

TEMPUS JEP\_40059\_2005:

Development of Master program in Industrial Ecology in Bosnia and Herzegovina

## Learning Engineering Through Projects



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## How can we learn to design a PBL course?

- Jordi is a senior professor and an expert in PBL so he will lecture to senior professors how to design a course ..... during 3 hours.....



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## How can we learn to design a PBL course?

- We will Project Based Learn
- Steps:

### 1. To define the project

#### – Outcomes:

- To exchange experience of teaching engineering through projects
- To address key issues in the area
- To develop ideas for implementing projects or enhancing your use of projects in your teaching.

#### – Methodology: Project Based Learning

#### – Assessment: Peer review

### 2. To form groups to develop the project

### 3. To start working.



## Our Graduates

- What characteristics do we want our graduates to possess?
- Please discuss this in your groups and produce a joint list of the most important ones.



## Experience of Projects

- In your groups, please share – briefly – your experience of **learning through projects**
- This may be as a student or as a lecturer
- Please identify one of your group members to provide a **very brief description of the types of projects** that you have experience with.



## The O-M-A Model

- Designing for learning needs to consider:
- **Outcomes** – what are you trying to achieve?
- **Methods of teaching** – what methods are you going to use, and why?
- **Assessment technique** – how are you going to assess the achievement of the outcomes?



## Outcomes

- Often broken down into categories
- Engineering Subject Benchmark Statement uses five headings:
  1. **Knowledge and Understanding:** discipline knowledge
  2. **Intellectual Abilities:** solve problems
  3. **Practical Skills:** use laboratory equipment
  4. **General Transferable Skills:** Work in multidisciplinary team
  5. **Qualities:** Self-motivated



## Comment from an Assessor

“That was a brilliant lecture. I enjoyed it immensely and I can’t see how it could have been improved...

...but...

...it was **not** an excellent piece of teaching.”

Explain!



## The O-M-A Matrix

Outcome	Method	Assessment

This O-M-A matrix highlights the direct relationship between individual outcomes and the methods used to teach and assess each of them.



## Project Outcomes

Outcome	Method	Assessment
?????	Project	
?????	Project	
?????	Project	

**What outcomes could projects achieve?**



## What do we mean by a project?

- Diverse!
- Key feature is that a project...
  - **Applies a range of expertise to a task in order to produce an output with defined characteristics**
- Freedom within this framework
- Often substantial in size, but doesn't have to be
- Often involves group work, but doesn't have to.



## Types of Project

- Design portfolio
- Management simulation
- Mechanical dissection
- Environmental impact assessment
- Design and build.
- Product analysis
- Design competition
- Simulated public enquiry
- Production of a tender document
- Economic feasibility analysis
- Teamwork training.



## Projects and Problems

- PBL is used to refer to Problem Based Learning and Project Based Learning
- Much project-based learning involves problems
- Much problem-based learning involves projects
- Not identical but they do overlap a lot
- We can learn from problem based learning – see “School-based” handout.



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## Examples of Project Briefs

- During the break, please spend a little time looking at the examples of project briefs that people have provided.



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## Projects reach the parts...

- ...that other methods can't teach
- Problem solving
- Identifying key issues
- Teamwork and leadership
- Negotiating skills
- Integration of expertise
- Management, including risk management
- etc



## Your Project

- To give you something concrete to work on...
- ...please identify a way in which you either already use, or might use, projects in your teaching
- Please write down a few notes about your approach and add to these as we move through the next few stages.



## Project Outcomes

Outcome	Method	Assessment
?????	Project	
?????	Project	
?????	Project	



## Outcomes Activity

- In your groups...
- ...please make a list of items that could go into the outcomes column alongside projects as teaching methods...
- ...for the use of projects that you have in mind.



## Examples of Projects

- Any comments on the examples of projects that you have been looking at?



## Programmes and Modules

- The discussion so far has been in the light of your own modules
- We work within the context of subject benchmark statements
- The benchmark items we select at the programme level have to be delivered at the module level
- Projects can help deliver some of the more difficult items.



## Programme Matrix

Benchmark item	Modules						
1							
2							
3							
4							



## Can Projects Help?

- Are there items in your subject benchmark statement that projects could help with?



## The Skills, Attributes and Qualities of an Engineer

- See summary of these from Maddocks, Dickens and Crawford (2002)
  1. Knowledge & Understanding
  2. Intellectual Abilities
  3. Practical Skills
  4. General Transferable Skills
  5. Qualities



## The Skills, Attributes and Qualities of an Engineer

# The Barcelona Declaration

## EESD 2004

The declaration summarizes the fertile discussions and intense sharing of experiences made by more than 230 participants towards Engineering Education for Sustainable Development.



# The Skills, Attributes and Qualities of an Engineer

## We declare that

### Today's engineers must be able to:

- Understand how their work interacts with society and the environment, locally and globally, in order to identify potential challenges, risks and impacts.
- Understand the contribution of their work in different cultural, social and political contexts and take those differences into account.
- Work in multidisciplinary teams, in order to adapt current technology to the demands imposed by sustainable lifestyles, resource efficiency, pollution prevention and waste management.
- Apply a holistic and systemic approach to solving problems and the ability to move beyond the tradition of breaking reality down into disconnected parts.
- Participate actively in the discussion and definition of economic, social and technological policies, to help redirect society towards more sustainable development.
- Apply professional knowledge according to deontological principles and universal values and ethics.
- Listen closely to the demands of citizens and other stakeholders and let them have a say in the development of new technologies and infrastructures.



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# The Skills, Attributes and Qualities of an Engineer

- Try some of the specific skills in the following matrix...



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## Benchmark Outcomes

Outcome	Method
The ability to assess and manage risks	Project
Manage resources and time	Project
Work in a multi-disciplinary team	Project
Self-motivated	Project



## Assessment

- Projects may be substantial proportions of a student's assessment
- They may also present particular difficulties
- eg Groupwork
- Consider this aspect of the matrix...
- ...and then come up with your recommendations.



## Project Assessment

Outcome	Method	Assessment
	Project	?????
	Project	?????
Work in a multi-disciplinary team	Project	?????



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## Assessing Groupwork

- What are we assessing?
- Who is assessing?
- How are marks allocated?
- How is consistency of marking ensured?
- What happens in the case of a failed group project?
- Do all students evidence all outcomes?
- See handout and Issues & Advice.



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## Guidance on Projects

- See Guide to Learning Engineering through Projects (2003)...  
<http://www.pble.ac.uk/guide.html>



## Issues in Projects

- Outcomes and assessment are not the only issues in relation to projects



## Some Issues in Projects

- Resources – including space
- Staff skills
- Student skills
- Supporting individuals and groups
- Group size and selection
- Managing risk.



## Recommendations

- In your groups, please produce a group list that offers your recommendations on your group's issue.



## Using Projects in Your Teaching

- Please spend a few minutes reflecting on how you could improve your use of projects in your teaching
- Then share your ideas with one or two colleagues
- Please then identify one action that you are going to take that you can share with the whole group.



## Contact Information

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Time	Item	Comments	Who
000	Welcome and introductions		
005	Our Graduates	Group task and plenary	
010	Purposes	Input	
	Experience of Projects	Group task and plenary	
020	O-M-A Model, Types and Matrix	Input	
040	From...Project Outcomes into...to...Your Project	Input and individual/paired task	
055	Project Outcomes activity	Group task	
075	<i>Break</i>	<i>View examples</i>	
090	Discussion of examples	Plenary	
100	From Programmes and Modules... ...to...Benchmark Outcomes	Group task	
110	Assessment and Assessing Groupwork	Input and group task	
135	Guidance and Issues into	Input	
145	Recommendations	Group task and plenary	
165	Reflections	Individual and plenary	
175	Closing comments		
80	Close	<b>Course INDUSTRIAL ECOLOGY</b> <b>27-29 September - Sarajevo</b>	