Present Trends and Possibilities of International Integration of Engineering Education at Technical Universities in Slovak Republic

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Abstract: Traditional engineering education at technical universities can be recently considered as a highly integrated study penetrating into many scientific disciplines. The integration trends of technical education are manifested mainly in the area of introducing innovative study programme having an interdisciplinary character. When creating such study programmes and the study structure, the emphasis is increasingly laid on a maximal flexibility of the education, providing students with the possibility of their own selfprofilation according to requirements or demands of industry. That is why individual mobilities of students allowing them to work on cooperative projects between universities and the industry are strongly supported. The cooperation is oriented toward a common utilization of research laboratories for solving tasks of applied research and fundamental or theoretical research. Moreover, the international character of the integrating effort of particular technical universities plays an important role in drafting educational programmes on various levels of the engineering study. In the contribution, a present situation in the engineering university education at selected technical universities in the Slovak Republic is described. Simultaneously, possibilities of developing programmes of engineering education are indicated from the viewpoint of participating the universities in the international exchange of informationa at all levels of academic and scientific-research activities. Also, a model of distant education operating at the Technical University in Kosice, in which accessible and progressive methods of lecturing are used, is introduced. This contribution also hints at the possibilities of the international support of the education through various foundations as well as at concrete aspects of international cooperation in the area of academic exchange of students and teachers, especially in the framework of DAAD. A part of the contribution represent some results of analyses concerned with the creation of internationally cooperating educational institutions, namely academic institutes, departments, integrated teams, etc. Using a practical example, a possibility of establishing joined European department for mining and mineral engineering is presented, that could substitute for many of present mine academies and universities in the area of central Europe. It is based on the tradition of the mining engineering education at the BERG Faculty of Technical University in Kosice, as well as of other, historically well known mining academies or universities located in the region. The main idea of such conception is the need for a permanent transformation of study of the university mining engineering to the interdisciplinary study with a marked international character. An indivisible part of such engineering education should be aesthetization, humanization and ecologization of the curricula contents and structure of the study directed to geoaesthetics.

Keywords: engineering education, distance learning, ICT, foundation

1. Introduction

Technical engineering education at the Technical Universities in SR has a character of an integral and multidisciplinary university education. It has been using all known, and from the international point of view, existing and acknowledged forms of education in daily, distant and life- long learning. Similarly as in other educational institutions in SR, the education at the Technical Universities is free of charge. Within the framework of organization and realization of individual forms of technical education, new or innovated procedures, methods and

techniques have been sought in the process of the engineering education. The aim is to create a functioning and highly progressive educational system which makes it possible for students to use all accessible techniques and methods of an information community. The Technical Universities in SR took hold of the main trend of an Information community, e.g. to let the engineering education be based on information or knowledge and skills how to work with information. Besides the main specialization and activities of Technical Universities, e.g. the development of the base for international cooperation in the field of multi-level information exchange , the most significant mission of these institutions is the professional preparation of students for a complete analysis, selection and creative processing of accessible technical information. At present it becomes evident that new information and communication technologies (ICT) are not only an essential part and a cause of ongoing changes in the technical education process, but also a unique tool for achieving maximum flexible education in the field of research and science.

2. International Projects and Integration of Engineering Education

The Technical Universities in SR put stress on the creation of relevant conditions for continuous education of students. The main target is to gradually create so called permanently learning community. The transition to the information community deeply effects the sphere of engineering and technical education. Similarly, as in other fields of education there is also in the field of the technical education an evident trend in the use of obtained and used information that was verified in international research projects. There are, as a rule, co-operation , research and scientific projects, which are supported by various programs within the framework of EU-member states. Slovak Technical Universities have also been involved in these programs. Out of more significant programs which enhance the development of research –technological and exploration-scientific field several projects have been currently realized. Out of these more significant programs the 5.RP EU is to be mentioned, which is orientated to research and development programs that are being solved at academic and university institutions, e.g. also at Technical Universities. From the point of view of already mentioned Information Community the ESPRIT-program can be mentioned, which is devoted exclusively to Information Technologies (IT). It represents an integrated program of industrial and technical projects for the research and development of new technologies. For Slovak Republic, as one of the smaller countries in Central and Eastern Europe, the program INCO has a significant value from the point of view of achieving a higher level of education. This program is intended for science and research field, as well as for a scientific and technological cooperation. For obtaining information from the research and research activities intended for technical engineering there is the program CORDIS.
This program represents an offer of EU- Information Service, which enables an effective approach to complete information not only in the technical research. It would be possible to name further existing programs and initiatives, but from the point of view of an education support of a new Information Community the above mentioned programs have a significant value. This also accounts for the engineering education which is all the more directed for seeking environment friendly technologies for obtaining and processing material and resources exploitation, as well as for a research and exploration of new technologies for exploitation of reusable energy. In this process it is necessary and urgent to provide Technical Universities with information and communication technologies (ICT) and to integrate these technologies into the educational process. In these efforts the Technical Universities should have the programs at their disposal which are intended for education support by means information technologies. The main tools of these are computers, which enable a quick access to information -e.g. intangible property, mainly with the help of Internet. Many individual mobility schemes for research and pedagogical workers and students of the Technical Universities are designed for mastering and developing of information techniques. It can be stated that in the time of forming a multi-international information community the computer literacy enables the most effective way of study.

2.1 Technical – engineering education in the international relation

The university and technical-engineering education in Slovakia has its traditional position. The study is being realised in humanitarian and technical universities in all forms of the education. The Slovak universities are engaged in the international exchange co-operation on various academic levels. The keystone of this co-operation exchange is in widened participation of students, university teachers, scientific and research workers in scientific-research projects and educational programmes. In this international co-operation the non-government organisations and foreign private foundations have their unsubstitutable role. These foundational non-state organisations, at very advantageous conditions, in versatile ways, support, through their programmes, the educational, scientific and research activities of the Slovak universities. They give those interested in the study the scholarships for the support

of gradual, as well as postgraduate education, and at the same time they allocate financial means for research and scientific projects for young scientific workers. There is a great number of foundations world-wide, which support the educational programmes and projects of the scientific co-operation. One of them is the DAAD Foundation (Deutsche Akademische Austausch Dienst) with the seat in Bonn, Germany. The main role of this foundation is in the development of partner and co-operation relations among universities in Germany and academic institutions abroad. Through this foundation, students of the Slovak universities can get their scholarships. As in the past, also at present, in this exchange also students, young scientific workers and teachers of the Technical University of Košice take part. The participation at the given exchange also has the Faculty of Mining, Ecology, Process Control and Geotechnologies (Faculty BERG), the foreign partner activities of which are oriented on the German universities in Aachen, Clausthal, Berlin and Freiberg.

The technical universities in Slovakia give students enough possibilities of the education. The technical education has the character of the university education, while it uses all the progressive and classical forms of study. An important factor at the education of students and doctorands is a high degree of the informatization of the study, with the worked out methodics for the elaboration of a developed academic infrastructure, which would use the world-wide academic computer network. In this connection the Internet plays an important role. Besides the informatization, the technical universities are oriented towards a higher humanisation and aesthetisation of the study within the scope of individual study and science fields. A part of the engineering education is also a high degree of the ecologisation and economisation of the study, even at the level of special subjects. The basis, however, is in the technical –engineering study coming out from the technologies, which at present, more and more, are oriented towards progressive technologies. An inseparable part of the university education is the work and activities in research and special laboratories, which are aimed at the visualisation and monitoring of technological processes in laboratory and pilot plant conditions. The technical universities as a rule do not have sufficiently equipped these laboratories by the most modern apparatuses and devices, which is solved by renting the laboratory devices, or buying used devices. Despite the fact that the technical and humanitarian universities in Slovakia have recently come trough transformation changes, the material development of universities is still behind and the deficit in the technical and laboratory equipment of the basic units of research and education is still evident. In this connection it is necessary to draw attention to the possibility of common research within the scope of the partner relations with foreign countries. It consists usually of the utilization of research laboratories, in which there are high-duty and peak devices, that within the scholarships can be used by our students or young scientific workers in the solution of research projects. The experience up to now shows, that the technical equipment of the laboratories at renowned universities in Germany is on high level. The scholarships for students and scientific workers, or university teachers, either short-term, or long-term, enable to carry out the part of the defined basic research in a foreign country without allocating financial means for this research. At the Slovak universities the study has wide theoretical fundamentals, with the distinct practical research results' application in the technical and technological practice. The research activities are concentrating within the scope of science and study fields on basic working places of universities. The main feature of the research at the Slovak technical and humanitarian universities is its basic-theoretical or application character, with possible applications in natural and technical sciences. The carried out research, at the same time, enables the mutual participation of other science fields within the technical universities. In many cases the research is carried out co-operatively with the foreign partner, which is the assumption of the international research and scientific projects. The international co-operation of the technical universities is being developed towards the intensification of activities, with regard to four main aspects of the co-operation. First of all it is the deepening of the up to now, already existing, co-operation with foreign partners, furthermore the searching and establishing contacts with new partners, but also the introducing new international EU projects and support of those university working places, that so far have not developed the co-operation with foreign countries. The educational practice at the Slovak universities proves, that in the area of development of the international co-operation there are also possible activities utilising offers of the foreign foundations, connected with various projects. Among these foundations in Slovakia the DAAD has its firm position.

3. Information Technologies Objectives in Engineering Education

The Technical Universities in Slovakia make every effort to create relevant conditions for their students, studying in various scientific and study branches, and for their scientific and research workers for development also in the field of information technologies build up, in education and research. For international integration of the engineering education at the Technical Universities basic areas have been defined, necessary for their engagement into the processes of education conditions creation for the future information community.For the technical engineering education it will be necessary to secure following:

1.A sufficient information infra-structure in education (providing the universities study rooms with multimedia equipment and necessary peripherals). This suggestion assumes that every teacher and scientific research worker shall have a computer at disposal, linked to a computer network, and connected to Internet with his/her own www. Page and e-mail address for every teacher and student.

2.Continuous learning for teachers and research workers of TU in ICT (notably in various levels and in two intertwined and supplementing fields). In this case the main task will be to achieve adequate computer literacy for all teachers and at the same time to obtain specific knowledge and skills for a successful integration of ICT into a concrete form in various forms of educational process. These goals will not be and cannot be achieved by one shot activities but only by a continuous and permanent change. Engaging the greatest possible number o students and teachers into ICT-training is the necessary precondition for new project creation.
3.Gradual change of content, organization and forms of education (there will be an imple- mentation of new methods of education which will use ICT on a larger scale). For technical-engineering education such forms of education are envisaged which will be based mainly on:

-the development of new competencies , skills and creative habits on the part of students and teachers, by means of ICT- use,
-the creation of multimedia tools and products of learning process(e.g. digital and inter/ active textbooks and other study materials),
-various content and organization forms of implementing and applying ICT in teaching, lecturing, consultations, learning and education,
-the creation of multiplication information and data-base sources for engineering education.

4.Development of broad spectrum of opportunities for gradual, post-gradual and life-long learning with the aid of ICT (based on the fact, that information and communication technologies make the study on various places and in different times easier , through which they create conditions for life-long learning).

ICT enables an effective and rational variety of technical education, which thus acquire even more interdisciplinary character. Essential is in all this the fact, that ICT help balance education opportunities in various technical directions and fields (some of them are more, other less attractive for students). ICT contribute at the same time to the development of professional education (with the aim of attaining diploma, PhD-degree, Professor),as well as special- interest education with the aim to obtain a professional preparation, re-qualification or a certificate. The aim of technical and engineering education at the TU is to achieve such a knowledge level, which would correspond to the aims declared in the initiative-**Electronic Europe**- an information community for all. For this reason the existing programs within individual faculties are directed to wider exploitation of the wireless world of Internet.

4. Information system capabilities in distance learning

Distance learning at Technical Universities , in the field of engineering education, presents a relatively well proven form of study. It has been applied in post-gradual study or in requalification study but possibilities of its application in evening or daily forms of study have been looked for. The basic form of study in distance learning are consultation on a regular basis and teaching in individual modules. These are defined as individual lecture units which are sequenced as regards the content and subject. These are widely used in distance learning concerning post-gradual study. The lectures are held in English and they have been secured by the Center or Institute for life long-learning on regular basis.
The learning is organized outside the university facilities, directly in production and technological plants. The participation of foreign guest lecturers for lecturing in pre-selected modules is on regular basis. For the case of implementation of the distance learning into a daily form of study such modules have been considered which would include the content of subject specializm problems. For such a form of distance learning support information systems are prepared to which a system belongs that was tested on-line by students at some faculties of TU in Košice. By means of this system it is possible to assign students various tasks (written , oral or worked out after consultation). Students apply for optional subjects within their study and by means of this system , entrance examinations and accommodation applications in student hostels are being processed. This system also offers another possibility of time table formation for as long as one week that offers a significant advantage as regards the frequent absence of lecturers because of various work or business trips at their workplaces.

One advantage of this system is evident as regards its variability in subject selection by students and the possibility of assignment checking by the tutor. Prepared and worked out time - tables, together with a variant of optional , obligatory and selective subjects (as well as a faculty offer) can be stored in a database. A student is thus able to work out his/her own time table on line via a computer. The student can work out this" personal time table" in such a way so as to obtain the necessary number of credits. The subject assessment by credits corresponds directly to student' s efforts a student has to bring in order to pass the examination. It is just the European System of credit transfer (ECTS) which qualifies the assignment of Technical Universities in SR to internationally acknowledged education institutions (schools).

5. Conclusion

The position of Technical Universities and engineering education in SR are marked with a continuos adaptation to progressive trends and forms of study that exist at renowned colleges and universities in Europe and over the world. Individual faculties of Technical Universities undergo at the same time a dynamic transformation development process, the aim of which is to secure the study for the needs of an information and communication community. The main goal of this transformation is to increase the ratio of Technical Universities and corresponding faculties on international cooperation in the field of research, science and education.

A specific feature of the above mentioned changes is the sustainability or increase of the dynamics of these processes , but also looking for the integral substance of engineering study at colleges and Technical Universities. It is ,however, possible to state that from the point of view of ongoing changes, they cannot be implemented in some specific technologies, such as mining technologies for exploitation and processing of raw material. In such a case possibilities for formation of international integral educational units are being sought, which could use all the potentials offered by information and communication technologies.

6. Reference

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