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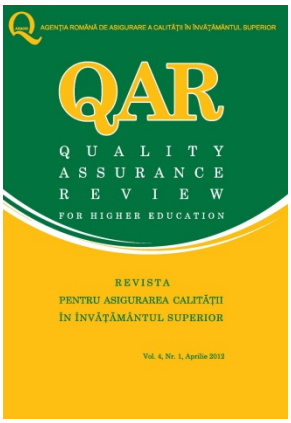

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Specific Aspects Concerning the Internationalization of Electronics and Telecommunications Master Studies at "Politehnica" University of Timisoara

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Specific Aspects Concerning the Internationalizationof Electronics and Telecommunications Master Studies at "Politehnica" University of Timisoara

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Abstract: *After presenting the background and a survey on similar study programs in other universities, the discussion is focused on the international master programs in Electronics and Telecommunications offered by the "Politehnica" University of Timisoara. Specific aspects of the introduction of the programs, of staff selection and the strategy of attracting international students are presented. Quality assurance of these study programs is of major concern and thoroughly reviewed. Some of the international programs have already run for 10 years, so a series of pertinent conclusions could have been drawn, that could improve future activity.*

Keywords: *internationalization, master degree programs, quality assurance.*

Rezumat: *După prezentarea contextului și a unui studiu privind programele similare de master din alte universități, lucrarea abordează aspectele specifice programelor de master în Electronică și Telecomunicații de la Universitatea "Politehnica" din Timișoara: introducerea programelor, selecția personalului, strategia de atragere a studenților străini, asigurarea calității programelor de studiu. Unele programe rulează deja de 10 ani, astfel încât au fost trase concluzii care permit îmbunătățirea activității viitoare.*

Cuvinte cheie: *internaționalizare, progame de master, asigurarea calității.*

1. Introduction

"Politehnica" University of Timisoara is one of the largest technical universities of Romania, comprising 10 faculties and more than 14,000 students. It has an International Office that is very active in managing, coordinating and supporting international exchanges and cooperation, a Department for Communication and Foreign Languages (DCLS) with important contributions in implementing the internationalization strategies of the university, a Department for Quality Assurance (DGAC) and an Office for Student Career Advising (CICS). It offers study programs for all three cycles according to the Bologna declaration (Bachelor/Master/Doctorate). The university committed itself to internationalizing study programs. Moreover, the university joined a consortium of 8 Romanian universities together with ARACIS (National Agency for Quality Assurance of Higher Education) that won an EU funded project entitled "ASIGMA" (Asigurarea Calității în Învățământul Masteral Internaționalizat: Dezvoltarea cadrului național în vederea compatibilizării cu Spațiul European al Învățământului Superior).

The paper is focused on the international master programs in electronics and telecommunications offered by the "Politehnica" University of Timisoara. Specific aspects of the introduction of the programs, of staff selection and the strategy of attracting international students are presented.

Quality assurance of these study programs is of major concern and thoroughly reviewed. Some of the international programs have already run for 10 years, so a series of pertinent conclusions could have been drawn, that could improve future activity.

2. Background

International study programs bring benefits to both students and teaching staff. Among the benefits for students there are: employability, improved communication skills in the language of study and personal development in a multicultural environment, while for teaching staff there are personal development and international networking.

Introduction of internationalized study programs at "Politehnica" University of Timisoara was preceded by a careful preparation in which extensive international cooperation played a crucial role. The university focused mainly on bilateral agreements as well as on European projects on education and research (such as Tempus, Leonardo, Grundtvig, Socrates/Erasmus, Copernicus, Cost, FPx).

As a result, in 2001 two international master programs were introduced, both in cooperation with major multinational companies with facilities located in Timisoara:

- Automotive Embedded Software – in cooperation with Siemens (Continental) and
- Traitement du Signal – in cooperation with Alcatel – Lucent.

Another step for insuring students for the internationalized master degree programs was the introduction of English medium bachelor degree programs.

3. Survey on Master Programs on Electronics Worldwide

Importance of master studies is highly recognized in Europe and worldwide, in all fields of teaching. Our focus is on Electronics.

International master programs are more and more numerous in different universities all over the world. They are mainly of one of the following four types:

- study programs in English (generally) or other foreign language
- joint masters, involving several universities
- internet-based master programs
- double diploma master programs.

An important aspect of every master program is Program and Curriculum Development.

The problems and curriculum development of a two-cycle preparation for engineers have been debated early in the United States, together with the fact that one four-year cycle is not enough for specialized preparation of engineers (Gross 1968, 75-76).

The Diplom-Ingenieur degree meant in Germany more than 100 years of tradition and a very high international reputation. Nevertheless, the country decided to adopt the Bachelor / Master / Doctorate system, motivated mainly by political pressure, financial reasons and internationalization (Wiesbeck 1999, 80). The EE curriculum changes have such implications as cutting lectures in Mechanical Engineering and specialty lectures in Physics in favor of lectures in Economics and Management. However, it is considered that the tradition of in-depth study of Mathematics, Physics and Informatics in the first years must be kept. Is that in contradiction with the same author's statement that more practical (hands-on) work has to be introduced in the same years?

Electrical and Computer Engineering Curricula have little changed in the last 30-40 years in the US. Fundamental changes are necessary to keep up with technological developments such as information processing systems, light wave technology, biotechnology and manufacturing (Mitra 1997, 27). Educators agree that a 4-year BS program does not provide adequate preparation to enter

engineering profession. Today's graduates must specialize in more than one field in order to quickly change their direction of work as their companies change their product lines. Engineers must have cross-disciplinary backgrounds. Joint master programs are proposed to be established involving cross-disciplinary fields such as e.g. Engineering, Computer Science and Industrial Administration. Core courses have to be restructured accordingly. Following the shift paradigm towards research in universities, courses shifted away from practice. It is argued that this tendency must be reversed. An "Internship-in-Industry" program is proposed, which may be developed only with the active cooperation of industrial partners.

Early experience in Master curriculum development for *Engineering of Computer-Based Systems* has been gained in Israel (Lavi 1996, 405-410).

Master degree programs, combined with modern education technologies such as distance learning and Internet based teaching are by now currently introduced in Russia in fields such as Material Science, Electrical Engineering and Applied Physics (Chucalin and Soloviev 2003, 254). An integration of the regional scientific potential with academic research and international cooperation is targeted. Discussions on some aspects of radio engineering education from the same geographical area (ex Soviet Union) in the context of Bologna declaration have been published (Pravda et al. 2008, 643-644).

The organization of the Microelectronics education in an innovative way at the Brno University of Technology, Czech Republic, including bachelor (three years), master (two years) and doctoral stages is discussed in (Bursik et al. 2009, 2-6). The new conception of the education in the field is gaining interest among students due to orientation towards practical aspects.

Other examples of Master program and curriculum development are: at the Indiana's University's School of Library and Information Science (Cronin el al. 1997, 14) in the field of social informatics and an early experience in the field of Simulation and Modeling at Brunel University, UK (Paul and Hlupic 1994, 1394).

Defining reference curricula for academic fields and disciplines is a very important activity that helps educators create their own versions of course programs. For example, an early, highly regarded work in defining a Software Engineering reference curriculum for Master degree in view of satisfying industry needs has been realised by G. A. Ford and N. E. Gibbs (Ford and Gibbs 1989, 59-70). A review, taking into account the present situation in 28 US universities and an up-to-date proposed version are available (Pyster et al. 2008, 2009). A full-time MS degree in Software Engineering designed to compress five semesters in one calendar year, through employer support and sponsorship has been created at the University of Florida in 2009 (White and Coffey 2011, 257).

Authors discussed various syllabi, such as one proposed for a Master Degree in Software Engineering that meets Bologna Declaration requirements (Fernandes and Machado 2006, 2-4). The two-year study cycle degree is intended for students that have finished undergraduate computer degrees and both professional and scientific paths are provided.

A comprehensive list on United States programs offering master Degree Education in Software Engineering and requirements, background and educational offer can be found in (Bagert and Mu, 2005, F1G3-F1G4). Software Engineering master program in the United States offer professional degrees in general, similar to the MBA degree. Students have a bachelor degree in a computing discipline, but many of them are software developers in industry.

Recognizing that "distributed computing systems and applications are not only changing the face of computing, they're also continually changing the way we live, work, and interact as a society", a Master Program in this field has been proposed at the University of Melbourne, Australia (Buyya and Ramamohanarao 2007, 1). This is an illustration of the flexibility of the three-level organization of education, when industry needs stemming from an emerging field can be fulfilled in a fast way.

Curriculum development poses special problems when interdisciplinary fields are involved, such as biomedicine and bioinformatics (Sahinidis et al. 2005, 269).

An Internet-based, intercultural and interprofessional 2-year master curriculum has been developed and successfully tested recently in the field of Biomedical Engineering (Molenaar and Verkerke 2011, 77). Three Asian and three European universities participated in the project. Although collaborating in virtual environment proved feasible, face-to-face meetings and video chat sessions had to be scheduled in order to cope with issues such as cultural differences and mutual expectations.

Students attending multidisciplinary Master programs, e.g. Biomedical Engineering, have different backgrounds. Special care must be taken by educators in order to develop their ability to solve problems related to very different areas. Innovative approaches, such as multidisciplinary charge activities related to particular courses have been proposed in a joint Spanish master, involving two universities (Colomer and Pere 2010, 321-322).

Particularities of Medical Informatics and Telemedicine education in an institution comprising almost half of the students in the field in Italy and offering, among others, a one-year "post-Laurea" master's degree have been reported (Pinciroli, Masseroli and Tognola 2003, 394). The discussion was made in the context of an important educational reform in the country.

Joint Masters and Double Diploma pose different problems.

A national joint master program in EMC has been started quite early (Marvin 1992, 159-161). The introduction of this Master program was motivated by the development of the field, by the necessity for three-year bachelor graduates to improve access on the European labor market (where at least four years were more credible at the time of publication of the paper), by availability of interested persons in a recession time and by the needs of average physics graduates to enhance their employability. Funding opportunities and a complete curriculum have been presented. A pan-European version has been proposed.

Defining Master degree curricula is an important activity, which is advisable to be approached in a systematic, scientific manner, especially when programs from newly identified fields have to be introduced. Examples of such an approach, financed through European programs, exist (Dubois et al. 2011, 573). The participants defined a new professional Master program, in the field of Innovative Service Systems, aimed to professional individuals working in Information and Communication Technology, with duration of 1 year (60 credits) and conceived to fulfill previously identified needs in the service sector in Europe. The program has been supposed to start in January 2011 in 6 European Universities. According to the authors of the cited paper, the content of the curriculum has been established in three steps, by defining the attendant's job profile, requirements and skills, by defining a so-called *knowledge map* and finally by establishing the *learning trajectories*. Professional attendance from industry and academia ("Think Tank") have participated to meetings organized for this purpose.

Master programs must respond not only academic and personal fulfillment requirements, but also industry needs. A Master Degree education program, involving 4 French Engineering and Business Grandes Écoles from PARISTECH, and dealing with electric energy driven cars has been described (Semail et al. 2010, 1-4). According to the authors, the program creation has been fostered by the interest the French producer Renault has shown in having specialized staff in this field and the curriculum has been developed following the industrial partner's needs. Conversely, the program is supported by the well-known car producer.

Joint master programs in Electronic Systems, came about as results of EU-ERASMUS cooperation, have been developed quite early – 1991 (Lydon et al. 1991, 1518). The creation of a new, successful Joint Master Program in Microelectronics, Microsystems and Nanotechnology, involving three European Institutions from Italy (Politecnico di Torino), France (INP Grenoble) and Switzerland (EPFL) has been described (Montes and Morfouli 2007, 155). According to the authors, besides the specific character of the syllabus, the success of the master has also been ensured by the different social and cultural identities of the countries hosting the educational institutions.

A double diploma international, two-year master program in Image and Signal Processing and Microelectronics, set up by two institutions form France (University Rennes 1) and China

(South-East University of Nanjing) is reported in (Bonnaud et al. 2010, 325-326). The program is described as fully compatible with the Bologna Process rules and its creation has been motivated by the decreasing number of French students at all levels in Electrical Engineering and Information Processing. The claimed outcomes after one education cycle are exceptional. The admission examination is held nationwide across China and therefore only candidates with outstanding results are admitted. All students from the first promotion graduated with marks corresponding to the "top-ten" level of a class in France.

Other aspects refer to the relationship between research master programs and doctoral programs, the European Credit Transfer System, etc. A tight relationship between research master programs and doctoral programs is recognized. The necessity of integrated development of curricula has been demonstrated for the case of universities from Mexico (Herrera 1997, 809). A multidimensional analysis of Master Degree final thesis importance and assessment has also been tackled (Xiaohong and Hongpin 2009, 4203-4206).

The European Credit Transfer and Accumulation System (ECTS), together with the learning outcomes for every course, allow for course evaluation, comparison, recognition and validation throughout European universities. A certain number of credit points is allocated to each course and a maximum number of credit points (60) must be realized by a student per academic year. It has been demonstrated that the ECTS may be used to optimize the student workload per week, by correlating credit points with attendance and self-study hours required for each individual course (Komenda and Malisa 2010, 170). A case study for the Master level at the University of Applied Sciences Technikum Wien, Austria, is presented in the cited paper.

A method of recognizing and assessing learning at Master level and monitoring competence in the work-place, aimed to individuals having great experience and competence at the work place, but who are not registered as chartered Engineers in the UK, and using work-based learning methods, has been developed at the Kingston University, London (Ling et al. 2010, 391-394).

Original methods of quality management in a System Engineering master program have proposed recntly (van Peppen and Rojigh-van der Ploeg 2000, 189).

4. Master Degree Programs at "Politehnica" University of Timisoara

Out of a total of 68 master programs comprising 3250 students, 6 are international (5 in English and 1 in French) with 357 students enrolled. The university offers the following international master programs: Computer Engineering, Software Engineering, Information Technology, Automotive Embedded Software, Advanced Design of Steel and Composite Structures, Advanced Electronics in Intelligent Systems, Communication Networks and Traitement du Signal.

International master programs are of two types: developed solely by the university or developed jointly with major companies.

Master programs developed jointly with major companies (Automotive Embedded Software and Traitement du Signal, that are both monitored by ASIGMA) benefit of full support from the companies in jointly developing the curriculum, quality management and assessment, participation in defence of diploma and dissertation theses, as well as equipment, software, technical literature and teaching staff. Some companies also offer facilities for students (e.g. joint projects, internships, reduced work program – 6 h/day).

Internationalization of master degree programs refers not only to teaching in a foreign language, but also to involving international students and teaching staff from partner universities. In recruiting international students of great importance are the English medium bachelor degree programs of the university and the Erasmus framework which offers excellent opportunities for student mobilities. However, there is a limited number of incoming international students, despite the efforts to promote and develop international cooperation; for the time being the university is not too

visible to the outside world. One should not forget that the opening of Romanian universities to international life started only 20 years ago. So, one of the goals of the management team is to increase the international visibility of the university and to promote the international study programs at all levels.

At the Faculty of Electronics and Telecommunications of the „Politehnica" University of Timisoara, a massive promoting campaign has been under way. Members of the teaching staff visited European partner universities and presented the international study programs. On the other hand, between 1996-2011, the Faculty of Electronics and Telecommunications hosted for practical stages over 150 French students (from IUT Rennes and IUT Angers). As a result, over two consecutive academic years, more than 20 students from Germany and France have been following one semester or one full year of study at the Faculty of Electronics and Telecommunications. Efforts are still to be made to increase the number of incoming international students.

Quality assurance of all study programs is of major concern for the management team. Besides ARACIS norms, that are carefully observed, the "Politehnica" University of Timisoara developed its own methodology and procedures of quality assessment. It set rules and regulations for Master Degree Programs developed in UPT. It developed evaluation questionnaires and performs internal audits on a regular basis.

Visits to and from partner universities within the ASIGMA project played an important role in quality assurance. A particular aspect of quality assurance that should be revealed is that at the "Politehnica" University of Timisoara a careful selection of the teaching staff for the English medium study programs was performed. Professional competence of candidates was assessed through research and publications portfolio. Each candidate was asked to submit a written essay on personal vision of course development (in English). Each candidate was required to commit himself/herself to produce teaching materials (in English) by the end of the first year. Foreign language proficiency was assessed by the Department of Communication and Foreign Languages.

Another aspect of quality assurance is the way the foreign languages are used for instruction. The lines below are aimed at outlining peculiarities in teaching foreign languages for specific purposes to master students attending classes in the English / French medium of internationalized studies.

To start with, we have to admit that the LSP (language for specific purposes) practitioner trained as a language teacher exclusively has become a legend nowadays. To permanently develop and meet the requirements of present-day education (master programs included) an LSP teacher is supposed to gain new skills and competences; moreover, his/her profile is influenced by several factors such as: the development of linguistics and of the teaching methodology based on different learning theories, the inter- and multidisciplinary approach present in all professions, the need for specific skills and competencies to communicate appropriately in various professional situations, the impact of global issues on our daily lives.

For this presentation we are going to explore one of the less tackled aspects, namely, the development of terminology skills, a component of the multidisciplinary know-how. All the ideas dealt with below are addressed mainly to the foreign language practitioner, but, inherently, they relate to the learners as well. From among the disciplines that relate nowadays more and more to LSP we mention:

- communication science / professional communication;
- terminology;
- intercultural (cross-cultural) communication;
- information science
- knowledge engineering.

Knowledge of terminology does not mean simply looking for meanings of terms or just translating terms from one language into another. Languages for specific purposes can benefit from developments of terminology, a science on its own, that has progressed significantly during the last

few decades. Terminology includes activities of selecting, describing, processing and presenting terms as a means of accessing knowledge in a subject field.

Knowledge of selecting terms from documents of a field is linked to understanding the concepts terms are assigned to. The selection of general and individual concepts based on understanding their relationship with each other results in grouping, structuring, organizing information that leads to conceptual systems. Such systems of concepts are vital tools that help in grasping the logical framework of that field. By building a conceptual system, definitions of terms, based on the place of the term in the system and its relationship with the surrounding concepts, help in describing a term and in understanding its meaning. At the same time, comparison and confrontation of definitions of terms belonging to two or more languages represents the possibility of establishing the correct equivalents with respect to the underlying concepts; these equivalents are not mere formal translations of terms.

Additionally, knowledge of term formation helps in understanding and creating appropriate terms. Terminography, in its turn, becomes a precious tool in accessing, storing and retrieving information of various specialisms. Information and documentation within terminology means acquiring knowledge of selecting and evaluating the quality of terminographic products. Nowadays, terminology proper is perceived more and more as terminology management. Besides managing the terminological units, one becomes aware of the value of terminology used properly. In other words, basic terminology knowledge can contribute to successful communication in occupational settings. Today's learner, tomorrow's employee in a certain domain, will be able to use the jargon of his domain, being more independent in the professional communication events.

5. Conclusions

In the globalization context sustained efforts for promoting international master programs are required. An increasing number of international students in internationalized study programs is highly desirable since they are an important source of added value. In attracting international students direct contact with potential students and personal links of the teaching staff are much more efficient than web pages.

The international visibility of the university is highly important and efforts are still to be made to increase it. Quality assurance of the international study programs is of major concern and is carefully dealt with by the management team of the university. Besides, the ASIGMA project is supposed to significantly contribute to this matter.

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