European Physics Students' Initiative

Physics, Knowledge and Society

Information Brochure for Physics Students

Liviu Bîlteanu

EUROPEAN PHYSICS EDUCATION NETWORK

EUPEN

STEPS Stakeholders Tune European Physics Studies

Contents

Europe : a short history of an evolution

One can find the idea of a unique European political entity very early in the history of Europe and some historians are claiming that the first state creating some European premises through a culture visible until today is the Roman Empire. The same ideas appear subsequently in other multi-national states (like the Holy Roman Empire, the Austro-Hungarian Empire) and they are ideologically formulated by many philosophers starting with the Enlightenment period until the XXth century [5]. The same ideas are emphasized by W. Churchill in his speech at the University of Zürich in 1946, in which the British prime minister calls for the creation of an institution representing all the European states. This institution called the **European Council** inaugurated on 5th May 1949 in Strasbourg is the first institution of the European Community. Albeit the European idea was very old, it could not have been materialized until the moment when it started to serve the interests of all nations, rather than the interests of a single dominating nation like in the case of the multinational states we mentioned before.

Beyond the above-mentioned historical premises, the creation of the European community was triggered by the events preceding **World War II** (the configuration of the European map with the new national states) and those following it, in particular the application of the Schuman plan for economic cooperation [1][2]. In 1951, five years after the **Paris Peace Treaties** (1947) establishing the geopolitical conditions after WWII, another treaty is signed in Paris aiming the creation of the **European Steal and Coal Community** (the first European organisation for economic cooperation), followed by the creation of **European Economic Community** and **European Atomic Energy Community** by the Treaty of Rome (1957).

The European Community, including few states in its early years (Belgium, France, Federal Republic of Germany, Italy, Luxembourg and The Netherlands) later known as founding states, grows in several steps by the acceptance of new members:

1973 – Denmark, Republic of Ireland and United Kingdom;

1981 – Hellenic Republic;

1986 – Spain and Portugal;

1994 – Austria, Finland and Sweden;

2004 – Czech Republic, Cyprus (Greek speaking region), Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia.

2007 – Bulgaria and Romania.

European Union, counting today 27 member states and a population of 494.296.878 [4] is based on several treaties [3]: Rome (1957), Maastricht (1992), Nice (2001), Rome (2004) establishing the role of the main European institutions: European Council, European Union Council, European Parliament and European Commission within the legislative framework [7].

Once the number of the member states increases, reaching a consensus regarding the decisions becomes more and more difficult. Moreover, beyond the important differences between society developments in different parts of Europe, the lack of information addressed to citizens of the member states and the incorrect implementation of some European directives at the national level are the main causes of the slow evolution of the European Community. While there are some issues on which the member states did not agree (like the common foreign policy, the budgeting and the environment policy), the European Union cohesion force resides in the common interest of an integrated economical and social development necessary to face the global economical context.

However, one cannot finish this section without adding that there is a (euro)skepticism related to the European politics caused by the fear of dissolution of the national cultures within

the more and more accentuated globalization. On the other hand, one states repeatedly that one of the essential features of the Union is the cultural diversity. Indeed, the European identity is formed by a mosaic of national identities related by a common history and as well by a series of beliefs or principles, which can be found in various forms in the national cultures.

References

1. Martin Dedman, *The Origins and Development of the European Union 1945 – 1995 (A history of European Integration)*, Routledge, 1996.
2. http://europa.eu/abc/history/index_en.htm (History of European Union, on the EU site)
3. http://europa.eu/abc/treaties/index_en.htm (Treaties and Law, on the EU site)
4. EUROBAROMETER, http://ec.europa.eu/public_opinion/index_en.htm
5. Wikipedia, *Pre-1945 ideas of European Unity*.
6. Wikipedia, *History of the European Union*.
7. Wikipedia, *Politics of the European Union*.

Physics Students in a Knowledge-based Society

The Role of the University within a Society Based on Knowledge

Apparently, the creation of the European Community is based on some economic and political reasons, but a developed society cannot be sustained without an educated population. On the other hand, while in some periods of the human history the economic progress has been achieved by the conquest of new territories (Antiquity, Middle Ages) or by the discovery of new territories and the exploitation of new resources (Renaissance), in our age the economic development is based on technological progress, which is realized by scientific research, an activity strongly linked to education.

In this sense, the *World Year of Physics* (2005) was an emblematic event celebrating 100 years from the publication in 1905 by the *Annalen der Physik* of the three articles written by Albert Einstein, a Physicist who changed definitively the history of science by introducing new theories over space and Universe. His work represents an immense progress of knowledge and a tremendous impact over the today technology being that the number of industrial scale applications of the theories emerging from these articles (the photoelectric effect, laser theory, diffusion and heat theory) is increasing continuously.

One may conclude that the universities, whose tradition is lasting almost for one millennium, are the "laboratories" (and this contains all the possible meanings from the immediate ones to the most profound ones) of the society of tomorrow. Indeed, the university is the place where one conducts research leading to technological progress (the most immediate sense) and where the specialists meant to continue this activity and apply the results are educated (one of the profound vocations of the university as an establishment). The role of the university is essential in a society, this institution being a centre of culture, education, knowledge and research having a fundamental role for the creation of the human resources [1]. However, a university cannot exist isolated from the rest of the world and the academic world is based on the free circulation of information, of researchers and of students, on the common effort of many universities to lead to an end a project, on the direct relation with society etc. These were the preliminaries of launching the Erasmus program in 1987 aimed to fund the common university projects and the mobility of students and researchers as well. Celebrating 900 years from the creation of the first university in Europe (1988) the leaders of the European universities joined at Bologna in Italy to adopt a Charter (**Magna Charta Universitatum**) proclaiming the common formal adhesion to these major premises. Eleven years later (1999), the Education ministers of the European Community members states sign a common declaration (**Bologna Declaration**) a document forgone one year earlier (1998) by a common treaty referring to the "harmonisation of the higher education system in Europe" (**Sorbonne Declaration**) [2] signed by the respective ministers of Education in France, Germany, Italy and United Kingdom. The Bologna conference is followed by so-called "follow-up conferences" in Prague (2001), Berlin (2003), Bergen (2005) and London (2007) amending, analyzing and complementing the Bologna Declaration.

The Bologna Declaration [3] proposes, shortly, the creation (until 2010) of a Higher Education Area leading to the free circulation of a specialized labour force by the automatic recognition of previous university studies [4], as a direct and irreversible consequence of the politic and economic transformation throughout Europe. Such a measure was necessary to sustain the economic dynamics of the European Community by a real economic progress. The reform process aiming to reach these global goals is known as **Bologna Process** (BP). The BP language is quite complicated and it is not our aim here to explain it explicitly, therefore we project a future issue to explain this vocabulary. We emphasize, however, that even if BP seems an option to organize the Higher Education, it is in fact a consequence, a solution to face the requirements of a more and more dynamic and competitive society.

Once arrived at the University the student seems to be "the captive" of the education programme requirements and his/her single purpose is to prepare and to pass successfully the exams, missing in this way the global context in which (s)he is evolving as an individual. We offer in the next paragraphs some possible projections of the perspectives on which the Physics students may perceive their education.

Even we may be considered a sort of "fundamentalists" of Physics, one may dare to consider Physics having a greater impact than other sciences. From a cognitive viewpoint, in Physics one generates a series of theories (paradigms) with a high degree of generality, which may be applied in many different fields like: Banking, Transportation, Biology and even Linguistics. We remind here the well-known example of the application of the methods of Statistical Physics in the prediction of the stock markets, banks and to evaluate public health risks and other hazards.

In general, if one analyzes the labour positions occupied by physicists one may observe a very large "spectrum" starting from the classical positions of scientific researchers, teaching staff in schools or in the universities, laboratory technicians, meteorologists, other positions in the fields (related somehow) to the field of Physics: IT, energy production, medicine or engineering up to some "exotic" fields like banks and insurance companies. While in the Eastern Europe one may explain this large spectrum due to the migration of students toward other domains because of the lack of professional opportunities, however, in the Western Europe this phenomenon is due to the fact that the employers appreciate in general the Physics graduates for their general skills. The Physics graduates are appreciated for their direct problem-solution paradigm approach to any tasks, for their abilities to construct a general view of the situation and to keep it in mind all the way long, for their easiness and rapidity to adapt to new situations, for their unique capacity to effectively transfer knowledge from one field to another by doing analogies etc.

How One Build a Knowledge Based Society? Bologna Process

A knowledge based society may be confounded (if one translates the text *ad literam*) to a society where each individual has university-related preoccupations, for example, and the main way to progress would be the academic activity. This vision fitting only to a limited professional category (that is the academic community) is a part of larger perspective over a society in the centre of which lies the education process giving to the individual the possibility to apply the acquired knowledge in the field in which he or she was educated, but also giving the ability to approach easily interdisciplinary or transdisciplinary fields. The previous example of the labour market distribution of Physics students is very illustrative in this sense.

In the new paradigm, the education is no longer a process taking place in a limited time period, but within the entire length of a lifetime (***Life Long Learning***), the role of the learner being fundamentally changed in its professional construction (the learning methods, the selection and the organization of knowledge). In this context, one expects an increasing effectiveness of the education by the enlargement of the specialization and by consequence, the development of the society will be based on an efficient administration of resources of all kinds (natural and human resources, infrastructure etc.) thanks to the knowledge accumulated by the society members. In this way, one observes the appearance of a new society increasingly bounded to the accumulated knowledge in the formal education (that is by enrolling to an education system) and renewed continuously during lifetime. Such a society is known as ***Knowledge Based Society***.

Today's technological development level and the evolution of society that is strongly related to it make necessary some changes in the (European) Education systems, especially in the Higher Education Area. The **Bologna Process** announces the necessity of reforms in the Education and Research such as the individuals graduating from the university to be able to face wide variation of requirements of a society evolving in an accelerated rhythm. The society

development is an historical and sociological uncontested fact (corresponding to a new era) [7] and it is supported by economical and geo-political interests. Therefore, the Education reform is not an option (as it is seen by many) but a consequence of these interests, and the **Bologna Process** was designed to guide the European governments in the Education reform process because Education is an essential field in the European construction.

It is also well known that the Bologna Process, a term reuniting a complex of reforms and perspectives, is sometimes incorrectly applied when it is wrongly, insufficiently or not at all perceived by politicians, academic staff, university administration and students communities. This motivates our intention to inform the students on what one expects from the reform and on the perspective on which the reform is needed and applied.

The main long term Education reform objectives are defined, from the beginning, in the Bologna Declaration [4] :

1. **the creation of a system of transparent Education programmes**. This means that two Education programmes aiming diplomas in equivalent specializations should be sufficiently well described such that an automatic recognition of previous studies at different universities is possible.
2. **the organization of the Higher Education in two cycles: the first cycle (*Bachelor*) of minimal duration of three years being needed either to give the possibility to continue the Education in a second cycle (*Master*) or to access the labour market without any further education**. On the other hand, during the second cycle the students are expected to develop a sufficient number of competences to conduct research (for the enlargement of scientific knowledge) or to be able to fulfil the tasks of a possible job.
3. **the implementation of a system of credits whose awarding depends on the effort and on the time to reach the objectives of a course**. A minimal number of credits has to be established for each cycle (today 180 ECTS for ***Bachelor*** and 60/120 ECTS for ***Master***). This system would allow the regularisation of student mobility such that the validation of the minimal required number of credits could be done by attending courses offered by different universities of Europe or even by extracurricular courses (in some exceptional cases).
4. **the promotion of free mobility for students and researchers**. For the students some mobility funding schemes have been implemented **Socrates** (1987), **Erasmus**, **Erasmus Mundus** (2007) in the framework of which the students were receiving a grant (sometimes insufficient) to face the costs of residing in other country. The Erasmus students are given some special help and assistance in the host country[1]. Young researchers may be receive research grants within the programmes like **Tempus** or **Marie Curie Fellowships**. In general the mobility of researchers is a funding chapter of the budget within the **Framework Programmes** of the European Commission.
5. **the cooperation at the European level to ensure the Education quality**. This stipulation refers to the implementation of measures allowing the integration of the European universities into the **European Higher Education Area** where the quality criteria are supposed to be unique (universal).

[1] A special mobility programme for Physics students is the European Mobility Scheme for Physics Students (EMSPS) initiated in 1992 by the European Physical Society (EPS). More information on http://www.kfki.hu/~emsps/ .

6. **the introduction of the European dimension**. By European dimension one usually understands more or less correctly the introduction of foreign languages (in general English) as a teaching language in some of courses in the Higher Education. The purpose of such a measure is the rapid transfer of knowledge and the effectiveness of the mobility. In the larger sense, the European dimension means the cooperation of the Education and Research institutions materializing into common research and education projects (joint-diploma programmes).

One attempts to reach these objectives while respecting the local traditions of each university and nation, shortly, the cultural diversity which is not an impediment, but an element of tremendous value which has to be preserved. Although, at the first glimpse, it seems that the Bologna Process aims the standardisation by stating clearly what has to be done and how it has to be done, these recommendations emerging after lengthy consultations with all the stakeholders (politicians, teaching staff, students, employers) have a very high degree of generality and are intended for guidance rather than for the control of the reform.

Bologna Vocabulary

After tuning the majority of Education structures in Europe [5] one could summarise the survey in some conclusions which have been in fact the recommendations for the implementation of the reform. Remarkably, the terms in which these recommendations have been formulated have some general features (they are applicable in any discipline), they are very integrative (representing in general a combination of singular concepts) and they are strongly related among them. We attempt in the next paragraphs to explain shortly (and hence, non-exhaustively) how this terminology "works".

The central concepts in defining a **programme** (**degree**) are the **learning outcomes** and the **competences**.

By **learning outcome** one understands what a student knows to do, to prove, to apply after an entire course or just after one course unit. These outcomes are evaluated during the exam. For instance: at the end of the first unit of course of Mechanics or of General Physics a student should be capable (among other things) to perform calculations with vectors (learning outcome). To evaluate this outcome the teacher puts the student in a situation of applying his or her knowledge to try to solve an exercise whose solution involves vectors calculations. For the "classical" Physics courses the formulation of the learning outcomes is relatively easy, for the courses in the superior years of a degree this becomes complicated. This is the reason for which the master courses, for example, are some encyclopaedic exhibitions of theories and facts and the exams consist in rewriting them again. The worst cases happen when the teacher forgets what the student is supposed to gain from a course and therefore focuses on lecturing exhaustively on the topics of the course. Finally, the exam transforms itself into the evaluation of some abilities which were not developed after all due to the lack of time.

By **competence** one understands a dynamical combination of various field-specific or general skills/abilities (knowledge, interpersonal interactions). The competences are developed gradually during a programme and they are evaluated continuously. An example of competence is the *oral or written communication* of knowledge [6] (this competence is specific to all fields) and consists of the student capacity to express herself clearly and concisely orally or in written on a field topic she knows. This means that s/he should know the scientific terminology, the scientific rigorous style (the paper organisation, the documentation, the cause-effect principle) etc. In general, this competence is developed in the first years by assigning documentation tasks over topics of general interests (like *Greenhouse Effect* for example) and in the superior academic years (once the student gained some experience) on specialized topics related to the final dissertation (for example). The evaluation of this competence is done during individual communication

(when the student develops the idea in written papers) or during a presentation session when the students are obliged to present orally the results of their documentation.

A field specific competence in Physics is *the ability to model the phenomena*, which means a conjugation of several abilities like the description of phenomena in terms of physical quantities, the specification of evolution/state equations, the ability to simplify and approximate, the reduction to simpler cases etc. Many of these competences are tightly related. For example, the general competence *written or oral communication* is related to the *fundamental knowledge of the field* or to the *capacity to analyze and synthesize* etc, and the specific competence *capacity of modelisation of phenomena* is related to the *theoretical or phenomenological abilities* [6]. Many general competences are **transferable** that is they can be applied to any other domain. A Physicist developing the competence *problem-solution approach* in the field of Physics will be able to apply it easily to any other domains like engineering, finances etc. enlarging in this way her employment possibilities.

The goal of each learning cycle is the cultivation of several general and specific competences. Our opinion is that **the development of these competences and of the learning outcomes too will improve significantly if the students will be informed regarding the objectives of the courses** or of the **course units** and of the programme in general. This should be done periodically (at the beginning of the academic year – during some orientation weeks, the beginning of the semester) and systematically (at the beginning of each course) in written (in the course materials or brochures) or orally by the teaching staff.

The competences and the learning outcomes for each field are specifying the **degree profile** and their development is done during the **degree programme** hierarchically organized in **cycles, modules, courses** and **courses units**. The degree awarding is conditioned by the validation of the **cycle**.

The **cycles** are stipulated in the Bologna Declaration: **Bachelor** (of minimal duration of three years and the validation of a number of courses summing at least 180 ECTS), **Master** (two years and the validation of coursework summing at least 120 ECTS sometimes 60 ETCS) and **Doctorate** (at least three years, the title of **Doctor of Science** is awarded after fulfilling some obligations related to the research activity). The **modules** represent some **courses** which are scheduled in parallel and which are aimed to develop a specific set of competences. For instance a module called *General Classical Physics* (Mechanics, Thermal Physics, Electricity and Magnetism, Classical Optics, Waves) develops the competences *fundamental knowledge of the field*, *phenomenological abilities* etc. Other examples of modules might be something like *Theoretical Physics* (Analytical Mechanics, Quantum Mechanics, Electrodynamics, Theory of Relativity, Statistical Physics, Thermodynamics) which would develop the competence *theoretical abilities*, other *Mathematics for Physicists* (Superior Algebra, Calculus, Complex Analysis, Differential Equations, Equations of Physical Mathematics etc.) for developing competences like *theoretical abilities* and *modelisation* or *fundamental knowledge in the field.*

Usually the validation of cycles is achieved by validating several modules. Our opinion is that the implementation of the module organisation should not limit the students freedom to have options (choose courses adequate to their preferences) especially in the second cycle. We propose, therefore, **the modularization of a certain number of courses considered as general/fundamental and summing a balanced percentage of credits, while the rest of credits to be obtained by the validation of a number of courses freely chosen by the students.** The percentage of credits obtained from the modularized courses should decrease in time during the first two cycles. The balance should incline significantly towards the freely elective courses starting from the second cycle such as in the third cycle the students should be able (if the case) to chose only elective courses. The third cycle (doctorate) should be dedicated exclusively to the research and the possibility of courses validation should be free and optional.

References

1. Magna Charta Universitatum, 1988.
2. Sorbone Joint Declaration, 25 Mai 1998.
3. Bologna Declaration (Joint Declaration of the European Ministers of Education), 19 iunie 1999.
4. The Bologna Declaration, on the European Space for Higher Education: an explanation, http://ec.europe.eu/policies/
5. Tuning, *An introduction to Tuning Educational Structures in Europe – University Contribution to Bologna Process*, Tuning general brochure presented at Tuning Validation Conference, March 2007.
6. Tuning, *Subject Area Group – Physics*, Tuning Validation Conference, March 2007.
7. Liviu Bilteanu, *Physics Students' View on the Knowledge Society*, EUPEN General Forum - Sant Feliu, 2007.
8. www.physics2005.org

Teaching and Learning Methods

While in the first section one has focused on the presentation of the general framework and on the introduction of terms, in this section one focuses on the presentation of the application of these ideas at the programme level by the enumeration of the main methodologies of teaching and learning. We strongly emphasize what it has been said before that the students should know the "game rules" from the beginning, that is a possibilities list should be provided in order to make them capable to face the requirements of the Education programme. One does not attempt to present a collection of receipes, but the possible ingredients and some various experiences with the help of which the students might be able to define their own learning style and adapt it to the learning methods.We hope also to inspire the teaching staff to use the new teaching approaches in their activity.

A Very Short Review of the Modern Learning and Teaching Methods

Within the "classical" paradigm of teaching, in which the educator is the prime source of knowledge and the student "the consumer", the main teaching methods might be the lecture, the explanation, the proof, the exercise, the study case etc. In the new context, of a knowledge-based society, these methods become insufficient and inefficient, the principle of substantial learning being broken. This happens because the quantity of information necessary to construct a correct general vision grows rapidly. Instead of compensating and reorganizing the information using more general principles, the educator adds continuously information to her expositive course. In this way the course becomes over charged and, in the absence of some well formulated objectives (learning outcomes), the evaluation becomes more and more difficult. On the other hand, the students have a natural curiosity and desire to explore (specific to their age), therefore, sometimes, feeling the insufficiency and the limitation of the course panorama, they are starting themselves to look for the information and once submerged into the information ocean and without the intellectual instruments of searching, selection and systematization, they will have always the frustration of not mastering the minimal. Therefore they are considering the university studies useless, an absolutely needed "torture" necessary to obtain a diploma allowing them to work lately.

It is obviously necessary to change the approach of the education act by adopting a new attitude, in which the student is informed about what she will learn and what it is expected from her, studying and searching methods are suggested to her, some reference points of the programme are defined allowing the educator to conceive a minimum of abilities necessary to lead to an end a given task, one condensate and systematize the information because what was written in tomes few centuries ago, now it may be taught in a two hours lecture [1]. The student should be far away of being static, but involved with a greater responsibility in searching all the study opportunities (seminaries, team learning sessions organized together with their fellows or assisted by students of superior years, individual study and documentation, lab practices, popularization presentations, workshops, trainings, exchange programmes like Erasmus, internships), to explore all the available resources (databases, libraries) and to evaluate continuously her own professional project.

Among the teaching methods having an immediate impact we mention: **multimedia methods**, **computer-based methods** and **problem-based method**. All these methods have

been presented and discussed during the EUPEN General Forum in St. Feliu, Spain, September 2007.

The Working Group no. 3 (of the total of five working groups[2]) within STEPS deals with the analysis of the **multimedia methods** used in teaching Physics. Beyond the classification of the main sources of multimedia animation, the members of this group attend various conferences on this topic (for example, *Multimedia in Physics Teaching and Learning*) and they promote the animations as an alternative or/and supplementary method to teach Physics. The two dimensional visual examples may be illustrative, but the greatest impact is produced by the three dimensional effects animations in which the assistance experience the feeling of immersion into the physical reality. The direct advantage of these animations is that they can illustrate directly and rapidly how the laws of Physics are applied in different situations; however the disadvantage is the fact that they need a specific instrumentation (computers, projectors etc). This disadvantage is reduced by the fact that many codes are accessible on Internet or within the commercial products.

Within the Physics Department of the University of Oslo, one uses more and more the computers in teaching Physics in what might be called **computer-based method** or the **computational approach** of teaching Physics. This method consists in using the programming languages to create computer programmes to find the numerical solution for different problems or to perform simulations. For example, while during the lecture one presents the mathematical pendulum, whose solution is found out by solving the equation of motion, the students are required after that to find out numerical solutions for anharmonical oscillations or for oscillations of great angular amplitude of the gravitational pendulum. Morten Hjort-Jensen [2] claims that this method is very fruitful and moreover, gives to the students the freedom to find out solutions to their own problems.

Instead of starting from mathematical abstract considerations to illustrate the Physics laws, Derek Raine from University of Leicester [4] advocates the teaching Physics by starting with daily problems. The **problem-based method** consists in solving problems which are not simple numerical applications of Physics law, but the applications of these laws in practice. Bellow the reader may find an example of such a problem.

The lead shot used in shotgun cartridges consists of small spherical pellets 2-3mm in diameter made by pouring molten lead through a frame suspended in a high tower, a method used since its invention by William Watts in 1782. In order to produce spherical shot the lead must solidify before the pellet has reached terminal velocity. How high should the tower be?

One evaluates the knowledge on the followings: ***dimensional analysis, kinematics, Newton's law, and conservation laws***.

We suggest to visit the following webpage http://www.le.ac.uk/i-science/about/pbl.html for more informations.

[2] STEPS activity is developed within five working groups where Physics education specialists are activating. Each group has a central topic on which the members are working. The working group coordinated by a coach is investigating the actual status related to the working theme in Europe by doing consultations and surveys and, sometimes, they are doing some recommendations related to the implementation of eventual reforms at the curriculum level.

References

1. Gheorghe Popa, *Physics Education and Physics Research*, Proceedings of the 7th EUPEN General Forum, Saint Feliu, September 2007.
2. Morten Hjorth-Jensen, *Computers in Science Education. A new way to teach science!*, Proceedings of the 7th EUPEN General Forum, Saint Feliu, September 2007.
3. Sir Peter Wiliams, *The Physicist in the European Knwoledge Society*, Proceedings of the 7th EUPEN General Forum, Saint Feliu, September 2007.
4. Derek Raine, *What is Physics*, Proceedings of the 7th EUPEN General Forum, Saint Feliu, September 2007.

SITUATION REPORT: Romanian Physics Education and Its Methods. The Romanian Physics Students: the Present and the Uncertain Future

In Romania, there are independent Faculties of Physics in the following universities : University of Bucharest, University of Iaşi (Alexandru Ioan Cuza University), University of Cluj-Napoca (Babeş Bolyai University), University of Craiova, University of Timisoara (West University) and Departments or Sections of Physics at the Polytechnic University of Bucharest, University of Constanta (Ovidius University), University of Oradea, University of Piteşti, University of Targoviste (Wallachia University), University of Baia Mare (North University), University of Targu Mures (Petru Maior University). Obviously, the Universities where the Faculties of Physics are independent are gathering the greatest number of students and most of the human and material resources. Among them the Faculty of Physics of the University of Bucharest distinguish itself as the greatest Physics Education institution in Romania, due to its position on the Magurele "Platform" a Research campus lying in the south-eastern part of Bucharest where most of the Physics fundamental research laboratories are located.

Physics is taught in Romania starting with the sixth grade (12-13 years old) and the pupils in the seventh grade may attend already the Physics contests (Olympiads). The Olympiads tradition ensured for a long time a Physics students population in Romania. Either winners of national or international Physics Olympiads, ex-members of the national teams attending the International Olympiad of Physics or simply attendants to the local or national Olympiads, the knowledge in Physics of these students are coming from their high schools increases the level of the first years' classes at the Faculty of Physics. However, in general, the winners of the Olympiads are choosing to study at the Polytechnic Universities (Electronics and Telecommunications, Control Engineering or Computing)or they obtain the financial support to study at the most famous universities in United States of America and Europe. In the case they chose to spend one year at the Faculty of Physics they leave afterwards to the same highly regarded universities in United States and Europe.

This is not very "tragic" because these students represent approximately 1-2% from the total population of student, but the next big student migration "wave" is registered after they obtain the Bachelor of Science/Engineering and they chose to continue their Master and/or Doctorate in the Northern American or European universities. The few of them who chose to stay are very unhappy with the lack of opportunities and the general unoptimistic trend of the Romanian society, although economically flourishing but still disturbed by political instability.

After joining the European Union, the situation is visibly improving (however not in the most rapid rhythm), the Faculties of Physics and the research institutes accessing some funding opportunities allowing them to purchase instrumentation and logistics and therefore to develop high quality education and research activities. The employment in the field of Physics and related fields and the salaries of the Physics graduates are much lower than those of their peers in the

European Union. And this adds to the continuous quality decreasing of the secondary education, which, leads, of course, indirectly to a lack of students capacity to adapt to the requirements of the courses in the first years of university studies.

Given the fact that Higher Education in Romania is funded by allocating a fix amount for each enrolled student, to maintain the teaching activities the faculties councils took some decisions which damaged the education act: the elimination of the admission exam the only admission criterion being the Baccalaureate Diploma (the secondary school diploma) and the "relaxation" of the education programme in the first cycle such that many courses are aiming to create competences with whom students were coming from high school in the past. Therefore, the Faculties of Physics become a sort of an academic "refuge" for those who were not accepted in other Education institution or who want to enjoy the students rights (transport reductions, low cost lodging in the University dormitories).

The key issue is not the passing from the heavily difficult traditional high school textbooks of Physics to the various heavily coloured alternative textbooks (as most of the high school teachers would say), but the fact that there is no harmonization of the Education system at the national level, because this one is permanently "reformed" by the different regimes.

The main deficiency of the recommendation we have made in the previous section to the Physics students to improve the study strategy is the fact that we place the students in "ideal" conditions, in which she has all the necessary financial resources to have a decent living during her studies. Following the ESIB survey [1], this is very far from the true situation in many European countries. In Romania, many of the Physics students are working to support themselves or they are enrolled as students just to be able to work, and their number is continuously increasing. Far away of being ideal, the organisation of the Education programme is not very well optimized, while the reform is closing to the end, but the implementation is far away to be achieved.

To this main issue, one may add other issues of social nature (the medical assistance, the diseases prevention, the lack of cantinas, the lodging conditions) and cultural (the lack of interest for extracurricular activities, for communication at the national and international level).

However, one cannot deny a particular feature of the Physics Education, a sort of universal value widely known, that is, independently of the teaching quality, the competences gained by the Physics students allow them to adapt to the requirements of many fields from University or school teaching to business and insurances [2].

References

1. ESIB Bologna Committee, *Bologna Process with Students' Eyes*, London, May 2007.
2. Tuning, *Subject Area Group – Physics*, Tuning Validation Conference, March 2007

Planning, Planning, Planning ...

The First Steps toward a National and International Physics Students Organisation

The independent students association "tradition" re-started in Romania with the anticommunist Revolution in 1989 and with the protests in the beginning of 1990 against the newly installed neocommunist regime, when the young "League of the Students in the University of Bucharest" (the precursor of the today Association of the Students in the University of Bucharest) participated heavily. While the new society was stabilizing, the role of associations in students' lives changes and this was happening unfortunately together with the impact diminution of their message. The typical activities of the student organisation at the national and international level is materialized into social and cultural events (festivals, parties, books exhibitions, global content cultural events – the most known is the STUDENTFEST), educational and professional events (jobs markets, seminaries and trainings on different topics – mainly on youth strategies, management or communication) and militating at national and local level (University Senates, Faculty Councils) for students rights.

While the first two kinds of the events are welcome in the students lives, the militant activity is either reduced (due to a lack of students interest to fight for their rights) or is sometimes unconfidently perceived because it takes place on a "playground" where the "players" are not trusted by many students: the university or state administration, politicians etc.

From these series of activity animating the students life (mostly gray) is missing the International Relation activity and professional orientation of students and this is due to the different methodologies and kinds of information specific to each field. It is therefore needed at the local level an association environment ready to present to the students the overview related to the professional opportunities, international relations and the national and European policies that may affect their present and future.

Although this initiative may be highly regarded there are two aspects that have to be taken into consideration: the target audience and the implementation. In general the Romanian Physics students may fall into two extremes: either they are exclusively interested to obtain a diploma (of any kind) and then find a job or they are extremely preoccupied of their field of study such that they ignore all the opportunities during the studentship period. In the latest years, it seems that the number of those falling in the first category is continuously increasing. This is not very bad. The worse facts are the low number of extracurricular activity opportunities and the decrease of students' initiatives.

While the appetite for debates, social and information events, international relations may be raised by a good dissemination, the initiative and the constancy to lead to an end a project are spontaneous qualities appearing less and less among the students and that is a so-called "cultural" defect.

At the European level, the students association – reference in the consultation of the EU youth policies is the European Students Union (ESU, www.esib.ro), an organisation with a

federative role reuniting the main students movement from all the European countries (members or not of the European Union). ESU is an active militant of the students' rights, participating to debates and editing documents which present the association positions (sometimes supported by the results of surveys) regarding the EU policies (generally those related to Education).

Without the impact and the resonance of ESU the **International Association for Physics Students**, www.iaps.info is organising for more than twenty years an annual conference of Physics students. Apart of this event with a true international dimension, IAPS was not remarkable in the latest years for its militant and information activities. With a generous support from the **European Physical Society,** www.eps.org, IAPS can have a good role in ensuring the cohesion of the European Physics students.

European Physics Students Initiative

Born at the EUPEN General Forum in autumn 2007, in St. Feliu, Spain when an important number of students participated, European Physics Students Initiative (EPSI) is a student reflection group which aim to collaborate with the SOCRATES thematic networks and not only to debate and disseminate the main ideas of Physics Education and Research policies and by informing the students about the trends in these domains, hopes to stimulate them to actively participate to debates.

By this, EPSI wants to promote the Physics students as partners in the Education act and to improve the quality and quantity of information reaching them. EPSI cannot exist without the participation of the students; therefore any contribution is welcome and highly regarded.

Contact:

For more information visit our website :

http://www.eupen.ugent.be/steps/epsi.php

or contact us at :

liviu.bilteanu@cea.fr