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Realizing an international student exchange program for Belarusian engineering students to Belgium

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ABSTRACT

In the framework of the Erasmus+ project “Improvement of master-level education in the field of physical sciences in Belarusian universities”, 14 Belarusian students participated in a one week student exchange program to KU Leuven in Belgium. The training focused on a number of attractive engineering topics related to energy efficiency, clean energy and clean technology in general. This initiative aims to facilitate the modernization of the physics and engineering educational programs in Belarus including the integration of the European bachelor master degree concept. The overall satisfaction of the students as well as of the teaching staff about the training week is large. The present paper discusses the main goals, the practical realisation and an evaluation of the one week training program.

Conference Key Areas: Physics and engineering education, attractiveness of engineering education, skills and engineering education.

Keywords: international student training

INTRODUCTION

The Erasmus+ project “Improvement of master-level education in the field of physical sciences in Belarusian universities” is an educational collaboration between three European Union universities (Riga Technical University (RTU), University of Cyprus, KU Leuven), four Belarusian universities (Belarusian State University (BSU), Grodno State University (GrSU), Gomel State University (GSU), Belarusian State Technological University (BSTU)), the Ministry of Education of Belarus and two industrial partners [7].

The project aims to improve the relevance of master degree programs in the field of physics in Belarusian universities. This improvement includes the integration of the

European bachelor master degree concept at the Belarusian universities. A transition from the educational 5 plus 1 system to the 4 plus 2 system is an important goal. The bachelor program reduces from 5 to 4 years implying a challenge to prepare the graduated bachelors for the labour market in a shorter period of time. The master program increases from 1 to 2 years implying the need for new up-to-date course material.

At the Belarusian universities, an increase of the number of master students is expected and a larger part of these master students must be prepared for the industry i.e. not only to realize a PhD. This means the new master program needs a closer link with the labour market. Input is expected from the European partners to inspire and help the Belarusian academic staff when realising this modernization.

This modernization of the physics and engineering educational programs requires the implementation of innovative ICT based teaching methods, the development of innovative learning methods, the development of updated courses and teaching materials (including e-books). It is important the teaching of new and updated courses starts during the lifetime of the Erasmus+ project with an adequate number of retrained teachers and students.

Exchanges to European Union universities of Belarusian teachers and students are needed. The experiences of these teachers and students are not only useful for themselves, their experiences need to and will disseminate in the campuses of their four Belarusian home universities [4]. As also mentioned in [3], “any student who is able to receive a better education or broaden his/her personal horizon due to participating in an exchange and scholarship programme is a huge plus”.

Student training programs at KU Leuven, Riga Technical University and University of Cyprus have been planned. The present paper mainly focuses on a one week student exchange program, the first student training program of the Erasmus+ project, which has been organised in February 2017 to KU Leuven in Belgium. When organizing this event, the KU Leuven engineering campus in Ostend relies on a long standing tradition of international activities including the development of international curricula and organizing internationally oriented programs [6].

1 THE MAIN GOALS OF THE STUDENT EXCHANGE WEEK

The training program focuses on a number of topics related with energy efficiency, clean energy and clean technology in general. These academic and technical state-of-the-art topics cover a broad range of interests as reflected by the different professional orientations of the participating students and the modern multidisciplinary industrial reality.

The goals of the student training week are much broader than just the teaching of state-of-the-art technology to Belarusian students. Integrating research in all its aspects in an educational program is a major concern at the Faculty of Engineering Technology of the KU Leuven. This concern is reflected in the training program by visiting two research laboratories (lighting and Electro Magnetic Compatibility) and presenting research results of a Belgian PhD student (wind impact on dunes).

When considering the educational objectives of the Faculty of Engineering Technology at KU Leuven, application oriented engineers are educated. This application oriented approach is reflected in the exchange program by visiting an international industrial company (producing agricultural machines and having connections with the Commonwealth of Independent States (including Belarus)). Since the new Belarusian

master program also prepares to employment in the industry, such a company visit is mandatory. It is also useful to demonstrate how the Belgian research laboratories cooperate with the local industry.

Intensifying the contact between the European Union and Belarus is also an important goal of the Erasmus+ project. From this point of view, the stay of young and promising Belarusian students in the European Union, Belgium and Flanders is important. Besides having important personal relationships and personal development, obtaining familiarity with the European Union and Belgium has been stimulated by:

- a session comparing the energy policies in Belgium and Belarus,
- cultural historical activities including the visit of Medieval cities like Bruges and Ghent,
- obtaining familiarity with the Belgian climatic conditions and nature (e.g. the formation of dunes at the Belgian coastline).

Increasing familiarity with the English language, the main lingua franca in the scientific world, is important. English is the official language during the entire week and a dedicated course on general and scientific English has been included. The training week allows to realise informal and formal English practicing.

2 REALISATION OF THE MAIN GOALS OF THE TRAINING PROGRAM

The practical organisation of the training week is a result of a decent communication between all European Union partners (including the receiving KU Leuven campus in Ostend) and the Belarusian partners at the management meetings of the Erasmus+ project. The needs and suggestions of the Belarusian partners have been taken into account at an early stage of organization [1] in order to satisfy their expectations.

The student training week focuses on a well-chosen number of topics related to energy efficiency, clean energy and clean technology in general. More precisely, the training program contains sessions on:

- energy supply and electrical energy generation in Belgium and Belarus,
- solar energy in combination with energy storage and fuel cells,
- optical communication,
- energy savings in lighting technology and innovative lighting,
- innovative material properties,
- the use and production of biodiesel,
- Electro Magnetic Compatibility and the design of reliable electronics,
- wind speed measurements and wind impact on dunes.

These topics are closely related to courses taught in the bachelor and master programs at the KU Leuven campus in Ostend (Belgium). These topics reflect the know-how at the campus mainly originating from social, commercial, purely academic and industrial oriented research.

The training week contains a combination of theory sessions (PowerPoint Presentations), laboratory sessions, practical demonstrations, a company visit, visiting research laboratories and cultural activities. The combination of this broad range of activities will inspire and help the Belarusian teaching staff and student population to organize modernized master programs which have a closer link with the Belarusian and international labour market.

By focusing on attractive topics like energy efficiency, clean energy and clean technology, the attractivity of engineering and engineering education has been

emphasized. As explained further on in the paper, the participating students appreciated such an approach. By including laboratory sessions, a broader range of engineering skills have been addressed.

3 PROFILE OF THE PARTICIPATING STUDENTS

Although the size of the visiting group of students is rather small, the group represents a large diversity in many aspects. The group is composed of 14 persons (very similar with [8]) originating from four different Belarusian universities (BSU, GrSU, GSU, BSTU). Each university selected three or four students. This limited number of students allowed the Belarusian universities to choose highly motivated students. All students are volunteers and they are also strong promising students.



Fig. 1. Visiting group of students

The visiting group is composed of two professors having a PhD, 4 PhD students, 1 master student (still studying the 1 year master program) and 7 bachelor students. The diversity is also emphasized when taking in mind the different professional orientations of the students. More precisely, the professional orientations include chemistry, nuclear physics, computer science, physics, metrology and electronics.

Also when considering the prior knowledge of the English language, there is a large diversity in the group. In general the participants are rather familiar with reading English texts and understanding spoken English. When considering the ability to write English and especially to express themselves orally, there are large differences between the individual participants.

Based on the evaluations performed by the students and the teaching staff, it is possible to conclude that the general scientific training of all students allows them to understand the sessions on clean energy and clean technology. When considering the English course on general and scientific English, the teaching professor focused towards a medium prior knowledge for the students.

4 EVALUATION OF THE EXCHANGE WEEK BY THE STUDENTS

At the end of the week, two self-designed questionnaires containing positively defined statements have been offered to all 14 Belarusian students. Although the questionnaires are inspired by pedagogical science [2] and practical experience [6] available at the KU Leuven campus, the questions are adapted to the practical realisation of the training program.

A first questionnaire evaluates the general appreciation of the week including three main topics.

- 1) The general objectives of the week have been evaluated (including exercising the use of the English language, obtaining an introduction to the culture and the history of Europe and Belgium, learning the importance of international contacts and collaboration).
- 2) The program of the activities has been evaluated (including the scientific and technical content of the lectures, the clarifying nature of the laboratory demonstrations, the ability to perform experiments, visits to local companies and research laboratories, getting familiar with a virtual learning environment).
- 3) The accomodation and the hospitality of the KU Leuven staff has been evaluated.

In order to obtain an adequate dispersion of the data, a five-point Likert scale was used in the questionnaire. At the end, a limited number of students also mentioned an open statement concerning their experiences.

The general satisfaction of the participating students was very high on all topics. When considering the general objectives of the week, on average 73.2% indicated the highest score 5 (ranging from 71.4% to 78.6%) and on average 25% indicated the score 4. On average, 98.2% of the indicated scores are 4 or 5. When considering the evaluation of the program activities, on average 61.9% indicated the highest score 5 (ranging from 35.7% to 85.7%) and on average 29.8% indicated the score 4. On average, 91.7% of the indicated scores are 4 or 5. Especially the possibility to carry out practical experiments in a laboratory environment (technical hands-on sessions) is extremely appreciated.

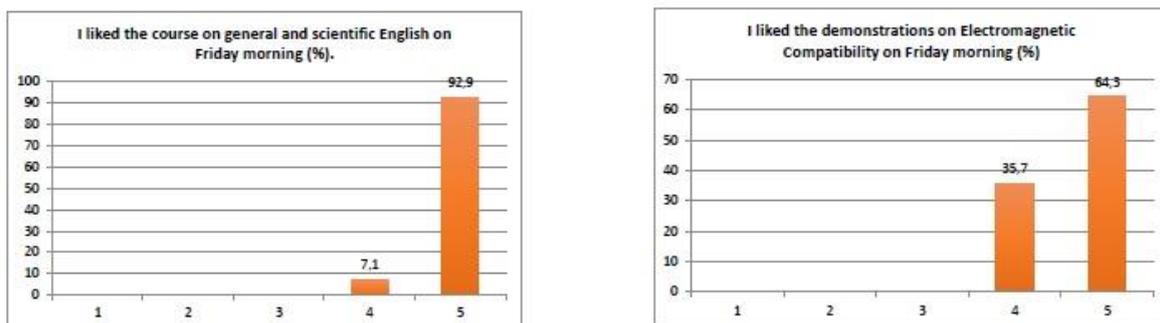


Fig. 2. Detail of the student questionnaire results

When evaluating individual sessions by a second questionnaire, all individual appreciations are really high. Figure 2 gives an excerpt of the results of the questionnaire giving the appreciations of the sessions on English and Electro Magnetic Compatibility.

The laboratory session of making biodiesel and the touristic visit of the historical city of Bruges both got the maximum score of 5 by all students. An interactive session on general and scientific English obtained a score of 5 by 92.9% of the students (7.1%

gave a score of 4), a more theoretical but also interactive session on energy and fuel cells obtained a score of 5 by 85.7% of the students (14.3% gave a score of 4). At their home institution, students do not lack traditional “ex cathedra” courses. The evaluation demonstrates that the students enjoy interactivity when realising an international training week. This observation is important when organising the future student training programs and when developing new teaching and learning methods in Belarus.

The overall satisfaction of the participating students will encourage them to maintain contacts with foreign countries in general and the European Union in particular. When focusing on the current Erasmus+ project, the satisfaction related to the first training week will encourage other Belarusian students to participate in other international weeks which will be organised in Riga and Nicosia.

5 EVALUATION OF THE EXCHANGE WEEK BY THE TEACHING STAFF

At the end of the week, a self-designed questionnaire containing positively defined statements, has been offered to the teaching staff realizing the individual sessions. Also this questionnaire contains a five-point Likert scale and formulating open statements concerning their experience has been stimulated.

In general, the satisfaction among the teaching staff is also large since they are satisfied about the organization of the international week (62.5% gave a score 5 and 37.5% gave a score 4) and they have the opinion such a student training is worth repeating (50% gave a score 5 and 50% gave a score 4). Despite this satisfaction there are a number of stimulating conditions which are not always that easy to fulfil. The teaching staff finds it important that:

- The teachers have sufficient information about the prior knowledge of the students which allows them to build upon this prior knowledge (see the results in Figure 3).
- The students have a sufficient knowledge of the English language since during the entire week the English language has been used. It is also important the prior knowledges of the students are more or less comparable.
- The diversity in the student group is not too large (concerning prior scientific technical knowledge).
- The students are motivated to participate and to acquire scientific technical content.

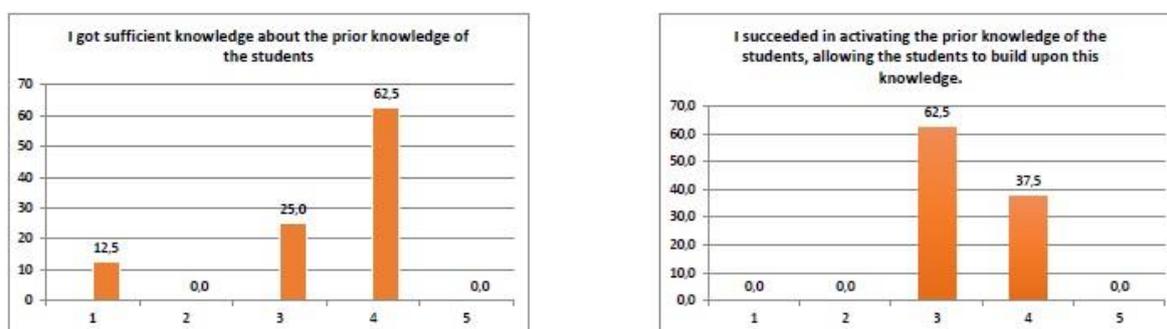


Fig. 3. Opinion of teaching staff concerning prior knowledge of the students

Obtaining sufficient information about the prior knowledge of the students, when considering scientific technical subjects and the English language, is a common challenge for the sending Belarusian universities and the organizers of the receiving

university (see the results visualised in Figure 3). Decent communication about that topic has to be a concern when organizing the next student training programs at the Riga Technical University and the University of Cyprus.

A more or less homogeneous group of students is to some extent obtained by the general scientific training all participating Belarusian students have. However, a student group which is composed of

- students of different universities,
- bachelor students, master students, PhD students and participants who already finished their PhD program,
- students studying different professional orientations

inherently implies a diversity. It is a challenge for the receiving teaching staff to face this situation.

During the student training week in February 2017, there were absolutely no problems concerning a lack of motivation of the participating students. The Belarusian universities have selected strong promising students which were all volunteers to participate. These promising students are able to disseminate their experiences at their Belarusian home universities [4, 5] and the local industry.

Due to the general satisfaction of students and teaching staff, it is clear that future international weeks can be organised based on a similar philosophy. When considering the international weeks which will be organized in Riga and Nicosia as part of the current Erasmus+ project, the teaching staff of Riga Technical University and the University of Cyprus will take the suggestions into account formulated by the KU Leuven teaching staff.

The visiting Belarusian students were not able to participate in regular classes with European students. Due to practical reasons, the training program has been organised during a holiday week of the local Belgian students (similar with the situation discussed in [8]). When organizing future training programmes, it can be useful to include contacts (scientific and personal) between the incoming Belarusian students and the local European students.

6 SUMMARY AND ACKNOWLEDGEMENT

In order to integrate the bachelor master degree concept at Belarusian universities for physics and engineering students, collaboration between Belarusian universities and universities in the European Union is very important. From this point of view, a student exchange week has been organised which allowed Belarusian students to get familiar with the educational system of the Faculty of Engineering Technology of the KU Leuven in Belgium. The student training week focused on topics related to energy efficiency, clean energy and clean technology but also linguistic and cultural aspects were considered. Based on a final evaluation among the participating students and the teaching staff, it is clear that the overall satisfaction is large. This satisfaction will encourage other Belarusian students to participate in similar student training weeks which will be organised to Riga and Nicosia as part of the Erasmus+ project "Improvement of master-level education in the field of physical sciences in Belarusian universities".

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