

Fab Labs are a place where students assemble with other students and professors to learn. A Fab Lab is a technical prototyping platform for innovation and invention, providing stimulus for local entrepreneurship. Students visit the lab and ”do”; they take ideas from the depth of their imaginations to create real world ”things”. Fab labs respond to a growing crisis of diminishing research positions and growing student enrollment. Fab labs are rooted in the concept of idea-sharing and multidisiplined projects. The lab is an open-platform, where all ideas are shared and layed out on the table for all to see, and for all to participate. Fab labs are equipt with numerically controlled machines and a suite of electronic, chemical, and biological equiptment. The first year expenses are estimated to be $350,00 and 200,000$ every year thereafter. Students are provided with an environment where they can apply what they know and confronted ideas they never knew existed. In the two years of our existence we have intergrated into three course structures and involved 500 students in various projects. This type of ”learn by doing” attitude teaches students not just the sciences, but how to: manage a project, research and troubleshoot, and to work in teams. The Cp-CNU reported that between 2009-2013 the amount of ”research postions” dropped by 26% and that the number of professors retiring between now and 2016 will drop 30%. This situation is made worse if we consider the amount of students entering the univerisity system is actually increaseing. The Fab lab offers a platform for companies to propose projects to students in the university. Many American universities use Fab labs to attract enterpises into funding projects and offering interships. The companies benefit from reduced overhead costs and tax incentives by employing student interns, all while tapping into a source of future scientists. Students benefit from real experience with jobs that will form the foundations of their careers. Due to growing interest in ”captial venture” tax structures, we are seeing large companies create foundations that invest into start-ups for the sake of market stimulation. These foundations, which claim over 51 billion dollars, are tapped into more readily if student entrepeneurs have a platform from where an idea can be launched. The Fab lab can increase the amount of work and participate in closing the gap in the growing number of students and shrinking job market. The Fab lab can benefit students by giving them an enviroment to create. With unfavorable trends in the current professional and academic fields it is obvious that new strategies must be developed. Creativity and innovation are the seeds of growth that should be planted in the minds of students. Universities benefit by increasing innovation on campus and creating adept students. Fab Labs are the perfect platform to do this with.

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OC4 Use of Physics Education Research (PER) tools in teaching and university professors' receptivity to PER in classical mechanics

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ABSTRACT

Students develop logical ideas, called misconceptions, which differ from scientific reasoning [1] and can inhibit the learning and teaching process. Some of them are robust and can persist after instructions [2]. Many Physics Education Researchers identified and analysed students' difficulties on understanding physics concepts [3] which led to the design of assessment tools to monitor conceptual understanding, i.e. Multiple Choice Tests (MCT) [4,5] with written distractors based upon students' misconceptions gained from interviews. We report results about misconceptions of first year university's students using the Force and Motion Conceptual Evaluation (FMCE) test [5]. This test is composed of questions grouped into clusters including several situations which probe the concept of force. For example, we highlight misconceptions about the Newton's third law: the more active / energetic (or bigger / heavier) object exerts more force or 'mass (action) dependence' mental model [6]. Gain between pre and post-tests is significant showing the validity of using analogies [7] between the FMCE Newton's third law cluster and anchoring examples. This cluster has been also presented to University's professors of two universities (4 in Lille and 5 in Paris). We precisely analyse their behaviour regarding these misconceptions. We also collect their opinion and understanding about FMCE. We highlight some barriers and the possible changes in teaching practice. These results will allow us to relate supplying in-service university teachers' training sessions plan in the context of professional development in physics' higher education [8]. [1] Hammer, D. (1996) "More than misconceptions: Multiple perspectives on student knowledge and reasoning, and an appropriate role for education research", American Journal of Physics, 64, 1316-1325 [2] Viennot, L. (2001) Reasoning in Physics: the part of common sense. Dordrecht: Kluwer Ac. Pub., Trad. A. Moisy. [3] McDermott, L.C., Redish, E.F. (1999), Resource letter: PER-1: Physics education research, American Journal of Physics, 67(9), 755-767 [4] Hestenes, D., Wells, M., Swackhamer, G. (1992) "Force Concept Inventory", Physics Teacher. 30, 141-158 [5] Thornton, R.K., Sokoloff, D.R. (1998) "Assessing student learning of Newton?s laws: The Force and Motion Conceptual Evaluation and the evaluation of active learning laboratory and lecture curricula", American Journal of Physics, 66(4), 338- 352 [6] Smith, T.I., Wittmann, M.C. (2008) "Applying a ressource framework to analysis of the Force and Motion Conceptual Evaluation", Physical Review Special Topics - Physics Education Research, 4, 020101 [7] Clement, J. (1993) "Using bridging analogies and anchoring institutions to deal with students' preconceptions in physics", Journal of Research in Science Teaching, 30(10), 1241-1257 [8] Endrizzi, L. (2011) "Learning how to Teach in Higher Education: a Matter of Excellence", Dossier d'actualit veille et analyses, 64, 1-24

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OC5 Improvements in European tertiary physics teaching in a global context - preliminary analysis and review

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ABSTRACT

The recent development of modernisation in European Higher Education (HE) has been observed, followed and checked during the last couple of years. The collection of the experiences obtained by attending several European, national and local conferences/ workshops/ meetings will be reviewed and analysed. These concern the improvement in European (physics) teaching ranging from the formal European level, through European projects, to the national, regional, university, faculty/ departmental levels down to the course level. Also the internationalisation of HE from the start of the ERASMUS programme, presently in the ERASMUS MUNDUS context and in the recently suggested future development will be treated. Possible conclusions and/or recommendations (eventually in a SWOT analysis procedure) will be suggested.

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OC6 Experiences with studio classroom and the integration of active and blended- learning methods to teach physics

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ABSTRACT

Research into the effects of active learning approaches in teaching physics has revealed that combining instruction and providing feedback support students' understanding of concepts and increases active involvement in classroom practices. Grounded in these facts, the increased interest in improving students' gains and engagement has led to use a variety of active learning methods in lectures and instructions in physics courses at Eindhoven University of Technology. In addition, the need to address students' individual needs regarding learning styles and prior knowledge, requires a different type of 'blended' education specially when it comes to large-size groups.
Interesting examples of the integration of active learning methods in physics courses in our university are Applied Natural Sciences (ANS) and Quantum physics (QP), among other courses. The combination of active learning and blended-learning methods (to enhance face-to-face education supported by ICT tools) has been used in the ANS, a freshman course, to improve students' understanding of physics concepts on mechanics, flow, waves, energy and momentum, heat transfer and collisions. These active learning methods include live demonstrations, Peer Instruction (PI) (that enhances students to discuss about concept questions and think and interact with their peers to come up to a solution), together with more technology-advanced tools such as Audience Response Systems (ARS), the so-called clickers, and weblectures or pencasts.
In the second-year QP course, however, an interactive learning environment studio classroom (an integrated instructional form of combined bocks of lectures, tutorials and self-study) was design to teach the Schrdinger equation and wave functions, the exploration of a number of time-independent one-dimensional potentials and introductory three-dimensional quantum mechanics, especially focusing on the H atom and the role of angular momentum. Apart from learning these quantum concepts, the application of acquired knowledge in solving problems using mathematical tools is an essential element in this course. Key in this altered model is that students acquire new QP concepts that they can immediately apply to concrete problems and calculations within the same course block. This is in contrast with the traditional approach, where concepts (lectures) and calculations (tutorials) were separated. Studio classroom lectures are to encourage students to apply the content not only during the lecture time but also to enhance the self-study time. Individual formative feedback by multiple-choice clicker questions was introduced as a rapid assessment tool to provide an overview on progress and identify gaps by means of questioning students at three levels: conceptual; prior knowledge; homework exercises. The method of using clickers was meant to identify gaps regarding misconceptions but it was also used as a feedback instrument for the teacher to get acquainted with the students' learning process. Results of these 'good practices' along the years of integrating active learning methods show promising students' gains and engagement

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P1 Transversal competences through complementary courses - a tool to broaden students' horizon

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ABSTRACT

West University of Timisoara (WUT), true to its principles and its mission, wanting its graduates to be not only specialists in a field of study, but rather intellectuals with a broad academic horizon, to meet the challenges of a dynamic society, offers its students the opportunity of achieving transversal competences by choosing from a very broad package of complementary disciplines. As the result of the University policy, all our University students have to take three complementary courses offered by other faculties of West University of Timisoara, one per semester, in semesters 3, 4 and 5. This approach was introduced in order to enlarge the students horizons and to increase their employability. The initiative was well received both by staff and students. Our Physics Faculty offered the students of the other faculties of WUT the following courses: The evolution and development of sciences; Recycling of materials and waste management; The history of the universe and cosmology; Physics for everyone; Planet Earth-a complex physical system. One preliminary conclusion that we can draw, after the first year of this action, is that the students of the Physics Faculty have considered as useful for their future career courses in the fields of Law, Economics, Management, First Aid, Politics, History, Web design, Art and Religion, etc. Each course was credited with 2 ECTS.

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P2 Developing entrepreneurship skills - a way how to increase the competitiveness of physics bachelors in the labour market

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ABSTRACT

University of Latvia is almost a typical example of physics bachelor study program in a small country. This is the only serious physics study program in Latvia. At present moment the local industry could only offer very limited choice of jobs in hi-tech sector. Students do not see specific job position in industry at the moment they are entering studies. Usually students are choosing ”academic path” of studies: bachelor master doctoral studies. What next? This ”next” will be in 8-10 years, so students usually do not worry right now about their position in labour market after finish of physics studies. Direct consequence of academic path as the main career choice is also relatively small number of students. Small number of students usually means less money for teaching staff and this could lead to reduced quality of studies. One of possible solutions is development of entrepreneurship skills thus changing the way how students think about their carriers and hopefully enabling easy way for them to enter labour market at the finish of every level (bachelor master doctoral) of physics studies.

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P3 Understanding quantum phenomena without solving Schroedinger equation : the case of the finite square well

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ABSTRACT

The main result of this paper is the expression of the energy levels of the bound states of a finite square well, in the Barker approximation, obtained with elementary methods. A suggestion of Garrett (1), concerning the approximate analogy between a finite square well, and an infinite, somewhat larger one, is put in a consistent form. It is used to obtain a recurent formula for approximate energy levels of the finite well, which gives an approximation obtained by Barker (2) and used, inter alia, to explain the experimental data related to the photoluminiscence of semiconductor quantum wells (3). The approach is elementary and can be used for teaching quantum physics to gifted students. The paper devoted to this subject will be published in European Journal of Physics (4).

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P4 Initiatives in teaching innovations at UPMC

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ABSTRACT

The faculty of physics at UPMC has decided to promote and support innovative teaching methods to a large scale in order to motivate students, to prevent student breakage, to develop soft skills.
The poster exposes the various initiatives proposes to the bachelor students. Among them the use of clickers has been the subject of a study published in a research journal. In order to prevent student breakage, the WIMS project has been implemented in several courses (math for physicists for instance). The system proposes a catalog of self-training exercises that can change each time the student connects and allows the validation of successive levels. Teamwork and multidisciplinary approach are in the heart of the concept of a new course called ARE (Activit de re recherch encadr). Two tutors from two different disciplinaries (physics/chemistry, physics/biology; physics/sport, physics/history) join to propose project based teaching to a team of 5-6 students. The example of physics and sport will be exposed. UPMC has also developed a FABLab that is extensively used by physics student that organizes special events such as “Game of drone” or “Robot competition” at the bachelor level. Problem based learning has been implemented at UPMC to a very large scale in a bachelor course of thermodynamics. The activity is proposed to more than 400 students and involves a team of about 20 professors. In order to implement the activity, training for professor has been proposed and a guideline for the evaluation has been developed.

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P5 Students and teaching assistants develop lab work and learn about physics education research

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ABSTRACT

We had noted that students in the teacher programme needed to learn about physics education during their physics studies. The lab assistants would also benefit from getting a pedagogical education focusing on their teaching tasks. We saw a possibility to meet these two needs and also combine with a third demand of the department namely to renew and improve the lab work that was used in the physics courses. We started a project that was supported by the Council for the renewal of higher education. The goals of the project were: - to develop a model for educating lab supervisors in cooperation with students - to introduce current research in physics education to lab supervisors and students - to investigate students experiences of lab work and what they want to learn from the lab work - to develop some new lab tasks and renew some old tasks and lab instructions. The project was well received by both students and lab assistants.

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P5bis "New skills" for graduates means "new skills" for teachers. Are the teachers trained ?

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ABSTRACT

New Competences for Physics Graduates, Fostering Innovation and Entrepreneurship that European and international documents anticipated as needs of society by 2020, is the attractive subject of WG 2 of HOPE network. Surveys between alumni and employers, interviews with a selected group of alumni and employers, survey for examples of good practices, could help the Physics Departments put a priority and rethink the curriculum in order to ensure the environment in which their students can build new skills. These skills should be related to interdisciplinary fields, solving of the problems the new century, entrepreneurial skills, project management, team work, and generally the business literacy. The above holds provided that we accept that the purpose of education is not only personal satisfaction from conquering of knowledge, but also the supply and usefulness to society. The question that arises here is: Is the Academic staff of Physics Departments ready to redesign entirely the courses so as to incorporate educational activities in order to help their students build the above mentioned skills through the activities done within the curricula, without abandoning the pure physics core of the lessons? The opinion of the authors of this paper is that it is not enough just the rethinking of the curriculum but also an appropriate training for the teaching staff is necessary, in order to respond to the new challenges that society launched. Otherwise, inertia of academic system will put a respectable distance between reality of work market and the possibilities for professional insertion of Physics graduate.

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P6 The Art of Teaching

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ABSTRACT

The purpose of the educational system and the meaning of the educational cycles varied throughout centuries and societies. From Plato's time to the nineteenth century there were many different motivations to incorporate certain knowledge into the scholar system. But from the Stone Age to the modern civilization there has existed only one really important reason why we develop educational methods and procedures: the human society influences the natural environment so profoundly that evolutionary cycles are too long for proper individual adaption. To ensure bare survival of biological specimen belonging to human community, an intervention of generational transfer through knowledge was implemented. Drawings from Lascaux caves can be very simply explained as remnants of educational process dating back to the Stone Age. Very often, mystical and religious facts from the far history of humanity can be simply explained as a generational knowledge transfer.

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P7 Fast track in physics

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ABSTRACT

Physics and Astronomy department in University of Turku have offered fast track studies for motivated and talented students. Program makes it possible complete studies in minimum of three years instead of regular five year curriculum. To achieve this objective, department has added fifth teaching period and also more attention is paid to personal study guiding for each student. First students to graduate for masters from fast track program are expected in year 2016.

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P8 University satellite as an attraction for students

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ABSTRACT

One of the challenges of the contemporary teaching is to give students a possibility to practically apply their knowledge while they continue university studies. A special challenge for physics studies is to increase attractiveness of this field for students having a wide choice of other fields that are generally considered to be simpler. Aerospace engineering is the area of knowledge that is, on one hand, is quite attractive for students and, on the other hand, is closely related to physics and other natural and technical sciences. Thus it may serve as a good start for those who would like to dedicate themselves to science and engineering. It also offers students a lot of opportunities to acquire practical skills during their studies. In autumn 2014, a student nanosatellite program was started in Tallinn University of Technology, Estonia (TUT). The main goals of the program are to create a space technology knowledge center in TUT and to offer students an opportunity to acquire practical skills under the guidance of academic supervisors. The Department of Physics was one of the initiators of the satellite program. This is an innovative way to increase attractiveness of physical studies, since student participants feel their important role in creation of a new engineering branch in Estonia. The satellite will be build following the CubeSat standards. Its principle payload is a camera for Earth imaging in RGB and IR at medium resolution. A number of additional on-board experiments are planned. Various University departments are responsible for subsystems of the satellite. The launch is planned for the year 2017 or later. The Department of Physics is responsible for the power subsystem, including photovoltaic elements, battery, and power management. Orbital planning tasks are also within the scope of the Department. Promotional campaign was organized within the Department to attract students, and a group of 5 students and 3 supervisors was formed (and more students are expected to join the project in the following years). The students have to accomplish the following tasks: 1) task planning; 2) participation in design works; 3) selection of off-the-shelf components; 4) correspondence with suppliers; 5) design presentations; etc. Students get additional credit points as a reward for their work. All works are performed in active collaboration with other TUT departments that are responsible for other subsystems. By September 2015, the project has passed the Preliminary Design Review stage.

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P9 Teaching physics starting from video-analysis of phenomena: the case of fluid dynamics

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ABSTRACT

One of the main problems in teaching physics at university level is that the methodological aspects related to the ways in which physics works are omitted in favour of a synthetic presentation of the main results of theoretical models. Student needs are often related to the discussion on how to apply theory, how physics methods and instruments work in context, what can be omitted and how the model of the phenomenon into the context considered can be build. Many learning difficulties are due to the lack of connection between everyday experience and physics models. Effective for student learning seems to be approaches based on personal involvement on them in the comparison of hypothesis and experimental data, in modelling process. To face this problem literature suggest in context studies. We implement this idea by means of video analysis of real phenomena as interactive lecture demonstration. Here we present those on the dynamic of fluids. The analysis of real fluids starts from the analysis of the water flow in real river as the Arno river in Toscana and the Tagliamento river in Friuli (two Italian regions). The video analysis of the motion of water motivate to apply the same technique to the study of the water flow in a rectangular duct. Assuming a laminar flow in the duct, a model is constructed to describe the motion of the different sheets of water. The model can be solved numerically or analytically, depending on students' ability.

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P10 Stimulating academic competitiveness as a tool to reach global competency

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ABSTRACT

Physics and its principles are not only global, but universal. The specialized language of Physics, Mathematics, is also common to the world physicists. To face globalization, the physicist, at the levels of teacher or engineer, needs no much more competencies than the generic and the field specific ones. Global challenges impose some new competencies (a multi-dimensional "global competency") to be acquired by physics students, aspiring to reach academic, managerial or leadership positions. In a finite and distributed unevenly resources World, global competency implies competitiveness, by which, people or groups wish and are able to compete successfully (competitive advantages) with others, ideally in a sustainable way, in a continuous competition with moving targets. University POLITEHNICA in Bucharest (UPB) organizes its activities, such as to ensure excellence and competitiveness for its alumni and its professors. Curricula are improved: f.e., the Faculty of Applied Sciences (FAS) has included in its "Engineering Physics" and in "Mathematics and Informatics Applied in Engineering" 4y BS curricula, the 2y common "Preparatory years" typical of the French Grandes Ecoles. The didactic and research laboratories are continuously developed. Placement and graduation work are ensured in high tech companies, in research institutes, soon in the Extreme Light Infrastructure Nuclear Physics EU facility. There are yearly sessions of research communications of students; on Inventics and Robotics. Simulated enterprises and real workshops for managerial and industrial practice, placement mobility (ERASMUS +) have their competitions (for entrepreneurship). Training in Mathematics and in Physics for high school potential candidates to admission are offered year round. The student recruitment to UPB is by competition, subject to 2 written 3 hour tests in Mathematics and in Physics or Chemistry or Economics. Some final stages of high school national and international competitions are held in UPB (f. e. MATHEXPERIENCE International Competition and Symposium). Academic fee waving, places in student hostels, mobility (ERASMUS +, . .) are offered by contest. Free training for professional competitions, engaging student trainers, includes weekly "Seminar for mathematical competitions" and an on line "Solved problems for Mathematics and Physics competitions". Mathematics "Tr. Lalescu" and Physics "I. Agarbiceanu" national contests, are attractive, leading to international prizes as well (f. e. at 9th South-East Europe Mathematical Olympiad for sophomore and freshmen SEEMOUS 2015, UPB got first team position). International programming contests (ACM, SIEMENS, MICROSOFT, IEEE) are popular, with good performances, women being well represented. UPB awards yearly IN TEMPORE OPORTUNO (¡35y) research Award. There are contests on: Parliamentary Debates; Sports; Miss Faculty and UPB. Exhibitions of art works of UPB students are traditional.

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P11 Introducing group discussions around context rich problems in the physics bachelor programme

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ABSTRACT

Some teachers at the Department of Physics at UmeåUniversity decided to introduce more student activity in the bachelor programme. We obtained support from the Council for the renewal of higher education and made a study visit to some universities in the USA. We decided to introduce group discussions around context rich problems in five of the first physics courses in the Bachelor programme. In context rich problems the task for the students is described as a short story in which the student is a part. The students work in group of three to solve the task during 1.5-2 hours with the teacher present as a consultant. At the end of the lecture the groups present their solutions to each other. Not all teachers thought this was a good idea so we had to exchange some teachers that had taught these courses previously. The students and the participating teachers appreciated this type of teaching very much. Now, several years after the introduction, the method is still used in only two of the five courses but it has been spread to teachers at secondary school and a small book with description of the method and a collection of problems has been written.

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P12 Can Elements of Nanotechnologies taught in high schools and universities to increase the interest of young people in STEM

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ABSTRACT

The development of nanotechnology (NT) in the last two decades has exceeded our most optimistic expectations. Thanks to the close collaboration between physicists, chemists, biologists and engineers NTs have vary greatly practical applications if we refer only to the production of energy-or medicine. At international level research in nanotechnology have well-defined directions and the investment are huge. (US - National Nanotechnology Program Initiative (NNI), EU Horizon 2020 Program). The ability to succeed in the field of NTs is determined by the skills of members of their societies in understanding, using and inventing NTs. This is why in the developed countries major efforts to attract scientists and engineers with outstanding performance in order to reach a critical mass of researchers in done in strategic fields. (Http://ec.europa.eu/research/fp7/pdf/fp-1984-2013_en.pdf). The lack of interest among young people to STEM can lead to a significant loss of Europe's research potential, which is manifested by delaying the emergence of the next generation of researchers, who bring new ideas and synergy, and by enticing excellent researchers who are at start their career to seek advancement elsewhere. In the US the National Center for Learning and Teaching in Nanoscale Science and Engineering (NCLT) was the first national center of learning and teaching nanoscale science and nanoengineering. NCLT mission is to develop the next generation of leaders in teaching and learning NSE (Nanoscale Science and Engineering), with emphasis on capacity building NSEE (Nanoscale Science and Engineering Education), providing a strong impact on national education in STEM. This program is designed to train a workforce knowledgeable of nano science and technology that can solve global problems by implementing a three-pronged strategy: publication of STEM training modules integrated with nano-based applications, training through workshops, courses and seminars and developing a network of nano-sectoral education. The center NCLT dynamic warehouse, NanoEd makes it possible dissemination of information, research and education community collaborations in science and engineering at the nanoscale (NSEE) students, teachers and researchers. NanoEd goal is to build a comprehensive network and a portal of resources to serve the global community for education in nanoscience and engineering. The paper aims to answer the question: to what extent HOPE project and its network of partners can contribute to creat a similar Initiative at EU level. The main objective should be to develop educational resources for secondary schools and universities to enhance students' interest toward STEM courses using new methods of teaching and learning and developing multidisciplinary topics by universities research institutes industry partnerships and research institutes. Offering scholarships, internships, grants and postdoctoral positions, developing joint programmes can be a solution.

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P13 Research Based Innovation in school - University cooperation

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ABSTRACT

Since from 1994 the Physics Education Research Unit working in the University of Udine developed different kind of projects focused on the cooperation between school and university to improve physics teaching/learning at all levels, to favourite formative success and the continuity from secondary school to university. Activities are involving schools at Regional and National level. The main characteristic of the projects is to be research based both because the suggested activities and materials are research outcomes both because the way of working into the projects is research oriented. Content and methodological innovation The kind of activities appreciated by school and shared in the projects are: 1. Outreach, popularization of physics research local activities interpreted as cultural diffusion for the school and with the school; each intervention is prepared by a discussions in school on the pre-requisites and problems treated by the research involved and accompanied by a successive report done by participating students for peers. 2. Game Experiment Ideas (GEI) exhibit: 250 experiments hands-on and minds-on integrated in the curriculum by teachers of primary and low secondary schools. 3. Conceptual Laboratories of Operative Exploration (CLOE) carried out with little groups of students on a specific topic by a researcher and a teacher. For pupils ranging from 4 to 14 years old CLOE activities are carried out on force and equilibrium, fluids, sound, thermal, electrical and magnetic phenomena, light and vision. For secondary school students CLOE activities are carried out on light diffraction, electrical transport properties of metal, semiconductor and superconductors, superconductivity and quantum mechanics. 4. Talent student full immersion summer school on modern physics: 50-60 hours including CLOE on electromagnetism, superconductivity and quantum mechanics, on Rutherfort Backscatteing Spectroscopy, on Mass-Energy relationship and experimental laboratories.

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P14 SSQ-HOPE Questionnaire on factors inspiring secondary students to study physics. Preliminary data analysis

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ABSTRACT

Different inquiries and inventories are carried out for the different scopes of the HOPE-Project. Secondary Student Questionnaire (SSQ) is an inquiry carried out in the framework of WG1 focused on factors inspiring young people to study physics. In this contribution we concentrate on the transition school-university with a focus on the factors motivating to study physics secondary school students, which are talent in physics. It is well known that also students interested in physics do not study physics in each case. Therefore the goal is to gain insight into factors that act positively on the choice of physics as field of study and to shed light onto the conditions of this choice. Hence we identified as target group students in the last two years of school education before university. They should be highly interested in physics and be involved in the decision process about their field of study or even already have chosen it. The research question are: 1) Does the group of students with positive attitude towards physics show a special pattern of interest? 2) Do they accept for themselves the role model of physicists? 3) Which aspects of physics or doing physics have contributed to their choice? For this goal the work group has developed a questionnaire which was administered by several partners of the HOPE-project. The questionnaire consisted of four parts: 1) Information about the student such as gender, age, type of school and intension of study. 2) Evaluation of the interest in physics in several dimensions according to the interest construct following Krapp. 3) Open questions concerning factors influencing the choice of a career as well content-related aspects as social aspects such as the image of a physicist 4) factors inspiring young people to study physics. In order to reach the pre-defined target group the questionnaire was distributed in events with physics content mostly taking place at universities, research institutions or at similar occasions. In order to identify promising activities information on the type of event, its characteristics and the process of selection of students were collected. In this presentation we will analyze the data gathered with a sample including 139 students participating in the International Particle Physics Outreach Group IPPOG-Masterclasses in the universities of Udine and Dresden. We focused on the the parts 1 to 3 of the questionnaire and will present results on the relation between the interest and the actual choice of field of study.

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P15 Factors that bring together and keep apart choosers and non-choosers of physics studies at university level in Greece

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ABSTRACT

There has been much discussion regarding the drop of enrolments in physics departments. Evolved countries in industry and research are concerned about this decline, since they need well-educated staff to fulfill their needs. Moreover, educational faculties around the globe need to occupy physics teachers to pass on the scientific literacy. Interestingly enough, that is not the case of Greece. Over 1000 students enroll annually in the physics departments. What is even more exceptional is that in each department one can find students who truly wanted to study physics, but just as easily can allocate students whose initial choice was another science or engineering department. A research on first year undergraduate physics students can provide us with interesting information about the factors that influence young people in order to choose physics studies. However, this research attempts to take advantage of the rather unique synthesis of students. It could give a first idea regarding the differences between those who definitely desired to study physics and those who ended up studying physics although it was not their first choice. We examine the following research questions: 1. Which factors are crucial for a student to choose physics studies? 2. What differentiates the students who chose to study physics from those who did not? 129 first year university students in University of Patras constitute the study sample. They were 17-19 years old and 46,2 percent were females. A questionnaire has been created to scrutinize the factors that led them to the physics department. Its questions derived from the literature, in which 5 factor categories arise: personal, school-based, informal, career-related and family/friends. For all students, personal reasons have the greatest importance. They believe that physics is more interesting in comparison to physics taught in school, it consists an intellectual challenge and the knowledge contributes to commonweal. Among the bottom 3 reasons we find informal science education, specifically visits to museums, science events and relevant family activities. There are statistically significant differences in the way the 3 groups of interest (first, second or other selection of the physics department) responded. The comparisons show that the first and the second group differ from the third in several questions that fall in almost every factor category. On the contrary, the first group outscores the second regarding merely physics as intellectual challenge. Factor analysis reveals that students who had physics as their first choice respond similarly when it comes to professional aspects. The second students group is more orientated to school-related reasons. In regard to the third group, we distinguish a cluster of informal science education factors. These results could shed some light to the reasons that lie behind the leak in the pool of potential physics students and play a role in inspiring young people to study physics.

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P16 Expectations of FAM students about their university studies

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ABSTRACT

In Ticino, the only italian-speaking Swiss Canton, from the 3rd year of the second level of the secondary school (the so called "Liceo", which lasts 4 years like the previous Scuola Media), the 16-17 years old students may choose a peculiar kind of option called "FAM", i.e. Physics and Applied Mathematics, strongly focused on physical and mathematical modelization of phoenomena. Then, if a student wants to study Physics or Mathematics at the University, then he/she choses the FAM option. Even if also students interested in Engeneering or Medicine choose FAM, all the "FAM students" are a very peculiar sample to understand the expectations of young people interested by Physics but not yet strongly oriented toward a real universitary path in Physics. In fact, even if the sample is relative only to the specific population of the Canton Ticino, it has the big advantages to be relatively little, easy-to-study and ready to spread between Zurich, Losanne or Milan, changing place, languages, competences, research. FAM students are indeed not only interested in Physics: if they choose to go further with it, they must turn for the beginning on a prospective very similar to that of every young European researchers in Physics. That's why SUPSI-DFA, a Swiss partner of the HOPE project, after the preliminary results showed in the Helsinki meeting, kept on studying their ideas about studying physics.

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P17 Factors affecting upper secondary school students knowledge about fundamental concepts in Quantum Mechanics

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ABSTRACT

Reforms of Italian national physics curricula introduced the teaching of basic concepts of quantum mechanics during the last year of secondary school. The main reason for introducing in school practice quantum mechanics is to familiarise students with up-to-date research topics in physics and to motivate them to purchase future careers as physics researchers, teachers or company-appointed specialists. Research results in science education over more than thirty years suggest a relationship between motivational factors and learning of science. Literature in physics education thoroughly shows that even physics university students experience several difficulties when learning about quantum mechanics. Most of the studies about students' ideas focus on basic and advanced undergraduate courses, but very little is known about physics students' initial knowledge of quantum mechanics and how their motivation for studying physics may impact on the way they learn about it. Hence, research questions that guided the study were: RQ1) What are the basic quantum mechanics concepts which are harder/easier for first year physics undergraduates? RQ2) Which are the factors that mostly motivated students to deepen quantum physics topics? We developed a multiple choice questionnaire about fundamental concepts in quantum physics and used the HOPE questionnaire to investigate motivational factors. The questionnaires were submitted at the same time to 87 students (23 females, 64 males) at the beginning of their first year university physics course. A Rasch model was used to analyze data in order to compare students' ability and items' difficulties using the same unit. Results of data analysis for RQ1 show that about 20% of the sample have correct ideas about quantum mechanics concepts featured in the multiple choice questionnaire. In particular, most of the students' difficulties concern items related with wave function, while items about the atom have an average difficulty; easier items concern the concept of measurement and Heisenberg's principle. Data analysis for motivational factors (RQ2) show that interest in learning advanced topics, understanding physics applications and the wish to work as a professional researcher, triggered not only the will to participate in physics-related out-of-school activities, but also the need of deepening the knowledge of more advanced topics (as those targeted in the questionnaire) through the reading of books, papers and internet information, independently of physics syllabus. Therefore, collected evidence supports a relationships between motivation in choosing a physics course and knowledge about quantum mechanics. As teaching implication, this study suggests that secondary school instruction should focus on motivational factors underlying the learning of advanced topics, thus proposing quantum mechanics as a powerful framework to improve the description and interpretation of natural phenomena.

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P18 Student Interviews on Inspirational and Drop-out Factors Progress Report (Sub-Group WG1-B)

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ABSTRACT

The poster concerns the progress report on the survey on Inspirational and Drop-out Factors we carried out, within the activities of WG1, through individual interviews to physics students. In particular, we will present: 1) the research groups involved in the survey and in the data analysis; 2) the sample; 3) the research questions; 4) the quantitative and qualitative research methods of data analysis we are designing; 4) the preliminary analysis and the problematic issues we are dealing with; 5) discussion, implications and future plans.

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P19 Trends in the Choice of Physics for Studies: the Case of Lithuania

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ABSTRACT

This report deals with university Physics studies in Lithuania presenting results of research carried out at Vilnius University (VU) and Lithuanian University of Educational Sciences (LEU) according to recommendations of WG1 of the HOPE project, as well as data on Physics teacher programs. Physics education is crucial for overcoming contemporary challenges (energy exploration and production, climate change, new technologies, etc.). In order to prepare sufficient creative young physicists understanding the world around us and constantly improving their qualifications, it is important to find ways to encourage young people to choose sciences studies, particularly Physics. In Lithuania, almost 90% of those studying Physics do so at Vilnius University. For about 15 years until 2014, the six bachelor programs at the Physics Faculty used to enroll 190-200 high-school graduates. In 2014, that number decreased by 20%; is this a signal? The Physics admission forecast this year is for only 130-140, again minus 10%; only 133 graduates indicated Physics as their first priority for studies. Only one program - Applied Physics remains attractive - the first that is a priority for 47 graduates. Other programs have only 15-20 applicants. In general, about 10% of high-school students attend 11-12 classes in Physics and pass the national exam in Physics only. Of them, in 2015, only 5% marked Physics as their first priority for enrollment in university studies. The number of students in Physics is relevant, yet the same cannot be said about students in Physics teacher programs. For the fourth year running, not one student was admitted by LEU to the Physics Teacher program. The situation is slightly improved by VU Physics students choosing additional subjects in pedagogy/psychology to gain a teachers licence, this year 9 boys and 5 girls obtained the certificate that way. This overall situation could well result in a critical shortage of qualified Physics teachers after 5-10 years. In order to understand to what extent and how this problem should be tackled it is necessary to find out why young people choose Physics studies, and why and how economic, social and emotional factors influence young people to earn a degree in Physics. VU and LEU to follow up on Hope activities, presents the results and preliminary conclusions of two initial phase actions: 1. Survey and interviews of first-year Physics students at Vilnius University - examining how social, economic and emotional factors influenced their decision to study Physics, inquiring about their satisfaction with their studies; 2. Survey of talented high-school students - to ascertain their views on sciences, their required knowledge, their personal qualities, and who led them to a deeper interest in Physics, what would motivate them to enroll in university Physics studies, and why.

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P20 Maltese and Dutch youth plan an ERASMUS+ Youth Mobility Activity

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ABSTRACT

Maltese and Dutch youth plan an ERASMUS+ Youth Mobility Activity: In the HOPE Forum held in Helsinki in 2014, Joan Borg Marks presented work relating to the formation of a voluntary club in Malta, by the name of ASTRO-CLUB Malta, which was responsible for the setting up of Planet Walk on the island. This club works to motivate and inspire young and old towards the sciences. Such motivation can spark the interest for further study in this line. During the summer of 2015, ASTRO-CLUB Malta is organising a visit to the Netherlands for a group of young people with a special interest in Physics and Astronomy. The Maltese group of 14 youths and 3 group leaders will meet another similar Dutch group in Leiden. Among the activities of the group a visit to Leiden Observatory is being planned. This activity is called Discussing Science. The young people will be visiting interesting places together, working together, giving presentations to each other, asking each other questions... in other words, learning informally together. On a poster presentation, we would like to give some highlights of our activity and at the same time promote ERASMUS+ programmes amongst other HOPE partners.

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P21 The "Young scientist" summer camp - a tool for developmet of children positive attitudes towards physics

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ABSTRACT

The growing decrease of the young people interest to study physics and chemistry and become teachers of these subjects that is in contradiction with needs of technologically developed society has reflected in strong efforts of teacher trainers and scientists from the Faculty of Natural Sciences, Matej Bel University Bansk Bystrica to promote sciences to school children by an attractive way. Having in mind that both learning and entertainment are important features in non-formal education we offer to school children an alternative vacation activity a summer camp "Young scientist" that connects leisure activities with active learning in sciences. The camp (organised from summer 2012) targets the youngest learners children 6 14 years old, which are divided into four age groups. The week programme of each group consists of one two three-hour sessions for each of science disciplines: physics, biology, geography and chemistry. Because most of the participants have not learned physics at school yet, each year we select new themes that enable children engagement and do not require any previous knowledge. A very positive feedback was gained after introducing two themes sound and motion. The first theme allows building upon a frequent children's hobby playing musical instruments. Second one enables to use natural skittishness and movements of children. Each of the sessions consists of various activities. First of all it is a set of attractive hands-on experiments and demonstrations that illustrate basic properties of sound and laws of motion. The sound topic includes for example playing the goblet harp, singing bottles, demonstration of waves with Julius wave machine and with a rubber hosepipe, visualisation of sound on the Chladni's plate or moving a paper butterfly with sound cannon, as well as simple computer investigations of children voices. The laws of motion were illustrated using models with children's direct involvement and demonstrations of different kinds of rockets. Then we encouraged children to make and to test small vinegar rockets by themselves. Children created also other toys from simple materials, such as paper airplanes, telephones, drinking straw flutes, paper flowers etc., that were used in further activities investigations, games and competitions. Magic experiments are another popular part of physics sessions. Each child learns a "magic" trick based on physics and promotes the trick in front of the others. Children are always fascinated to hold the water in the cup upside down, to paste the balloon on the ceiling without using glue, move a paper figure or a large broom with a "magic" stick or to "levitate". The summer camp "Young scientist" represents a new experience not only to participating children, but also to the involved scientists. Children provide us spontaneously with an immediate feedback. We can see a level of their motivation and engagement and are pleased to get positive reactions each year.

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P22 How to involve teachers of physics in building entrepreneurial skills of secondary school students

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ABSTRACT

Most of the leaders of large private companies around the world agree that career development management is a reality and are three kinds of career paths in business: management (managing and developing a team, managing a strategy), project management (cross-disciplinary management, no management involved but rather the supply of resources and competencies, with objectives and landmarks to be respected in terms of cost, quality, deadline), as well as expertise (an individual who is an authority to be consulted in a certain field). 2012 Euridyce study Developing Key Competences at School in Europe: Challenges and Opportunities for Policy concluded that further support needed for the development of transversal competences as in ICT, entrepreneurship and civics and in one third of European countries, however, the focus on entrepreneurship education does not start until secondary level. In Romania there are a lot o initiative sustaining the involvement of businessmen, from leaders and managers to professionals or experts in different sectors. Vasile Alecsandri High School of Iasi organizes annually one week of open events under the slogan: The town mirrored by our school yard. One main purpose of this project is to provide a vehicle for introducing basic awareness of business skills, to enable students to begin to learn about business by experience, to teach high-level group work skills and to use group work to motivate student interest and engagement. Students are introduced to aspects of running a business including: Researching the market; Market sectors; Making a business plan; Financial control; Quality matters by the professionals. They then run an small project in one local company and finally they produce a company report with groups of students responsible for individual sections (including marketing, finance, customer satisfaction). The report should show evidence of the entrepreneurial skills and the practice done in the offices, laboratories or production sectors. Physics teachers as headmaster of some classes are involved in these activities. Whatever the field of activity this extracurricular activity may be a good opportunity for them to promote the image of Physics as: engine of sciences and technologies development and explaining the world. The article presents how the cooperation with a large company that manufactures bread can be an opportunity to develop harmonious scientific and entrepreneurial skills of the students. At first observers of the process students then become part of the technological process that we can apply, dissect and discuss. They may be required for technical solutions or to improve a business plan.

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P23 QChallenge! - promoting hands-on experiments in Physics for high-school students

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ABSTRACT

In Portugal, teaching of sciences, in general, and Physics, in particular, still suffers from a deficit of hands-on experimentation at high-schools. Several problems have been pointed out as possible causes for such problem: lack of enough time in a heavy syllabus to promote experiments in the classroom, schools without properly equipped laboratories, teaching practices that emphasize the training of students for national exams (experimental skills are not evaluated in these exams) and lack of proper training of teachers in experimental physics. The University of Coimbra runs the Quark!-project, an informal school for talented 17-18 year old students who spend monthly one week-end at the university, enrolled in a number of activities lectures on subjects that are not comprised in the high-school syllabus, conferences on Physics, and experimental activities. A subset of these students are selected to participate in the Quark!-school by the Portuguese Physical Society on the basis of the results obtained in the National Physics Olympiads. The Portuguese teams to attend the International Physics Olympiad and the IberoAmerican Physics Olympiad are selected from this subset. To develop experimental skills in these students, one of the activities at the Quark!-school is the QChallenge tournament, where the students are requested to perform at home a challenging physics experiment, using simple and low-cost materials, either available at home or provided to them in kit format. These activities consist of two experiments: a lightly guided one, and another where very little guidance is provided and the student is supposed to use his(her) creativity to solve a given problem. The reports on the students activities are submitted in digital or paper format to jury at the university that awards the best reports with symbolic prizes. There are different categories of prizes, e.g. for the most accurate result, the most original solution of a problem, the most creative experiment. These activities have inspired new teaching materials that were used in a nation-wide study of new practices for promoting teaching of experimental physics in highschools. In this communication, several examples of QChallenge! activities will be presented, and an analysis of the impact of such activities on the students motivation, their learning outcomes and school dynamics will be discussed.

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P23bis ElMagNanoLab promotes ferrofluids as example of nanoscience to the secondary school students

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ABSTRACT

The development of nanotechnology (NT) in the last two decades has exceeded our most optimistic expectations. Thanks to the close collaboration between physicists, chemists, biologists and engineers NTs have vary greatly practical applications if we refer only to the production of energy-or medicine. At international level research in nanotechnology have well-defined directions and the investment are huge. (US - National Nanotechnology Program Initiative (NNI), EU Horizon 2020 Program). The ability to succeed in the field of NTs is determined by the skills of members of their societies in understanding, using and inventing NTs. This is why in the developed countries major efforts to attract scientists and engineers with outstanding performance in order to reach a critical mass of researchers in done in strategic fields. (Http://ec.europa.eu/research/fp7/pdf/fp-1984-2013_en.pdf). The lack of interest among young people to STEM can lead to a significant loss of Europe's research potential, which is manifested by delaying the emergence of the next generation of researchers, who bring new ideas and synergy, and by enticing excellent researchers who are at start their career to seek advancement elsewhere. In the US the National Center for Learning and Teaching in Nanoscale Science and Engineering (NCLT) was the first national center of learning and teaching nanoscale science and nanoengineering. NCLT mission is to develop the next generation of leaders in teaching and learning NSE (Nanoscale Science and Engineering), with emphasis on capacity building NSEE (Nanoscale Science and Engineering Education), providing a strong impact on national education in STEM. This program is designed to train a workforce knowledgeable of nano science and technology that can solve global problems by implementing a three-pronged strategy: publication of STEM training modules integrated with nano-based applications, training through workshops, courses and seminars and developing a network of nano-sectoral education. The center NCLT dynamic warehouse, NanoEd makes it possible dissemination of information, research and education community collaborations in science and engineering at the nanoscale (NSEE) students, teachers and researchers. NanoEd goal is to build a comprehensive network and a portal of resources to serve the global community for education in nanoscience and engineering. The paper aims to answer the question: to what extent HOPE project and its network of partners can contribute to creat a similar Initiative at EU level. The main objective should be to develop educational resources for secondary schools and universities to enhance students' interest toward STEM courses using new methods of teaching and learning and developing multidisciplinary topics by universities research institutes industry partnerships and research institutes. Offering scholarships, internships, grants and postdoctoral positions, developing joint programmes can be a solution.

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P23tre Black Holes in my school

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ABSTRACT

Black Holes in my School is a project aiming at introducing modern science in classroom. The project engages teachers in the use of ICT tools to explore the science behind black holes and its applications in the framework of physcis curricula

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Physics - gateway for universal knowledge, science learning and communicating for students in school education

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ABSTRACT

My poster reveals the experiences of a scientific workshop organized by Faculty of Physics, University of Bucharest, as good practices and successful recruitment methods for inspiring the young to study physics. My role was as administrative organizer. The workshop "Gate for universal knowledge" was aimed at developing scientific and research skills for high school students. The description took into account that the progress of science, culture and civilization can be achieved only through knowledge, learning of new knowledge and their communication to a widest possible audience. The aim is to show students the application fields of this science in a broader context, inter and trans-disciplinary. General competences that were pursued: organizing specific knowledge in sciences field; using the investigation method as sciences approach; communication of the concepts understanding and investigation results. The target group was the High school students eager to enrich their knowledge of physics. Goals of activities were: knowledge and understanding of physical phenomena, the terminology, concepts and methods specific; development of exploration, investigation capacity and experimentation through own physics tools; capacity building for analysis and problem solving; development of communication skills using specific language of physics; the formation of a critical attitude towards science effects on technological and social development and the interest for environmental protection; development of skills transfer inter and trans-disciplinary. The number of participants was 20 students in X and XI grades and their teachers. Activities of workshop consisted in laboratory activities / conducting experimental work with digital data processing in the laboratories of mechanics, electricity, atomic and nuclear physics laser physics; study visits to research institutes and development; interactive lessons; Physics competitions on sections with awards for students: Essays/ SF on scientific topics; Applied Physics; Physics on computer; Posters on scientific topics. Partners on project were: Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), Center of Technology and Engineering for Nuclear Projects (CITON), Institute of Space Sciences (ISS), National Institute for Earth Physics (INFP), National Institute for Laser, Plasma and Radiation Physics (INFLPR), Institute of Atomic Physics (IFA), NHN ECOINVEST S.R.L and Ascendia Design.

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P24 Effective in-service teacher education - a successful experience

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ABSTRACT

I (MJA) teach Physics Didactics at the University of Coimbra. During one of my classes I went to the central services (I cannot recall why...) and there was a telephone call for me... A school teacher (AMS), who had not been my student, found my book on Physics Didactics1 when spending sometime in a bookshop and acknowledged the "Energy" was dealt with in it. She told me that, at last, she could feel more at easy to teach the subject to her secondary school students (later I knew she had a PhD in Chemical Engineering). She asked me whether I could discuss some difficulties she shared with a group of colleagues when teaching Thermodynamics (in Portugal, Phys and Chem come together - same teacher - up to the 11th level). That is how it all started. In fact AMS belongs to a Teacher Education Centre, housed in a Secondary School. These Centers organize in-service education actions, which give teachers credits they can use to progress in their careers. After some meetings and written texts exchange, and some teachers' gathering together with AMS developing group work (about 20 teachers, from neighboring schools), I was invited to come for a day to the Education Centre of Viana to meet them all. My contribution started with an advice: teachers must be very careful with physics language, their own and their students' one. Students must be aware that, in physics, words are used with very specific meanings - which can be different from everyday language. I suggested the introduction of the particulate model of matter to very young students (12 years old, 7th level, the first contact with Physics and Chemistry), leading to a first understanding of temperature and the possible different effects of heat transfer... or radiation (winter sun effects, most noticeable when we are using black boots), or forces (to brush or clap ones hands to "warm" them up - to raise their temperature)... Heat and radiation transfer can lead water to boiling... Heat can move calendar sheets up, if it hangs over a heating system... After a short introduction, I called for questions? problems with teaching and learning situations... difficulties found when using school manuals? We discussed in the morning and in the afternoon... there were lots of questions, and we took time to discuss them all... one could notice that teachers had already discussed among themselves the problems they were submitting to my appreciation. By six o'clock I was losing my voice, but I was pleased with the enthusiasm of everyone. Teachers were pleased because they felt their knowledge was strengthened by our dialogues and discussions. They envisaged their future lessons on thermodynamics as much more enthusiastic and consequent students' learning much more beneficial, due to the perspectives on thermodynamics they had now, capable of raising students' motivation, inducing meaningful learning. To summarize: what teachers were eager of was clearly pedagogical content knowledge.

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P25 IRRESISTIBLE - Engaging the Young with Responsible Research and Innovation

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ABSTRACT

The poster presents a novel kind of collaboration between scientists, school teachers and teacher trainers in the EU-project IRRESISTIBLE. The collaboration aims to design educational modules that foster the involvement of students and the public in Responsible Research and Innovation (RRI). IRRESISTIBLE brings societally relevant cutting-edge science into both pre-service and in-service teacher education, as well as directly to classrooms and out-of-school environments. The topics of the educational modules 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, researchers from the thematic field, education experts from universities, and exhibition experts from museums / science centers. The material developed is 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.

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P26 Studying the spectra of different light sources with a homemade apparatus

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ABSTRACT

Designing and testing approaches and materials to introduce basic concepts of modern physics in the standard Italian high school curriculum is the aim of a research project carried out by the Physics Education Research Group at the Physics Department of the University of Pavia (Italy). In this project the experimental activities play an important role, and recently we focused on the design of a laboratory bridging optics and modern physics proposed to pre-service and in-service Math and Physics teachers and their students. A simple methodology employing digital photography and image processing techniques can be used, both in introductory physics laboratory and in high school, to obtain quantitative measurements of position and intensity in optic experiments by means of a CCD commercial camera or a cellphone. We applied this methodology to realize a home made spectrometer based on the use of either transmission or reflection diffraction gratings, suitable to be employed by groups of students with an inquiry approach. This simple equipment allows measuring the wavelength of visible lines of Balmer series from the hydrogen atomic spectrum, and estimating the value of Rydberg's constant with an error difference of few tenths percent. It can be also employed to evaluate the Planck's constant by measuring the wavelength of the light emitted by diodes of various colours, and to study some peculiar aspects of photoluminescence. We tested the use of the spectrometer with groups of high school students and with student teachers in a postgraduate course for physics teacher education. We collected data on the activity and on students' ideas from the worksheets completed during the experimental work, from discussions during and after the experiments and from the reports they prepared afterwards. Results confirm a good performance of the apparatus in terms of precision in measuring the wavelengths of spectral lines, and testify a related deep satisfaction of students, who were able to carry out a significant analysis of their data.

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P27 Inquiry for lower secondary school students and their teachers: "Sound"

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ABSTRACT

We report on research activities developed as part of a PhD on Teaching Sciences - Physics Branch, at the University of Coimbra. Within this educational research project we had two final aims: to develop lower secondary school students' inquiry minds (8th grade students, first scientific contact with sound), motivating them to study Physics; to implement teachers' reflective skills - a way of practicing in-service teacher non-formal education. As a complement of the traditional school ways of following government guidelines, we planned and organised some experimental stations to be run during a few lessons, where the students use guiding documents to develop group work following an inquiry perspective, connecting Physics school content with the understanding of everyday normal occurrences. The proposed activities rely on observation and curiosity, looking for students' motivation to answer some questions based on the performed experiments. Different scientific languages are used (Tables, Graphs, Texts...) and students have to comment on them. Pre- and post- tests are completed in order to detect efficiency of the proposed methodology on students' learning. The school teachers lead all in-school activities, using the guiding documents produced by the researcher: they have to report to the researcher the results of their observation of the activities impact on students, focusing both positive and negative aspects. The research project has completed the following steps: a pilot application with one classroom (2012/2013) followed by the analysis of results (students' pre-and post- tests and teacher's reports on difficulties met during activities development); small reformulation of activities and improvement of students' and teachers' guidelines; project application to several schools (2012/2013); analysis of results of students' pre- and post-tests and teachers' reports (2013/2014). From this analysis we could conclude that: 1) there were still some points worth focusing within the organization of experimental stations in order to promote better students' understanding of intensity, frequency and speed of sound; 2) although researchers organised specific experiences, oriented by students' and teachers' guiding documents, the most important factors to promote efficiency in learning were the teachers own teaching behaviours, which could be improved. Hence, after enlarging the scope of the experiments, we decided to extend this research with a small number of teachers, using a closer control of their teaching behaviours. During the last academic year we have worked with 3 schools, meeting Physics teachers and discussing the guiding orientations and the experiments, designed to correct common misconceptions and to promote motivation for the development of inquiry attitudes in young students; the necessity of time control during group work experimental activities was not forgotten. We have recently collected the results and are analysing them.

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P28 Planetary sessions fur physics teachers' education

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ABSTRACT

A recent research in Brazil showed that about 85% of the Planetary visitors were Basic School students, led by their teachers, searching for a complement of in-school obtained poor information. In fact, school teachers in Brazil perceive Astronomy as a gap in their education. However Brazil has the largest students participation in IOAA International Olympiad on Astronomy and Astrophysics and more than 775,000 students and almost 72,000 teachers attended the Brazilian Olympiad on Astronomy, OBA, 2013. During the XV Encontro da Associao Brasileira de Planetrios, Rio de Janeiro, 2010, one of the authors, GMO, interviewed 200 teachers cooperating with OBA, about their perceived role of Planetary among the possible other resources for preparing students for OBA: internet, books, magazines, audio-visuals, TV, movies, radio broadcasts, written media, education units on Astronomy, amateur astronomers, Astronomic Centres or Science Centres. Surprisingly 39% mentioned Planetary and 33% mentioned Astronomic Centres. Consequently interviewed teachers were asked about the relative importance, as a complement to their own education, of their visits to Planetary, Astronomical Centres, Science Centres or attending education units on Astronomy. About 80% mentioned education units; 15% indicated visits to Science Centres and Museums, 5% spoke about visits to Astronomical Centres and none mentioned Planetary. However, most of them mentioned a "dome session" while pre-university students and a Planetary visit during teachers education. These answers eventually point towards default or missing activities in Planetary, designed for meaningful education and not only for disclosing information. It looks as if Planetary uses only astronomic contents, neglecting other sciences supporting it, namely Physics, Mathematics and Chemistry. On the other hand, Planetary hardly run sessions for university students, devoting only to school students and neglecting teachers education. Within the development of educational research inserted in a PhD on Teaching Sciences, branch of teaching Physics, our intention is to design dome sessions organized to motivate university students, especially future Physics teacher students, and to search for efficient models and methodologies of complementing the school teaching of Physics using the Planetary scientific tools available outside the school institutions.

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P29 "Experimenta!" - Hands-on Showroom for high school students

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ABSTRACT

Educational activities carried out in the Experimenta! showroom at the Department of Physics of the University of Coimbra are presented. The main goal of the Experimenta! showroom is to offer a wide range of simple hands-on activities and experimental demonstrations of important physical concepts and their practical applications. High flexibility and adaptability to the audience, both in what subject and student age are concerned, are important features of the showroom organization. Permanent demonstrations include electromagnetism, electrostatics, superconductivity, , mechanics, vibration and waves. Temporary activities, the most recent being related to the International Year of Light, are also developed. All activities can be easily adapted to the respective level of knowledge of 10-18 years old students as well as to the school programme, focusing on experimental aspects of the subjects lectured in class room.

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P30 On The Interactive Whiteboard Simulator - Impacts On Learning Physical Education

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ABSTRACT

One of the problems in the teaching of Mechanics is that the topics are taught often through abstract problems and without context of reality, without any practical activity of demonstration. With this, there are many conflicts of the preconceptions with the scientific concepts in this area. To overcome them we need to classes include situations that involve solving active in the construction of knowledge. A difficulty in teaching of mechanics is the students relate the motion of bodies with their graphical representation and vice versa. Computer technologies have assumed an important role for teaching this subject, developing various tools and proposals that use the resources of virtual reality. In computer programs students can interact with the situations and observe the movements described by their representations. It is in this context that we propose to study this subject. With the aid of computer resources, build a simulator using the VPython programming language to be used in the classroom combined with the interactive whiteboard. We focus in particular on time-lapse study, with emphasis on the actual movement your description in terms of the graphics position/time and speed/time. The process will be tested in a High School of Coimbra, with the collaboration of Physical Chemistry teachers in classes of 10 and 11 degrees. We will describe the perceptions of teachers at various times in the process. We will examine their attitudes as well as the students, takings into account the previous experiences with the interactive whiteboard. Also verify the impact on learning through a quasi-experimental method, with the student survey. We hope that this research will contribute to changes of conceptions in the physical sciences, promoting the teaching and learning process effective. We also hope to contribute to changing attitudes to the interactive whiteboard, valuing it as an important tool for the teaching of physics.

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P31 An instructional experience for pre-service teachers: integrating simulations and hands-on activities in physics teaching

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ABSTRACT

Research suggests that the use of simulations in science teaching enhances the motivation and performance of students (Ruttenet al., 2012; Wiemanet al. 2008). As part of a teacher training course we offered a laboratory on electricity integrating hands-on activities and simulations. While providing the pre-service teachers an opportunity to experiment and reflect upon this kind of learning environment, the laboratory allowed to study the effectiveness of the proposed educational activities in the context of teacher training. The study investigates the use of simulation and its interplay with hands-on activities for pre-service secondary physics teacher education. All 45 participants had a masters degree in physics or mathematics. A conceptual test on electricity was administered to study the participantsprior knowledge. Information about prior laboratory experiences was collected. The laboratory activities focused on DC circuits. The participants were divided into two groups: one started with hands-on exercises and subsequently performed simulations, the other one followed the reversed order. The tasks required numerical or qualitative predictionsbefore simulating or building a certain circuit to check the answers with measurements.The participants were asked to reflect on the task-related difficulties, concepts, and surprising aspects. Results from a preliminary analysis suggest that there were no differences in performance between the two groups. When using the simulations, making predictions based on prior knowledge did not present any difficulty and even though 98% of the participants had no prior experience with simulationsno oneencountered difficulties during their execution. This confirms that simulations reinforce students' understanding of relationships between variables by providing exact agreement with the predicted outcome (Sethi, 2005).On the contrary, in case of the hands-on activities including simple wires, batteries and bulbs,making predictions and measurements resulted very problematic for almost all participants. Both groups encountered an equal amount of difficulties. It seems that the simulations do not help the pre-service teachers in transferring their conceptual knowledge to the reality. A quantitative analysis of the results and a study regarding the pre-service teachers attitude towards the activities is ongoing.

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P32 A museum for scientific literacy and research in Non-formal science education: MUDIC-VBS-CV

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ABSTRACT

The Didactic and Interactive Science Museum of Vega Baja de Segura in de Valencian Comunity 'MUDIC-VBS-CV' (www.mudic.es) is ECSITE member, it is developed by the Teachers Association "Hypatia de Alejandra" in collaboration with the University Miguel Hernndez (UMH) and the Town Council of Orihuela (Alicante-Spain). More than 6000 students visit it every year. In addition to organizing Secondary students visits, the MUDIC-VBS-CV has the aim both training science teachers and museums staffs and monitors in scientific literacy and teaching in science education research. In this way, MUDIC-VBS-CV organizes different courses such as the course "Learning science in a museum" into the Master on Teaching Training at Secondary Schools" and, the postgraduate course "Specialist in scientific literacy and science education in out-of-school and school contexts" at the University Miguel Hernndez (UMH; www.umh.es). This postgraduate course has Spanish and international external partners such as "El Parque de las Ciencias" of Granada (Spain), University of Udine (Italy) a University of the Basque Contry (Spain). MUDIC-VBS-CV organises also other training activities for science teachers: courses, workshops, lectures, etc, in collaboration with the regional training centre (CEFIRE Orihuela). In the last year the MUDIC-VBS-CV, has initiated a research line into science non-formal education. Three thesis have started, focused on designing and implementing exhibition modules and workshops in the museum in a scientific way in Mathematics, Engineering and Physics. For example, the research in the area on non-formal Physics Education aims to develop a workshop with an exhibition module for the scientific literacy on technological applications related to the emission spectra in the matter-radiation phenomena. The project will be developed in the MUDIC-VBS-CV context and it will develop, design, implement and assess a workshop with an exhibition module for seeing light emission spectra. We hope that visitors participating in the workshop will be able to explain some technology applications in their daily lives and they can discriminate with criteria devices for information treatment, based on the scientific theories of light spectra emission. In particular we want the visitors to be able to explain and differentiate the light of a filament bulb, a low-energy bulb, a LED bulb, a fluorescent bulb, the Bunsen burner flame and the Sun. With the same theory the visitors will be able to discriminate among several recording media such as, barcode, CD, DVD and BLUE-RAY too. In the end we hope that they will be able to recognise the existence of different types of lights, some which are detected by our eyes (visible) and others which are not (infrared, ultraviolet, etc).

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P33 "Olympic Experimental Physics" - a hands-on workshop for high-school teachers

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ABSTRACT

In a recent extensive survey to the participants of the Portuguese Physics Olympiads, the poor background on experimental physics of the teachers lecturing the subjects of Physics and Chemistry at the Portuguese high-schools was highlighted as one of the main reasons why these students perform, on average, few hands-on experiments in classroom, compared to their partners in other countries. To tackle this problem, the Portuguese Physical Society has been promoting, in collaboration with the Physics Department of the University of Coimbra, a recycling hands-on course for highschool teachers. This course is focused on a new methodology to explore experimental activities in the classroom, based on novel experiments inspired in the national and international Physics Olympiads. These activities are fully integrated in the Physics Portuguese syllabus but have a different, more attractive format, and go deeper in the analysis of the data than usually required by the syllabus. The course has a workshop format, one day monthly, for six months. New teaching materials have been developed, including texts for students using an inquiry-based approach and detailed methodological notes for each experiment aimed at helping the teachers. In addition, experimental kits suited to implement this new format have been developed at the University of Coimbra and provided at no cost to these teachers to test in their schools. In this communication, examples of such activities and the results of their implementation in the high-schools will be presented, as well as an evaluation of the results of such initiative in the eyes of the teachers and the students.

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P34 Physics for Primary School Teachers

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ABSTRACT

Physics as a teaching subject starts usually in the sixth year of the school attendance in the Czech Republic. It means that pupils meet physics in the age of eleven or twelve. On the other hand, some basic physics phenomena are included in the primary school teaching subjects. It is mainly school subject Natural Science in which the basic knowledge about water, air, electricity, heat, magnetism, optics and others are introduced to little pupil. The above mentioned contradiction represents relevant problem with significant influence on the tuition at the primary schools. The authors of this contribution report how they deal with this problem. They developed a new seminar for future primary school teachers. The seminar is still in developing stage, but an important feedback was obtained during last years. There is a very important aspect in the developing of this new university subject, which is reported in present contribution. By this aspect the authors mean the fact, that the seminar was created on request of students themselves. It was great challenge as well as great chance for them to do something for future primary school teachers and offer them a new opportunity how to learn something from physics. The seminar is organized every semester and the authors were obtaining many useful experiences within the tuition of the one. Such a feedback represents a new basis for present modifications of the seminar. The context of the seminar is described and the authors focus their report on the content as well as on the methods used in it. The seminar consists of ten three-hours experimentally oriented sessions typically, and every of them are focused on one of basic physics topic. These topics and some experiments are introduced within the contribution. Almost all aids which are used in the seminar are very simple. All of them can be easily prepared by children during the school lesson immediately. Authors concluded that such a seminar brings new type of skills for future primary school teachers. They apply both, the skills and knowledge acquired there, in their school praxis after graduation from the university. The authors stay in contact with their former students to have appropriate feedback and use this information in improving the seminar.

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