Offering Engineering Degrees in a Foreign Language-Preparing Engineers for a Global Experience

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***Abstract* - The present globalization trends and needs drive universities offering engineering degrees to find new avenues in the programs that they offer, in order to be attractive for their prospective students but also competitive on the job market. This paper presents the experience, benefits, trade-offs and challenges of offering Engineering Degrees in a Foreign Language at the Technical University of Cluj-Napoca, the main technical university in the heart of Transylvania County, Romania. The authors were involved in this innovative type of education from the beginning, at the Faculties of Electronics and Telecommunications, and of Automation and Computer engineering, respectively. Starting in 1996, the Faculty of Automation and Computer Engineering, and in 1999, The Faculty of Electronics and Telecommunications offer programs, in which all formal instruction is given in English. Its curricula have been agreed by the European Federation of the National Engineering Associations – FEANI.**

Index Terms –Technical education, English, International job market, Globalization.

INTRODUCTION

Universities all over the world support the development of sciences by research and by providing scientific training, aimed at achieving the ability to apply and further develop scientific methods and knowledge independently. The new generation of scientists and engineers should be well prepared to creatively apply the scientific methods in professional practice, as outlined by numerous authors concerned with scientific education issues [1-5]. Academic institutions are, everywhere, under the action of three important vectors that drive them to change [6]:

- globalization
- information and communication technology
- challenge for resources and for students

The end of the XXth century and the beginning of the XXIst century meant an increasing trend of Europe-wide and world-wide mobility of students [2] and of the graduates on the job market. This requires for consistent curricula and well prepared alumni, able to apply, present and communicate the knowledge, skills and training developed during their academic study. Ever higher numbers of Eastern Europe (Romanian included) students and graduates pursue their education with Master of Science and/or Doctoral degrees in universities all over the world, especially USA, European Union Countries and Japan.

All these determine the dynamic strategy of the Technical University of Cluj-Napoca (figure 1), which aims at offering an education compatible with the most prestigious universities in the world. Being aware of the importance of a rapid integration of the candidate in the foreign academic environment, and foreseeing the global scale of the new generations mobility, our Technical University launched a special program, offering all formal instruction in English.

Fig. 1. Main building of the Technical University of Cluj-Napoca

The motivation behind this type of program is to enhance the opportunities of education, international experience and better options on the global job market for Romanian students but also to attract students from other countries to complete their studies at the Technical University of Cluj-Napoca, without the need of one year intensive study of Romanian language, before starting the engineering program. If the applicant wants to study for an engineering carrier, in English as medium of instruction, a Language Test to prove the English Proficiency is required, or a proof of TOEFL or Cambridge test is forwarded. Another driving force behind the development of this type of programs is the need for the Romanian Universities to adapt to the European academic space. The academic environment is aware of the need of

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European dimensions in higher education, regarding curricular development, inter-institution cooperation, mobility schemes and integrated programs of study, training and research. Initiated in Bologna, in 1999 [7], the periodic conferences of the European Ministers of Education, held in Prague (2001) [8], and in Berlin (2003) [8], constantly reaffirm the need and the will to cooperate for establishing a strong European Higher Education Area by 2010. This explains the trend of several European universities (Germany, Austria, Switzerland, Hungary, Poland) to develop lines with instruction given in different language, especially in English, which proved to be the generally accepted language of communication. Each of these countries has its own motivation to do this, some for acquiring foreign students that would not learn the often more difficult local language, others for preparing their own nationals for the impact with the global job market.

SHORT HISTORY OF ENGINEERING EDUCATION IN CLUJ NAPOCA, ROMANIA

Certainly, between the year 1778, when the government of the Transylvania county initiated in Cluj the technical education, dedicated to lessons of technical measurements, mechanics and installations for civil engineering [6], and today, when the Technical University of Cluj-Napoca offers academic technical degrees in eight faculties, the higher education for engineering carriers in the Transylvanian academic city of Cluj-Napoca knew a considerable and continuous progress both in quality and in the number of specialties offered.

After the 1989 revolution, in 1990, the older faculty of Electrical Engineering was divided in three distinct faculties, based on models found in Western Europe and in the US:

- Faculty of Automation and Computers (A.C.)
- Faculty of Electrical Engineering (E.E.)
- Faculty of Applied Electronics, Telecommunications and Information Technology (A. E. T. I.T.)

Two of these, began offering a new line of instruction in the mid and late '90s. The Faculty of Automation and Computer Engineering, and the Faculty of Electronics, Telecommunications and Information Technology, they both started programs in which all formal instruction is given in English language.

Later, other faculties in the Technical University of Cluj-Napoca, followed the same trend, setting the base of English and German instruction programs, at: Faculty of Civil Engineering, and of Machine Building, respectively. Though, their programs are only for upper divisions, students in the IVth and Vth years of study, and they are also intended to accommodate exchange students in the frame of the European Erasmus/Socrates mobility programs.

The students enrolled in the special English teaching program, at the AC and AETIT faculties, begin their study line from the very first year. At this stage the authors worked with them in the disciplines of Physics (AC and AETIT) and Passive Electronic Components and Circuits (AETIT). The two programs offered jointly the courses of Physics and Mathematics.

The authors shared their teaching experience and worked together on choosing the best methods to help the students study in a language different from their mother tongue. The issue was though a challenge, both for professors and for students, who proved to be ambitious and capable to overcome the inherent difficulties. The authors were also among the ones strongly promoting and supporting the programs, sometimes overcoming adverse and bureaucratic opinions and actions.

PRESENTATION OF THE ENGLISH LINE OF ENGINEERING DEGREES AT TUC-N

In the Technical University of Cluj-Napoca, the curricula and syllabus of all the courses offered both in Romanian and English, are identical, in its contents. The students acquire exactly the same cognitive elements and identical laboratory skills. The faculty members involved in the English teaching program may though differ from those teaching in Romanian the same courses.

An English test must be passed by the instructors (TOEFL, Cambridge, or a two hours test from a local Modern Languages Department), and the contest for the academic positions in this line, necessarily include a public demonstrative lecture, delivered in English, for an audience that, besides the members of the examination board, may also include students, colleagues from other departments, or anybody in the university. Most of these faculty members are young and dynamic, capable to support high quality instruction, while correctly speaking English and having a good command of the specialty technical terms. In an effort inherent in any wide project, new books have been prepared and published, course supports, collections of problems solved and laboratory guides, in English, to sustain the initial lack of instruction materials in the University library, and to help the student pursue the instruction in English. We have to mention at this stage that the access to technical books in English, from prestigious publishers, was and still it is quite prohibitive for the Romanian State Universities and their libraries, due to the high costs of these publications.

Admission of students at the Technical University of Cluj, for all the electrical, electronics, telecommunications, computers, automation engineering majors, is based on a weighted average score calculated with the equation below:

$$Av = \frac{M_{Bac} + 3 \cdot M_{Math}}{4} \quad (1)$$

Where: M_{Bac} is the average score obtained at the High School Bacalaureate exam, and M_{Math} is the score obtained at the Mathematics test, administered by the Technical University Admission Examination Board.

The students for the English program are selected from those already admitted, based on an additional two hours test of English proficiency. This examination is absolutely necessary, because the number of those willing to follow the English study line is greater than the number of places offered by the University, although this number has increased constantly over the years, proving the success of the program.

In 1995, there were 2 groups (Automation, and Computers Engineering, respectively, with a total of 50 students), and in the next year three groups (1 Automation + 2 Computer Engineering). The Faculty of Applied Electronics, Telecommunications and Information Technology began with one 25 students group, in 1999, then increased at 60 students, at present. The evolution of the total number of students enrolled in the English teaching program, at these two faculties with electric profile, can be followed in Table 1 and in Figure 2.

Table 1. Evolution of the total number of students (freshman), English line, faculties of AC and AET, since 1999. Percentage distribution of students grades at the Physics final exam, in the freshman year.

Series nr.	1	2	3	4	5	6	7
	1999	2000	2001	2002	2003	2004	2005
AETIT	25	31	48	48	45	42	62
AC & AETIT	80	85	120	123	125	143	177
Grades	Percentage of the total examined students (%)						
<5 failed	5	2	19	3	2	6	15
5 (passed)	8	4	6	24	14	4	18
6	15	7	10	15	10	13	17
7	24	20	20	20	21	19	18
8	22	31	21	16	22	20	11
9	16	26	12	14	15	18	6
10 (max)	10	10	12	8	16	20	15

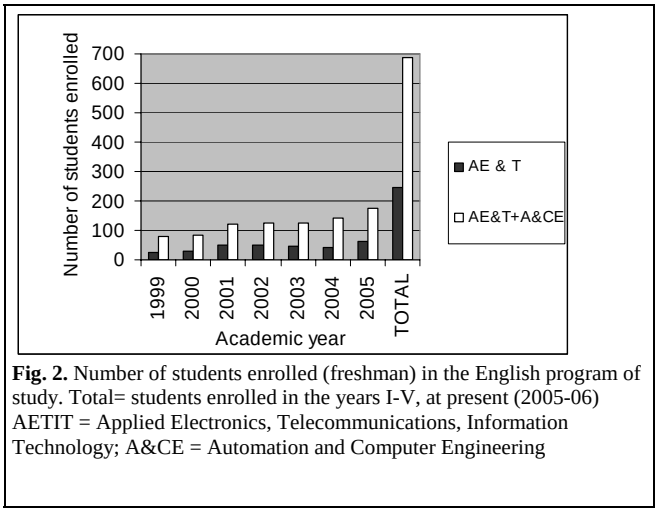

Fig. 2. Number of students enrolled (freshman) in the English program of study. Total= students enrolled in the years I-V, at present (2005-06) AETIT = Applied Electronics, Telecommunications, Information Technology; A&CE = Automation and Computer Engineering

Also, as an example, the percentage of average grades are given, obtained at Physics tests final examination. Only integer grades are allowed in the Romanian education grading scheme, between 1 (least score)- 10 (maximum score).

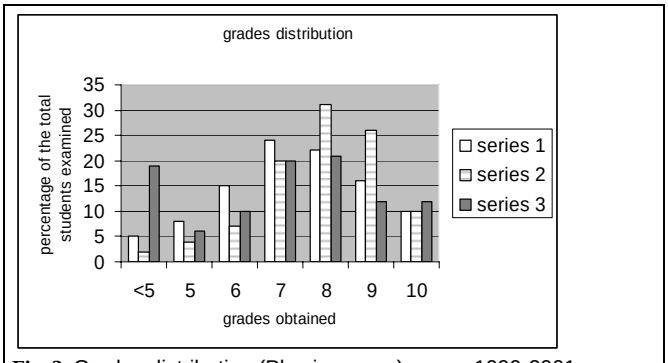

Fig. 3. Grades distribution (Physics exam), years 1999-2001

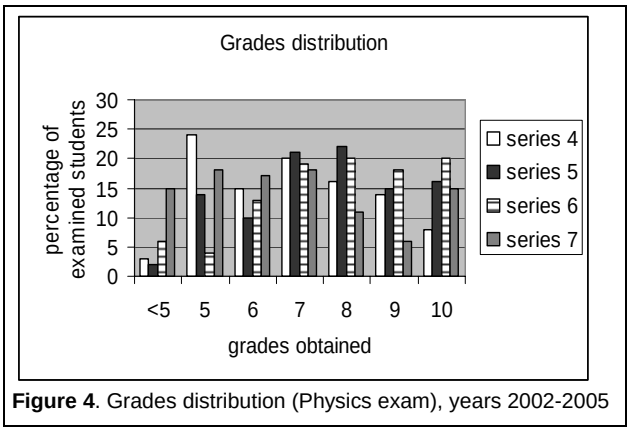

Figure 4. Grades distribution (Physics exam), years 2002-2005

To pass an examination, the student must obtain at least 5. A great number of students did not pass the first attempt of final examination in the years 2001-2002, when the University began the admission based on the Mathematics test only, giving up the Physics test, which was compulsory prior to that year.

The initial grades distributions shown in figures 3-4 were changed after the second session, when several students below the passing score (5) succeeded to pass the exam with scores of 7 (most), 8 (few), and even 9 (much fewer). In time, the seminar problems and the test subjects were adjusted such as to obtain a grades distribution closer to a Gauss shaped bell. This is though difficult, as the number of syllabi taught is too great for a continuously decreasing number of Physics classes. Moreover, similar problems were encountered with the Romanian line, which supports the idea that not the learning language was the draw back cause, but the insufficient fundamental Physics knowledge, of high-school level.

Student evaluations were carried out at the Faculty of Electronics, Telecommunications and Information Technology, showed that the students were satisfied with the instruction, and had no complains related to the English language. They had rather positive appreciations related to the faculty members who proved fluent English, ability to lecture for taking notes, Power-Point presentations, and the course support offered. We have to mention also that, unlike in the US, in Romanian Universities students evaluations are not implemented and carried out. This measure was applied exclusively for the English program, to assess and prepare for accreditation the new instruction line.

CHALLENGES AND DRAWBACKS

Resistance to change

Some of the faculty members were foreseeing difficulties for the professors to teach the same syllabi, in the same time frame, but in a foreign language. They were also reluctant with respect to the students capability to follow the lectures and to take notes. A group of enthusiastic assistant professors faced this challenge and, working with ambitious students,

succeeded in obtaining performances similar to those of the Romanian line of study.

Lack of course books and laboratory guides in English
This was indeed a real problem, and during the first year, the teaching and learning process was difficult and relied much upon the notes taken by students and on the personal books of the faculty members. Each professor elaborated hand written notes, and published course supports as soon as possible, the authors of the present article being among the first to provide printed support for their courses [10-11]. The fact that professors managed to elaborate and publish course books in English, for other disciplines [12-14] is very useful, as free access to English specialty literature, even though possible is very difficult, still scarce and quite expensive for students.

Tendency to switch to explanations in Romanian
This phenomenon was more often encountered at the very beginning, when professors were not at ease. This embarrassment soon disappeared, as the faculty members become more and more experienced and trained in oral communications due to international scientific conferences, scholarships and trainings in EU and US universities. Also, with the enrollment of students from other countries in this type of program, this tendency disappeared slowly, simply because these foreign students do not understand Romanian language.

Budget constraints
Relative to the Romanian line of study, the total costs for full instruction in English determine higher costs for the University. The Romanian higher education system offers in state universities, a given number of places free of charge, for candidates having high admission grades, and a certain number of paid places, for those willing to study a preferred specialty (Computers, Electronics), if their average grades are too low.

BENEFITS OF THE PROGRAM

The main outcome of this initiative concerns the students. They are better prepared to join international companies in a global job market. Also, many well-known companies (Emerson, Eckerle, Continental Automotive Systems, Tenaris, BP) are already investing in Romania (Cluj, Timisoara, Sibiu, Bucharest), and willing to hire local staff, well trained in a widely used language. English is perfect for this.

On the other hand, these Romanian students are a much better fit for programs of Master and Doctoral degrees that may be pursued in EU and US universities. More than 30 % of the alumni of Automation and Computer Engineering, and of Applied Electronics, Telecommunications and Information Technology won research grants, MS and PhD scholarships, mainly in US and in Western Europe, especially in the past 5 years.

Another advantage is the possibility to enroll foreign students in a study line that does not need the preparatory year for learning Romanian language, bringing cultural diversity and international exposure to the university. So far, students from Israel, Germany, Pakistan, India, African countries were enrolled in these programs.

For the academic staff, the benefits of the project were at least triple, with respect to:
-exercise and training to better manage conference presentations in English and international exchange programs
-the chance to examine similar curricula and course syllabi, at other universities, in US and in Western and Eastern Europe, offering the same kind of study programs.
-the possibility to publish their books in English, addressing a larger international audience.

CONCLUSIONS

In 1995, the TUCN launched its English program offering engineering degrees in various specialties. Those at electrical profile faculties proved their success and positive conclusions can be drawn after 10 years of experience. Facing the inherent difficulties, a dynamic team of faculty members, working with ambitious students, managed to fulfill a successful program of higher education in engineering.

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