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# Improvement of Product Development Studies in Serbia and Bosnia and Herzegovina



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*UNIVERSITY OF EAST SARAJEVO  
FACULTY OF MECHANICAL ENGINEERING*

## REPORT

### Education in the field of Industrial Product Development and Management of Product Development & Innovation Management

East Sarajevo, 2013.

## **INTRODUCTION:**

The University of East Sarajevo is an independent and self-governing institution, consisting of the 15 faculties and the two academies, established in 1993. University of East Sarajevo (UES) differs from the other universities and has many advantages, mainly because of the fact it is located in 10 towns, which makes it decentralized and therefore contributes to the faster development of these towns. The UES is the largest higher education institution in RS. In the UES study 17.000 Students ófull time studies and 1.000 students ó postgraduate studies. Number of employees in UES is: 941 and research staff: 579.

UES trains specialists in Bachelor, Master and PhD degree engineering programmes, essential for the industrial development as well as specialists in Law and Medicine. UES has become a promoter of the educational, economic, social and cultural development of the entire region, providing scientific and technical support, as well as establishing of intellectual and cultural links with the world. UES has significant experience in education in the field of Industrial Product Development. Education in that field is primarily provided by Faculty of Mechanical Engineering.

## **Industrial Product Development**

Faculty of Mechanical Engineering has established the new educational model in field of Industrial Product Development since 2006. The new education model is based on KaLeP (The Karlsruhe education model for integrated product development) developed at Institute for Product Development, IPEK, which is a part of Karlsruhe Institute of Technology (KIT). That model takes into account cultural and social characteristics of Western Balkans Countries region and previous experience in product development education. Implementation of new education model was preformed through several subjects related to product development education already existing in the curriculum of Mechanical Engineering Faculty, University of East Sarajevo since year 2006.

Table 1 gives an overview of directly and indirectly related subjects to the core module "Production mechanical engineering" at the bachelor (BA), master (MSc) studies in which the implementation of the new educational model was performed.

In order to prepare future engineers to their industrial positions a special focus is given to subjects that offer a broad basic understanding of development-related aspects. The basic subjects in the bachelor degree program "Production mechanical engineering" represent a good base for a structured and methodical development of products. The electoral subjects depend of personal interests and preferences of students. Theoretical education is contributed with practical experience and this knowledge is implemented during seminars and praxis with real examples from industry.

**Table 1.** Selected subjects related to Industrial Product Development from curriculum of University of East Sarajevo – Faculty of Mechanical Engineering

<b>SUBJECTS</b>				
<b>BACHELOR STUDIES</b>				
Title of subjects	Semester	Number of hours/ semester		Credits
		L	W/E	
Engineering graphics	1	30	45	6
Strenght of Materials 1	2	45	30	6
Mechanical Materilas 1	1	45	30	6
Mechanical Materials 2	2	30	15	4
Mechanical Elements 1	3	45	30	6
Mechanical Elements 2	4	45	30	6
Strenght of Materials 2	3	45	30	6
Basic of Management	4	30	15	4
Production technoligies	4	45	30	6
Numerical Methodes in Enigneering	4	45	30	6
CAD – Computer Aided Design	6	30	30	5
Engineering Design	6	30	30	5
Finite Elements Method	6	30	30	5
Computer Simulation	6	30	30	5
Development of Machine Systems	7	30	30	5
Project Management	7	30	30	5
Integrated Management systems	7	30	30	5
Integrated Product Development	8	30	30	5
Virtual Product Projecting	8	30	30	5
<b>MASTER STUDIES</b>				
Methodology of Science and research Work	1	45	45	6
Project Management	2	45	30	6
Virtual Product Development	2	45	30	6
Usage of Finite Elements Method	2	45	30	6
Structural anylasis of Construction	2	45	30	6

The courses integrate theoretical and methodological knowledge aimed to make a decisive contribution to the promotion of theoretical and methodological competence.

Courses programs are designed to promote the development of creativity and the potential to elaborate by combining the lecture with independent development work of the students. The main lectures related to education in field of Industrial Product Development according to KaLeP are located in the 8.semester of Bachelor studies. Those courses are organized as one large integral divided into three different components:

- Lectures,
- Workshops,
- Student work on development project.

These components cover different educational goals. The lecture, always the major component of the education concept, provides the theoretical fundamentals for both the other educational components. Purpose of other components is to enable students to in practice implement their knowledge because in that way best education results are achieved.

In Lectures students are introduced to product development of industrial enterprises with particular reference to the requirements of small and medium sized companies. Based on practical experiences and examples from industry, the theory of planning, design, cost control and management of the development and innovation process knowledge is introduced and discussed. Problem solving processes, system analysis, team leading, product lifecycle and development strategies are presented and discussed, as well. Students are taught how to define profile of the product and product concept from ideas and how to efficiently evaluate different concepts and variant solutions. During lectures teacher actively communicate with the students by discussing of all the topics presented during lectures. The lecture is designed for a limited number of students (maximally 30) to ensure interactive contact of professor and students.



*Figure 1. Students "office"*

This offers the possibility of teaching in discursive form with the use of multimedia tools to aid better presentation of the subject. If necessary the official time allotted to lecture is relaxed to enable opened discussions.

Teaching process must be in accordance with development project and effectively accompanies phases of the student's development project.

## **Workshops**

In the workshops knowledge is actively built up and developed with the first real application experiences. This is achieved through:

- a direct and practical translation of the learnt methods directed to the industrial product development process,
- simulation of team work during solving of practical problems on the workshop.

A total of 13 Workshops cover and expand knowledge in the following topics:

- Team processes,
- Product lifecycle,
- Project management,
- Definition of product profile, check list, design process,
- Presentation technique,
- Evaluation of concepts and variant problem solution,
- CAD,
- Simulation,
- Organization processes in enterprises, procurement process and
- Validation of mechanical systems.

## Student development project

The aim of student project is the development of realistic industrial product from product profile up to the virtual prototype (3D-CADModel) or from the idea up to the validation of manufactured prototype (Fig. 1) by independent student team.

Provider of the development task is possible an industrial company which defines either the development area (if projects start from product profile) or an idea (if project starts from the idea). But, present situation is ó development task is student's idea or their wish ó product which they want to develop.

The number of participants in the project work, and by that in the course, is limited to 30. The project work is so extensive, that it can only be solved by division of labor within the team. On project start, based on set of predefined tests, course professor and his assistants select candidates for the course. Teams are formed by course professor based on the results which determine personal profile of the students from the aspect of team work.

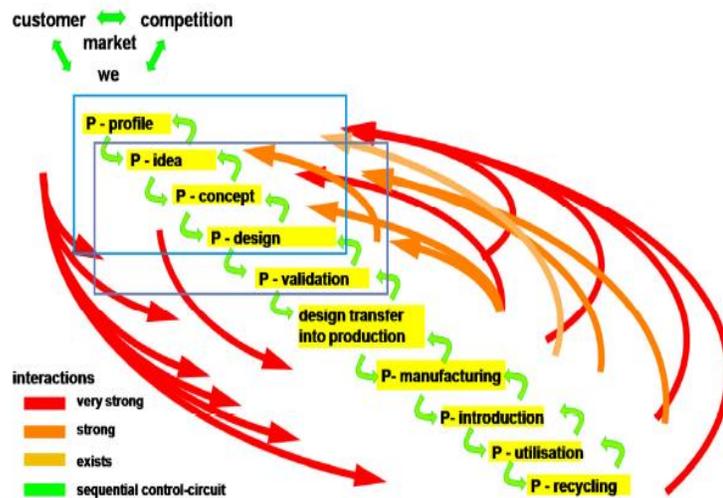


Figure 2. Development project: from product profile to virtual prototype or from idea to validation of actually manufactured prototype

Students work in the simulated environment of the industrial enterprise in which the virtual management is composed of course professor and his assistants (possible representatives from industry).

Management role is to ensure all resources needed for successful project work as students are actually employed in mid-sized enterprise. Student teams are located into separated virtual offices in which they dispose with all hardware and software tools necessary for project work. Students have to think about the whole project when they generate a solution for a small part, they have to think about system correlations and interfaces and the problems that they have to solve are mostly evolved from the project itself and not given in the task itself. So they get a very high self-reliance of their learning process and the motivation for understanding and learning is quite high. This requires a bigger autonomy of the students than a "classical" way of education as it is practiced in most fields of academic studies, but it gives the students the best chance to understand the things they are learning.

The basic task of management is to control and evaluate students' project work. The project is divided into four phases. At the end of each phase a milestone is predicted in which students present their project work to virtual management which decides on future course of the project based on these presentations. On the project end student teams present the whole development project to virtual management or to representatives of regional industrial companies, if possible. In certain cases the management awards prizes for the best solutions. Each team makes an evaluation of their group performance and their individual team members in a feedback briefing. The results are handed to the management for an assessment.



*Figure 3. Students Project Development Work*

Based on assessment of virtual management and students' engagement on lectures and workshops, the work, knowledge and degree of understanding of course problematic of individual students is evaluated. In that way, students are evaluated not only by course professor and in that way additional objectivity is added to evaluation process.

## Management of Product Development & Innovation management

Currently, UES does not offer the curriculum in field of Management of Product Development & Innovation management. There are some subjects in curriculums essential to education in field of Management of Product Development & Innovation management but the key subjects/topics are missing (Basic of Management, Project Management and Integrated Management Systems).

### CONCLUSION

Analysis of current state of education in the field of Product Development and Management of Product Development & Innovation Management (PDMPD&IM) at the University of East Sarajevo (Faculty of Mechanical Engineering) shows the following:

- Bachelor degree students have more than enough opportunities to learn fundamentals of PDMPD&IM, during the highly specialized training in the field of Integrated Product Development, which is provided in the 8. Semester. This subject is based on KaLeP model of education.
- Relevant Master degree study modules include some basic courses in the field of Management, but Mechanical Faculty in East Sarajevo will introduce new subject relevant to Industrial Product Development in next year of Master course. Some of the present courses could be additionally improved (especially those held by staff members of new relevant Engineering Product Design Department), by implementing new teaching methodologies, new teaching materials (handbooks, power-point presentations etc.), new workshops, new lectures (with latest trends in relevant scientific areas discussed) etc.
- UES (Mechanical Faculty of East Sarajevo) in the school year 2013/2014 will introduce new module "Engineering Design of Products", mainly based of needs for education in the field of PDMPD&IM. All important information about introducing new module in bachelor level and modernization of structure and content of curriculum in the field of "Industrial Product development" on master level will be a part of next report (related to WP 1, 1.5.).
- There are no obligatory courses on Doctoral degree studies related to the PDMPD&IM, but in the future, during the period of preparation of PhD studies in UES, subjects of this field will be include in official curriculum.
- All analyzed courses are well harmonized with the principles of Bologna declaration and they promote the importance of PDMPD&IM for future development of technical sciences. They also integrate both theoretical and practical knowledge in order to make students of the University of East Sarajevo more competitive on world-wide Labor market;