RAZVOJ NOVIH PROIZVODA U VIRTUALNOM OKRUŽENJU ZA UČENJE

Dorian Marjanović, Stanko Škec
Chair of Design and Product Development

Education topics:
- Product Development and Design Methods
- Computer Tools in Product Development and Design
- European Global Realization Course

Research interests:
- Extended CAD/PDM/PLM models
- Engineering knowledge management
- Computational design synthesis and complex systems optimization
- Traceability of the engineering design information

Industrial cooperation:
- Product Development Centre
- CAD, PDM, PLM customization and implementation
- Product families and modularization
- Rapid prototyping

International cooperation:
Research cooperation & visibility

- PhD students exchange
- Joint PhD thesis evaluation committees
- Postdoc exchange
- Joint projects
- Joint education

_Focal point: Learning & sharing experiences_
Struktura kolegija Katedre
Teaching Engineering Design & Product Development

Changes in understanding of engineering design led to novel approaches in engineering design education

Key question:
What is the right teaching / learning style/method?

No unique answer, but common agreement:
• Creativity
• Interdisciplinary approach
• International, multicultural facets
• Active learning
• Problem based learning
• Project based learning
• ......
Creativity fostering techniques and methods are recognized as being key for the future engineers.

Creative problem-solving is valuable at any stage of the design process, but it is of critical importance in the early design stage.

How to support students challenged by complex engineering design tasks.
European Global Product Realization (EGPR)
The European Global Product Realization (EGPR) course is an academic virtual enterprise which joins together students from multiple European universities. Different cultures, experience and knowledge are tossed together to realize a project in a virtual environment.

The aim of the project is to materialize a global product which includes steps ranging from the market research to the production of the physical working prototype.
EGPR Course Objectives

- to conduct product development in international teams by use of videoconferencing and other collaboration support technologies,
- to define and conceptualize new global products by applying state of the art knowledge and collaborative methods,
- to extend and apply students knowledge related to product technologies, product structuring and adaptability, use and recycling of materials, technologies for manufacturing, as well as economic, business and environmental aspects,
- to realize global product concepts in the form of virtual and physical models and prototypes, and
- to acquire communication skills by organizing presentations and by experiencing the teamwork
European Global Product Realization (EGPR)

Joint course organised by universities and industrial partner targeting global product development knowledge.

Teams formed with students from different universities.

Industrial partner:
• initial problem definition,
• project evaluation
Development of an active rehabilitation support device

**Industrial Partners**: University Medical Centre Utrecht, and companies Evalan and Protospace
Assignment: Adaptive parasol systems

Industrial Partner: Suman d.o.o.
2013 project

Assignment: Ultra-light aircraft for dissebled pilot

Industrial Partner: Kondor Project Ltd.
Assignment: Advanced meal preparators

Industrial Partner: Bosch-Siemens Kitchen Appliances
In October 2014 joint educational project called NARIP (Networked Activities for Realisation of Innovative Products) and supported by ERASMUS+ funding has been launched.

The main goal of the NARIP project is to develop, test and consolidate a design education methodology for collaborative new product development (NPD) in dislocated, virtual environment.

The collected and generated knowledge and data should be openly available for all interested public.

This task should be done based on all previous experience and research results gained during the history of EGPR course.
2015 NARIP/EGPR Project Task

- Device for underwater inspection of welds in nuclear reactor pressure vessel

- **Industrial Partner**: Institute for Nuclear Technology - INETEC, Zagreb
IT Support

Communication SW

CAD SW

Simulation SW

Patent DB

Visual collaboration SW

......
Due to complexity of the project digital whiteboard tool (Conceptboard) has been introduced
Discussion and sharing knowledge on innovative solution of partial function

Proposed idea for the solution of a main pump:
- Hydraulic scheme

Working principle:
- The main pump for hydraulic system which works at a constant pressure of 2 bar in water-based hydraulic systems, is one of the most commonly used systems. The pump is designed to provide a constant flow of water at a specific pressure, regardless of the load on the hydraulic system.

1. Attaching the hydraulicpt and oil tank
2. Attaching the hydraulic fluid
3. Connecting the hydraulic lines

Proposed idea:
- The main pump for hydraulic system which works at a constant pressure of 2 bar in water-based hydraulic systems, is one of the most commonly used systems. The pump is designed to provide a constant flow of water at a specific pressure, regardless of the load on the hydraulic system.

1. Attaching the hydraulicpt and oil tank
2. Attaching the hydraulic fluid
3. Connecting the hydraulic lines
From conceptual design to working prototype....
... and testing
Komentari studenata

“Količina iskustva stečena na ovom kolegiju je ono što me zaista oduševljava!”

“Stekao sam nove prijatelje, osjetio sam kako bi mogao izgledati moj budući posao kao inženjer strojarstva i razvio sam svoje komunikacijske vještine i moć uvjeravanja (barem na engleskom).”

“Kolegij mi se učinio kao prilika za stjecanje novih znanja i iskustava, kao i za sudjelovanje u multinacionalnom timu koji će zajedničkim snagama morati prionuti na dani im zadatak”

“Prvenstveno sam mislio da će mi to biti najbliži dodir sa proizvodnjom. Svi naši dosadašnji projekti bili su samo "na papiru" zbog toga me zaintrigiralo kako je to kada projekt dođe u fazu realizacije.”

“...osim toga, dobro je to što student na kraju može opipati ono što stvara tokom studija, a ne tek kad dobije diplomu u ruke!”

“...perspektiva kolegija koji za razliku od ostalih ne nudi samo teoriju, već i praktičan rad, dakle, da iza svega na kraju stoji nešto opipljivo, činilo se kao prava stvar... “
Conclusion

EGPR outcomes are function of the project, context, activity of the teams, and goals of the students.

Students build their own internal frameworks of knowledge.

Cognitive conflict is the stimulus for learning.

Fostering students critical thinking reflecting not only on *what* they know, but on *how* they know it.

Coaches monitor understanding and project progress.

Social and cultural factors affect teams outcomes.

Knowledge evolves through negotiation and evaluation of the viability of individual understandings.

Collaboration promotes PBL.
Conclusion

Organisational difference between real industrial projects and project-based learning in virtual environment:

- Industrial geographically dispersed teams solve partial problems locally.
- EGPR/NARIP teams solve partial modules of complex problem in virtual environment.

EGPR/NARIP approach adds to increased coordination and communication needs. The realisation of complex products increases the demand for project management and decision making protocols.

Regardless to project complexity, students gained sufficient competences in virtual NPD process.
DESIGN 2018
Excellence in Design

15TH INTERNATIONAL DESIGN CONFERENCE

NEWs & EVENTS

New conference venue for DESIGN 2018
February, 8 2017

Important dates for the DESIGN 2018
January, 31 2017

DESIGN 2016 ended successfully
May, 19 2016

www.designconference.org
Hvala!
<table>
<thead>
<tr>
<th>Year, host university</th>
<th>Partner company</th>
<th>Project task</th>
<th>Research focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015, Zagreb</td>
<td>INETEC d.o.o. - Zagreb</td>
<td>Remotely operated submersible device for inspecting of welds in nuclear reactor pressure vessel.</td>
<td>Complex mechatronic system, shared understanding between design teams</td>
</tr>
<tr>
<td>2014, Ljubljana</td>
<td>Bosch and Siemens Home Appliances</td>
<td>To develop the idea for a device which would radically ease the process of healthy meal preparation.</td>
<td>Future customer needs and trends in home appliances, social networks</td>
</tr>
<tr>
<td>2013, CUL London</td>
<td>Condor Project Ltd., Hull</td>
<td>To design and build a small aircraft to be flown by disabled pilots.</td>
<td>Ergonomics for disabled people, cross-team design communication</td>
</tr>
<tr>
<td>2012, Zagreb</td>
<td>Suman d.o.o. - Zagreb</td>
<td>To increase business opportunities by design and optimisation of various parasol products.</td>
<td>Product design vs engineering design, and the collaboration between them</td>
</tr>
<tr>
<td>2010, Ljubljana</td>
<td>BSH, LIV - Slovenia</td>
<td>Hand held blender which would target modern urban men. Innovative toilet flushing system.</td>
<td>Socio technical aspects of design, multitasking</td>
</tr>
<tr>
<td>2009, TU Delft</td>
<td>University Medical Centre Utrecht</td>
<td>Device and service to help patients and physicians through the rehabilitation therapy.</td>
<td>Biomedical engineering, fuzzy front end research methods</td>
</tr>
<tr>
<td>2008, Zagreb</td>
<td>TEHNIX d.o.o., Donji Kraljevec</td>
<td>Mobile autonomous ecological house - autonomy in respect to energy provided from the available alternative sources.</td>
<td>Sustainable energy, sociological factors of work in virtual design teams</td>
</tr>
<tr>
<td>2007, CUL London</td>
<td>Kesslers International Ltd</td>
<td>Technologically advanced point-of-purchase (POP) display which will be used in sales of a male grooming products.</td>
<td>Design integrated research for customer oriented products, integrating undergraduate and industrial research</td>
</tr>
<tr>
<td>2006, Ljubljana</td>
<td>NIKO, Železniki</td>
<td>Transport device to be used for civil engineering, furniture moving and other works performed in multi storey buildings.</td>
<td>Human centred PD for specific market, design for the bottom of the pyramid</td>
</tr>
<tr>
<td>2005, EPFL Lausanne</td>
<td>Avidor S.A., Lausanne</td>
<td>Device for vineyard treatment with micro spraying technology to reduce chemicals loss</td>
<td>Human- and environment-centred PD, development of holistic design competence</td>
</tr>
<tr>
<td>2003, TU Delft</td>
<td>Vlamboog, Netherlands</td>
<td>Innovative personal protecting and vision equipment for welding.</td>
<td>Conceptualization and prototyping for company</td>
</tr>
<tr>
<td>2002, Ljubljana</td>
<td>Kolektor LIV, Vlamboog</td>
<td>Innovative vacuum cleaner (LIV), breathing protection units for welders</td>
<td>Redesigning and prototyping for global market</td>
</tr>
</tbody>
</table>
References


NARIP documents