

**Internationalization of engineering education in European  
pre-accession countries: the Polish case**

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Abstract

A new challenge in the education area, especially in engineering, was opened up when the Central and Eastern European Countries (CEECs) joined the free world in 1990. Many elements of education had to be changed with a view to preparing our engineers for entering the European labor market.

Intensive international cooperation has appeared necessary to meet the requirements. The most important are international student and teacher mobility programs, international educational organizations, international grants and broad human relations through personal contacts, conferences and internet.

All these activities are well developed in Poland. The most significant role is played by the European education programs. International organizations, members of which are Polish technical universities, also make mutual exchange of experience possible, which is important for both parties. Grants awarded to our students and teachers by international organizations make Polish engineering education more and more integrated into the world education.

During ten years much has been done. At the level that has been reached so far, it is only financial problems that hinder further successful development.

1. History

The Treaty of Jalta of 1945 placed many of CEECs in the Eastern Bloc, dominated politically and economically by the Soviet Union. Forty four years of this domination had negative influence on all areas of human life. Engineering education was not an exception - during this difficult period it followed, at least officially, the imposed standards. The system of studies,

laboratory equipment, professional literature and many other elements of education were cut off from the development tendencies that took place in the free world.

In different CEECs these limitations were overcome at different level. Poland has always been among those countries where scientists and university teachers in a way succeeded to keep pace with the world development of technology and engineering education. Many of my colleagues, including myself, stayed abroad as visiting professors or scientists for shorter or longer periods of time. At most important international conferences one could meet Polish participants with accepted papers. It was usually a great individual effort to overcome existing difficulties, mainly financial, since the financing of participation in conferences was far from sufficient. Although it might seem humiliating, our persistence and commitment helped us overcome all the obstacles.

Thus, when in 1989 the Soviet domination collapsed, Poland - at least with respect to human resources - was ready to join the free world. An enormous task, however, was still facing us: in order to start efficient development of engineering education it was necessary to change the political and economic infrastructure and, what is even more difficult and time consuming, the human mentality and attitude.

## 2. Development of engineering education after 1989

When in 1989 Poland and other CEECs introduced market economy and gained political independence, the engineering education was delayed as compared to the Western European countries. Many elements of education had to be changed with a view to preparing our engineers for entering the European labor market:

- curricula
- laboratories
- teaching and learning system
- industrial training
- foreign language teaching
- attitude open to international orientation

It was a great advantage that education decision makers had become well aware of what was going on in the world and could try to introduce the most desirable changes.

Let me discuss the above mentioned elements of engineering education one by one.

Curricula. In this respect the situation was not so bad. Polish universities of technology were resistant enough during these forty four years, and introduced curricula reflecting the development of technology in the world. We were simply aware of what was going on and what should be taught. The evidence for that statement is that Polish engineers, who succeeded to emigrate to western countries even before 1989, were very well assimilated and accepted, and made fast careers both at universities and in industry.

However, some changes in curricula had to be introduced. Close and efficient cooperation with western countries, which will be discussed later, helped to reach a high level of education.

Laboratories. Hardware laboratory experience is a very crucial part of engineering education. In this respect the situation in Poland was very poor. The equipment was obsolete, mainly of COMCON production, not reliable and hand controlled. Unfortunately, the laboratory

*Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition  
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equipment is very expensive and even now, after twelve years, the shortage of modern, digitally controlled equipment is still enormous. The only kind of equipment which is of sufficient quality in student laboratories is computers, mainly PCs, but workstations are also often available. Thus numerous experiments are to be done in simulated, virtual reality. Thanks to broad international cooperation and exchange among universities, software owned by the Polish technical universities is good quality, although often of the "demonstration" type.

Teaching and learning systems. In this respect much had to be done and much has been done, international help being invaluable. The following elements are introduced in the majority of Polish technical universities:

- flexible system of studies
- credit point system
- two- or three-tier system of studies.

The flexible system of studies, enabling students to "tailor their own curricula", was the most difficult and not all universities, or even departments succeeded to introduce it successfully. It needs a well developed computer-aided system of recording student progress, good information about courses etc. The credit system, now very popular in Poland, and the two-tier system (undergraduate and postgraduate) help to introduce flexible studies. These three elements support the internationalization of studies, make the recognition of courses possible and help to increase student international exchange.

Much more difficult is the introduction of the "more learning less teaching" principle. It is well known in Poland that this is a contemporary, internationally recognized trend in education, though requires various learning aids for students, both written and in multimedia form, as well as more time devoted by teachers. With the shortage of funds, so typical of all the CEECs, this modernization of education is progressing slowly.

Industrial training. This part of engineering education is considered very important, but in the post-communist countries very difficult to introduce on a large scale. High technology enters our industry rather slowly, SMEs are not prepared to accept students for training. The possibility of being trained abroad by western industry is available but for a small number of students. Nevertheless, the necessity of industrial training is well understood and many efforts are undertaken with a view to introducing it on the national scale.

Foreign language teaching. During forty four years of communism only the Russian language was obligatory in schools, but most universities introduced one obligatory western language, of which English was the most popular. Some specializations, like electronics or computer engineering, required knowledge of English. Basic foreign language skills make it possible for our students to undertake studies abroad. Trends towards knowledge of two foreign languages are becoming more and more popular, which becomes *sine qua non* for certain positions, particularly in international enterprises.

Attitude open to international orientation. The year 2004, when Poland is expected to join the European Union (EU), is a great challenge for those students of engineering, who think seriously about their future. The polls in Poland show that more than 50% of the population is in favor of joining UE, and among people with higher education this rate is much higher. The student mentality is constantly changing and the idea of "European Dimension" becomes more and more familiar.

### 3. The Bologna Declaration

On June 19<sup>th</sup> 1999 twenty eight European countries (among them Poland) signed the Bologna Declaration in which the main problems concerning the higher education in Europe were listed. The Declaration gives excellent hints for all European countries of how to develop their engineering education to get mutual understanding and recognition and at the same time avoiding standardization, which would be against national traditions. These hints are particularly important for CEECs, where much more is to be done and where the existing delays in modern education create some sort of *tabula rasa*, to which many new ideas can be introduced.

The main trends pointed to in the Bologna Declaration are:

- introducing two-tier system of higher education
- introducing ECTS - the European Credit Transfer System
- developing students' and teachers' exchange among European countries.

These three topics had been introduced in Poland even prior to Bologna Declaration. This Declaration, however, gives us a good signpost for our future development and facilitates our international cooperation fixing a common, well recognized and understandable basis.

### 4. The role of European educational programs

The European educational programs gave an excellent starting point for internationalization of studies in CEECs. The first was TEMPUS (Trans-European Mobility Program (Scheme) for University Studies), financed by the European aid foundation PHARE (Poland-Hungary Assistance in Restructuring Economy). It was opened on May 7<sup>th</sup>, 1990 for 4 years as TEMPUS I and was extended as TEMPUS II for the next 4 years. It was an aid program, financing in 100% projects aimed at restructuring the higher education sectors in CEECs. Now, looking backward, one can see how important for the Polish higher education this program was. It covered 3 kinds of projects: JEPs (Joint European Projects), IMGs (Individual Mobility Grants) and CMEs (Complementary Measures). Additionally, from 1993 JENs (Joint European Networks) were opened. TEMPUS made it possible to start cooperation among European universities in student and teacher exchange, purchasing basic equipment (mainly computers), preparing new curricula, organizing conferences and summer schools, participation in international associations etc. The funds were quite sufficient, an average JEP had a 3-year budget of about 400,000 ECU (the old name for EURO).

As a whole TEMPUS I in Poland had the budget of about 100 MECU, mostly allocated to JEPs. The importance of the program can be illustrated by the following table.

Program	Years	Funds MECU	JEPs		IMGs		CMEs
			Σ	techn	Σ	techn	
TEMPUS I	90/94	97.5	257	74	1574	391	76
TEMPUS II	94/98	66.8 up to 1996	292	111	579 up to 1996	91	59

The Polish technical universities displayed considerable interest in the participation in the TEMPUS projects. The number of applications was about 5 times larger than the number of the accepted and on going-projects. Knowing that each JEP resulted on average in 20 mobility flows of teachers and students and each IMG – in one, one can see that during these 8 years more than 13,000 students and teachers visited their counterpart universities in the EU. Among most often visited countries were UK, Germany and France, but all the 12 EU countries participated in JEPs with Poland.

TEMPUS was enthusiastically received in Poland. After 8 years it occurred that it should be extended and TEMPUS II bis has been created. Its aim was somehow different, 3 types of projects were included:

- institutional building
- university management
- curriculum development

They were aimed at creating a new infrastructure at universities, preparing them to join EU. 40 projects were accepted in the academic year 98/99.

Now, in 2002, the TEMPUS program does no longer exist in Poland. Its role in the internationalization of higher education can not be overestimated. Thousands of teachers and students established contacts with their partners in the European Union, new fields of cooperation have been identified, friendships created, "European Dimension" developed. Last but not least, TEMPUS was in 100% financed by the EU, what was particularly important in the early nineties, when financial situation of universities and their staff was really poor.

In 1998 Poland was accepted as a full partner in the European educational program SOCRATES. This program is divided into several parts, of which the most important for higher education is SOCRATES-ERASMUS, responsible for student and teacher mobility, for curriculum development and ECTS. It is no longer an aid, but a partner program, and the participating countries pay their own contribution, allocated to grants for different activities. The amounts are much lower than in TEMPUS, and this caused some disappointment and frustration. However, very soon it became clear how important this program was for further adjustment of the Polish higher education to European standards. The table below illustrates the dynamic development of SOCRATES-ERASMUS in Poland.

Years	Funds KEURO	Outgoing students		Outgoing teachers		No of schools participating
		Σ	techn	Σ	techn	
98/99	4251	1426	447	356	129	46
99/00	7016	2810	829	614	240	74
00/01	*	5049	1567	850	314 estimated	99

The most popular country for student mobility is Germany, then follows France, UK., Spain, Italy and Belgium.

Less SOCRATES students and teachers visit Poland, the number of incoming persons can be estimated as 10% of those outgoing.

The numbers in the table can be considered impressive, particularly if one takes into account the growth rate. But the number of outgoing students equals only about 1% of all Polish students. The goal we set ourselves is to reach 10%.

The impact of SOCRATES-ERASMUS on the European consciousness of our students is enormous. Even those, who did not participate themselves, maintain contacts with ERASMUS students, read their reports on internet and become more and more aware of the progressing integration of higher education in Europe.

A very important part of the SOCRATES-ERASMUS program is the introduction of the ECTS. 72 universities in Poland participate in this activity, introducing gradually the credit system in different specializations.

Other parts of the SOCRATES-ERASMUS program are less popular in Poland. There are about 20-30 intensive language courses per year, some 20-40 teaching fellowships, 15 curriculum development projects.

The SOCRATES program also includes other components concerning higher education, among them Grundtvig (continuous education), Minerva (distance education) and Lingua (foreign language teaching). It is our aim to further develop also these activities.

The SOCRATES program is now considered the most important activity in the process of the internationalization of higher education in Poland. One can say that from the point of view of education (and also research) Poland has belonged to EU since 1998.

Finally, the program LEONARDO DA VINCI deserves to be mentioned. Its aim is European internationalization of vocational training. It has many components. From the point of view of higher education the most important is mobility, the organization of industrial training for students of technical universities. In the years 1998/99 170 projects were carried out in Poland, among them 132 projects of vocational training involving 2600 Polish students. The other component, concerning pilot projects, included 36 projects. In 2000, 75 new projects were accepted (respectively 69 and 6) and in 2001 Poland applied for 267 projects (respectively 150 and 90).

Summing up, the European programs have an enormous impact on the Polish higher education system. It is worth mentioning that EU countries entered Poland with educational activities very early, in 1989, leaving behind the United States. US never afforded such a broad initiative in this field as EU did.

##### 5. The role of international engineering education organizations

When the Polish currency became convertible, it started to be possible for the Polish universities to become members of international organizations. These memberships were very important for tightening the international cooperation and entering international education lobby. Here is a short list of the most important associations, members of which are many Polish universities.

- SEFI (*Societe Europeenne pour la Formation des Ingenieurs*) got Polish members very early, in 1990. Now, 17 technical universities in Poland are members of this association, participating in its meeting, annual conferences and having contacts with other organizations cooperating with SEFI like ASEE, FEANI, CEASAR and others.

- IACEE (International Association for Continuing Engineering Education) enables entering international lobby of CE. Conferences, courses and other initiatives became open for Polish members.
- EAIE (European Association for International Education) has many individual members from Poland, who participate in very interesting meetings and activities organized by this association.
- EUROPACE 2000 is an association involved in multimedia and distance education. It creates a lobby of universities introducing virtual universities and internet courses. The Polish universities have been members of this association for many years; financial problems, however, impose limits on our active participation.
- EUA (European Universities Association), former CRE (Conference of European Rectors) creates a very important lobby introducing new trends in higher education. It cooperates with UNESCO, was co-organizer of Bologna Declaration and other European meetings establishing the trends in higher education (Salamanca, Prague)

There are many other organizations and associations in which Poland participates, among them student international associations like BEST, IAESTE, AEGEE and others.

Such memberships help tightening international contacts of teachers and students. Their influence on the reforms of Polish universities is very important, too.

International grants are influencing our higher education to a less extent. Such well known and recognized grants as DAAD, Bosh, Fulbright, NATO, NSF, Kosciuszko and others are benefited from by a small member of scientists per year, but beneficiaries create nuclei of international cooperation.

#### 6. The role of personal bilateral cooperation

Individual contacts and friendships with counterparts abroad are a very important element in the process of internationalization of higher education in Poland. Some of these contacts have lasted for many years, since well before 1989. But most of them were established during the implementation of European programs, and thanks to participation in international associations. They create a starting point for broadening the cooperation, establishing networks and, last but not least, for creating consortia of international research projects. The Polish participation in the 5<sup>th</sup> Framework Programme of European Research and Development was mainly based on such personal contacts and makes a significant impact on education as well.

#### 7. Conclusions

The Authorities and staff of the Polish universities understand very well the importance of international cooperation in higher education. In particular, it is crucial for engineering education, where high technology and new trends in learning and teaching methodology should be included in curricula as soon as possible. Many aspects of this problem have been discussed in this paper. One can ask, however, what benefits of such cooperation could be for western partners. Beside the obvious one - more brains to solve problems - there is one not often noticed: people from CEECs have an experience in overcoming extreme difficulties, and this skill can be sometimes very useful.

It is expected that in 2004 Poland and some other countries of the former Eastern Bloc will enter the European Union. Education is relatively well prepared for that, but there is still much to be done. The economic crisis in Poland delays further progress in this field. However, let us hope that all difficulties will be surmounted in due time.

The authors acknowledge with thanks the help of Mrs. Anna Smoczynska from Polish SOCRATES National Agency in the preparation of this paper.

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