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## **Quality in Environmental Education at the Faculty of Mechanical Engineering Technical University of Košice**

**Abstract:** *Authors recall recent development of environmental education at the faculty of mechanical engineering from implementing the first environmentally oriented subjects to the establishment of independent department. They characterise contemporary state of environmentally education and they outline the perspectives the ways of its further development. At the same time they specify also the profile of graduates and the educational plans for particular types, forms and branches of study and personal and laboratory equipment including scientific-research support of pedagogical process.*

**Keywords:** *education, study branches, environmental studies, profile of graduates*

### **1. INTRODUCTION**

Environmental education has to be understood, from the conceptional view, as an organic part of whole educational complex at schools, including universities. Its improvement and increasing of its effectivity is a multidisciplinary and interdisciplinary problem which requires systematic and permanent solution coming from scientific investigation, theoretical platforms, comparison of up-to-date practice, current status and prognoses of production, consumption and development of environmentalistics itself.

There are more reasons for extensive and intensive environmental education development of mechanical engineers in Slovakia. Firstly, it is the fact that Slovakia belongs to environmentally most indebted European countries also after its integration to EU. Cumulated problems in environment which can technically be solved but their solution is postponed (so called environmental encumbrance), today represent hundreds of billion crowns and more hundreds of billions will be necessary for building

ecologization complexes and application of latest ecologization tools for products and production in accordance with the European legislation.

Solving of the cumulated problems depends on the increased level of environmental knowledge, awareness, behavior and activity of mechanical engineering intelligence.

### **2. HISTORY OF ENVIRONMENTAL EDUCATION AT FACULTY OF MECHANICAL ENGINEERING AT TECHNICAL UNIVERSITY IN KOŠICE**

The beginnings of environmental education at the Faculty of Mechanical Engineering go back to 1988, when the first dissertation works in the field of environmental production and its projection were written, within the scope “Production projection and plant operation” of study field “Mechanical Engineering Technology”. Department “Projection of

Automated production systems” of the then department of Automated production systems intensified its concentration on problems in the relationship Engineering project (production) – environment especially from 1990. In the two last years, students of the study field “Projecting of AVS” with focus on “Automated management systems of production processes in mechanical engineering” could focus on environmentalistics, including state exam, by choosing voluntary environmentally oriented subjects and by choosing the topic of their dissertation work. Approximately 10 students finished each year in this way.

Knowledge and experience from implementation of environmentally oriented subjects, dissertation works, long term cooperation with the Ministry of environment of SR, Regional authorities of environment and industrial practice with realizing the specific projects of ecologization, built up the knowledge base for opening a study field “Development and protection of environment” as a Bachelor study at the faculty in the academic year 1994/95, as well as approval of the study field “Management of ecological impacts of mechanical engineering production” by the scientific court of the faculty within the study field ASR VP in mechanical engineering study. Since then we could mention subjects like “Basics of ecology for engineers”, “Ecologization of products and productions”, “Technologies of industrial waste manipulation”, “Projection and operation of ecological technologies”, “Computer support for environmental”, etc.

The increased demand for environmental studies at the faculty initiated the headquarters to prepare and then to provide the accreditation of study field “Technology of environmental protection” for Bachelor internal and external study, master (Ing.) internal study and study field “Environmentalistics” with focus on “Environmental engineering” for PhD. study. Activities in this direction ended up by transformation of “Department of AVS” to “Department of Environmentalistics and Process management” in 1998.

3. CURRENT state of environmental education at Faculty of Mechanical Engineering and profile

of department

Department of environmentalistics and process management belongs to profiling departments of the faculty with very high personal credibility (2 professors, 4 assist. professors, 5 Prof. assistants and 5 Phd. students) and laboratory equipment (integrated laboratory of environmentalistic, integrated laboratory for assessment and management of environmental noise, technological center for acoustics and vibrations) for the study field Technology of environmental protection for Bachelor and Masters study. By choosing voluntary subjects within Masters study students are allowed to profile themselves into fields of projecting and management of environmental production or Technology of working environment.

Besides basic subjects of the study fields such as (Machines and utilities for environmental protection, Waste management and recycling, Ecologization of products and productions, Environmental management systems, Technique of working environment, Projecting of environmental productions, computer networks for environmentalistics, etc.) the department also provides environmentally oriented subjects in other study fields in faculty (Production quality and safety of technical systems – subject environmental engineering, Mechanical engineering technologies and materials – subject Recycling and Ecology in mechanical engineering production etc.), as well as basics of environmental engineering in Bachelor and Masters study. It has to be noted, that this form of study is currently in the finishing process.

The new concept of study starts from the academic year 2005/2006, according to study programs within the new structure of study programs at Slovak universities, (Fig. 1).

In the area of Phd. study the department provides scientific education in field Environmentalistic with the scope on Environmental engineering. It also takes part in works SOK technical systems safety and work safety and mineralurgy and environmental technologies. These are being finishing and new accredited three-level study – environmental engineering will start.

Scientific and research activities of the department

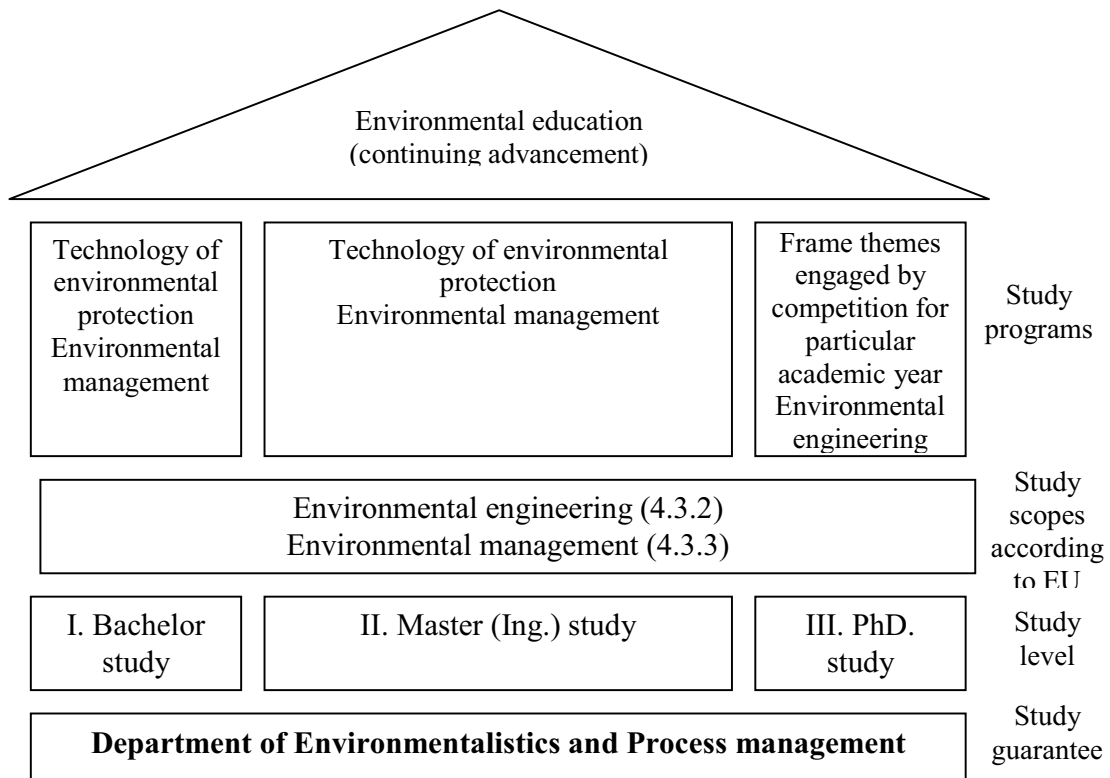


Figure 1. New structure of study fields and scopes of environmental education at SjF TU in Košice

are oriented into the field of the ecologization of mechanical engineering products and productions, logistics of technology waste of out-lived mechanical engineering products management, recycling-oriented production and multi-criterial assessment of environmental load. More grant projects and international scientific research projects are regularly being solved at the department.

Professional and expertise activities of the members of the department are oriented into the field of Environmental Impact Assessment according to the law 127/94 Z.z., accreditation and certification environmental management systems according to ISO 1400X, authorized legal measurements of noise, judicious expertise in the field of mechanical engineering etc.

The department is also an organizer of the regular international scientific workshop "Intelligent Manufacturing Systems" and the international conference "Environmental Engineering and Management", as well as co-organizer of

international symposium DAAAM "Intelligent Manufacturing and Automation".

The department cooperates with more companies and technical universities in Slovakia and abroad (Badger Meter Europa, GmbH, Beuren (D), Netzch Filtrationstechnik GmbH, Selb (D), SE a.s. Bratislava, Siemens a.s. Michalovce, Whirlpool a.s. Poprad, SCP a.s. Ružomberok, Mobilstar s. r. o. Košice, TU Wien (A), BUGH Wuppertal (D), TU Maribor (SLO), TU Novi Sad (YU), TU Clui-Napoca (RO), TU Budapest (HU), and others).

#### 4. STUDY PROGRAMS CHARACTERISTIC OF TECHNOLOGY OF ENVIRONMENTAL PROTECTION AND ENVIRONMENTAL MANAGEMENT

##### 4) TECHNOLOGY OF ENVIRONMENTAL PROTECTION

### **Graduates profile – 1st level**

Ecologization in mechanical engineering must be complexly oriented on life cycle of a product from projecting level through its production and consumption until to its physical liquidation after its out-living. To fulfill this goal, graduates – bachelors – get not only the basics of environmental engineering but also complex knowledge in the field of environmental protection technology focused on ecologization of mechanical engineering and its tools.

The study is focused on the problems of environmental protection. Students, after unified basics of natural sciences and mechanical engineering, profile themselves into problems of mechanical engineering production impacts on environment, industrial waste management, machines and utilities for the ecology, ecologization of products and productions, environmental monitoring, and technology of biosphere protection.

Graduates can find their place at work as experts in departments of environmental protection in mechanical engineering and non-mechanical engineering factories as well, organizations dealing with waste management, monitoring and environmental evaluation, as well as departments of public institutions for environment and landscape protection.

A graduate of this study field achieves deep knowledge with practical experiences in Environmental engineering. Within the study of environmental protection and production systems ecologization principles and consumption processes, the graduates learn how to create conditions for operation and development of clean manufacturing in mechanical engineering and in other branches of industry as well, e.g. energetics, mining, metallurgy, chemical, food, electrotechnical industry.

They will absorb not only the principles of production with regard on to environmental protection, but also new principles of product development (green engineering) and methods of their recycling. Particular accent in the study is put on problems of machines and utilities activities for environmental protection and working environment, new principles and development trends in this field.

By choosing selectable subjects within the study, it is possible to focus themselves on problems of environmental production projecting, mechanical engineering production environmental impact management or working environment technique.

### **Graduates profile – 2nd level**

A graduate of 2nd level of environmental engineering study achieves complex knowledge for application research needs, projecting for technological impacts assessment on environment quality, modeling and simulation of process pollute environment, impacts of ionized radiation, quality protection of water, air, soil, development of new remediation and recycling technologies for waste management needs, using environmental biotechnologies, environmental monitoring, computer data processing and its assessment etc.

Emphasis on study is put on providing deep knowledge in fields as chemical science, engineering science, physics and mathematic, with wide using of computer technique.

## **B) ENVIRONMENTAL MANAGEMENT**

### **Graduates profile – 1st level**

Graduates of environmental management course have knowledge of multicausality and variability of system human – environment, decode impact and define subsystems on personal, social, technological problems. They are able to define basic problems of environment, set priorities of their solution and possibilities of effective and saving human activities in environment. They are competent to work with all age groups of population with goal to form their environmental consciousness. The graduates find their jobs as environmental instructors, coordinators and advisors for work with public in reservations, on level of public state institutions, local institutions, in the third sector, and eco-centers.

### **Graduates profile – 2nd level**

Graduate of environmental management course masters system of progressive directing, decision-

making, coordinating and source control, processes and relationship of organization focused on environmental problems solutions. He knows and uses environmental management systems and environmental audit following from world wide approved documents. He creates and applies educational and training programs, he is able to stimulate, shape and model virtual mechanisms of the behavior of natural and human systems and impact of harmonic or disharmonic (pathologic) influence on environment, he knows methods of identification, diagnostic and leading of individuals and target groups. He coordinates activities of involved parts by solving problems of environment on regional and local level. [1]

**5. CONCLUSION AND PERSPECTIVES OF ENVIRONMENTAL EDUCATION AT SJF TU**

Growing interest for study at the department (annually app. 40 applied students after the third grade of master study, app. 40 applied students for internal bachelor study and more than 100 for external bachelor study and app. 5 applied

PhD. students) and requirements for pedagogic assurance of environmentally focused subjects from other departments of the faculty as well as other faculties is pleasant on one side, but in relation to quality of pedagogic process and putting into effect of graduates, it is challenging on the other hand.

From the view of human resources and laboratory equipment, the department of environmental studies and process management considers its capacity to app. 120 graduates (app. 30 in each form of study: bachelor, master – internal and external) per year and 2 – 3 PhD. students. The interest for the study in all study forms exceeds abilities of the department. Trend in number of graduates in the last 8 years is documented in Fig. 2. We can consider as stabilized numbers the data from last 2 years.

In next academic years the main goal will be improvement and stimulation of teaching process in finished integrated laboratory of environmental studies, quality and safety in the meaning of integrated management of company and preparation of graduates for this perspective and newly developing field in a way that the

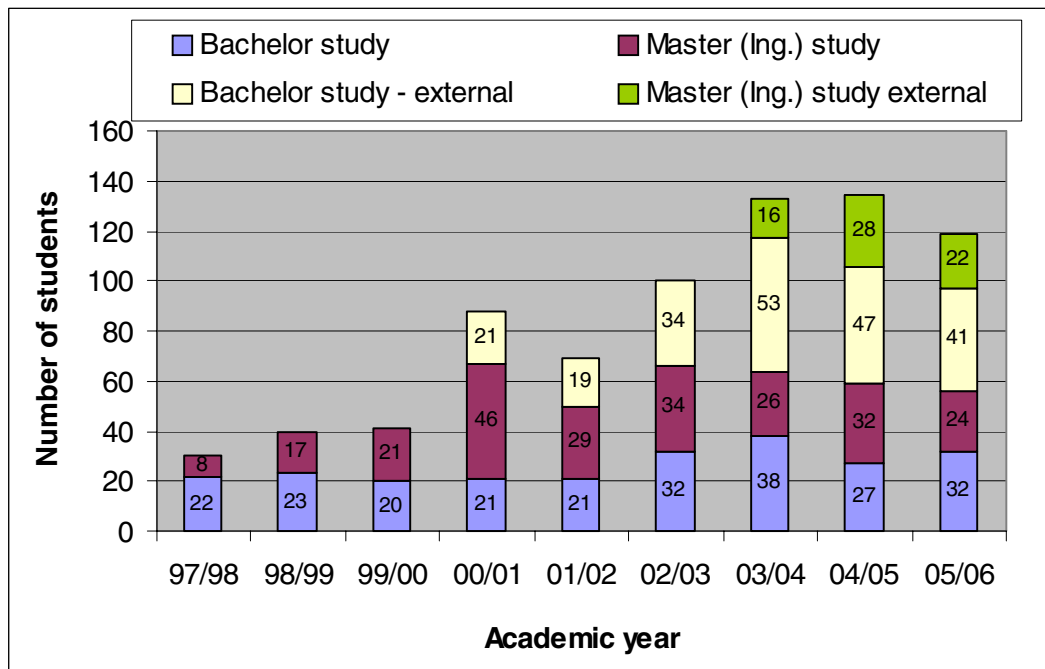


Figure 2: Development of graduates number at the Department of environmentalistics and process management at SjF since academic year 1997/1998

requirements of industrial praxis will be fulfilled and all graduates will find practical use in their field.

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