Project Based Learning in Internet: the NetPro approach

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Content

- What is NBPL and why it is important?
- The NetPro project: models and tools for NBPL
- Pilot Courses in Electronic Systems Design
- Students’ evaluation of the course
- Experiences and recommendations
What is NBPL?

- PBL (Project Based Learning) is an established pedagogical approach in Engineering Education
  - Learning through the development of a project
  - Emphasis on team work
- NBPL (Network Based Project Learning) is PBL supported by network services.
Why NBPL?

- Engineering work is project-organized teamwork
- Continuously changing working environment
  - network-based collaboration
  - rising role of information and communication technology
  - knowledge sharing
NetPro Project
(Leonardo Da Vinci Programme)

Innovative integration of PBL and network technology

(Design, develop, test and disseminate network based project learning approaches in engineering education)

NetPro I: 12/97 - 12/00
NetPro II: 12/00 - 12/03

(see http://netpro.evitech.fi/)
NetPro Partners

FIN Espoo - Vantaa Institute of Technology
Jyväskylä Polytechnic
Federation of Finnish Electrical and Electronics Industry
HCI Productions Oy
Employers’ Association Allianssi

F Universite de Toulouse le Mirail

UK Kingston University
University of York

NL Hogeschool Holland
Hogeschool van Utrecht

I University of Genoa
University of Trento
SCIENTER

BG Technical University of Sofia
Objectives of NetPro Project

- Models and methods for NBPL
- Materials and tools to support the implementation of NBPL
- Dissemination of experiences, materials and tools developed
- Teacher training
- Pilot courses in the area of information technology
- Systematic evaluation
Project learning

- Part of the learning organized as a *team* project

- Different types of design projects
  - Students from same or different level of study
  - Same project topic or different project topics
  - Topics given by teachers, students, customers

- Lectures, tutorials, self-study to learn basic knowledge and skills

- Project monitoring and assessment locally
Learning activities

- Collaborative project learning within own team
- Publishing of project deliverables for the learning community to share
  - Collaboration based on artefacts
- Networked learning activities
  - Peer reviews of project deliverables
  - Special Interest Groups
Networked project learning environment

- All pilot sites have their own local learning environments (with local resources)
- Collaboration space provided by the NetPro project includes custom tools to support NPBL on the Web
  - support material on learning activities
  - indexing of project teams and required deliverables
  - publishing of project deliverables
  - networked learning activities
  - peer assessment
Structure of Learning Environment

Local Learning Environment Pilot Site 1
- Course information
- Learning materials
- Specific tools and applications
- Resources
...

Team 1A Project Site
- Document archive
- Project log
- Team interaction
...

Team 1B Project Site
- Document archive
...

Team 1N Project Site
- Document archive
...

NetPro Collaboration Space
- Projects Deliverables
- Centres
- Peer reviews

Local Learning Environment Pilot Site 2
- Course information
- Learning materials
- Specific tools and applications
- Resources
...

Team 2A Project Site
- Document archive
- Project log
- Team interaction
...

Team 2B Project Site
- Document archive
...

Team 2N Project Site
- Document archive
...

Learning activity
- SIG Topic 1
- SIG Topic 2
- SIG Topic N

Learning activity
- Inter-institutional project
Student tools
### The ESD Pilot Courses in NetPro I

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<td>ESD1-00 Fin.</td>
<td>4</td>
<td>16</td>
<td>Using ESD1-99 GE linked projects</td>
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A Look to a Pilot Course

- NetPro models and concepts need to be applied and adapted to specific pedagogical situations.
- The following slides describe a few issues concerning the experimentation of NBPL in the core of a traditional introductory university course.

(see http://www.esng.dibe.unige.it/netpro)
Electronic Systems Design 1 (ESD1) is an introductory module on digital electronics,
ESD1 teaching develops in a semester (50 hours lectures, 15 hours lab)
ESD1 main contents are:
- Boolean algebra, binary arithmetic, combinational networks design and analysis.
- Introduction to design of digital systems, based on Finite State Machine (FSM).
ESD1 Main Features

- high number of students (more than 200)
- non-homogeneous student population in terms of background and motivation
- limited resources available in term of laboratories, networked PCs and tutoring manpower
- necessity of increasing the “practical” aspect of the course
How NBPL Improves Traditional ESD1

- NBPL does not replace traditional lectures, but runs in parallel with the traditional course
  » Lectures keep together the social tissue of the course and build a common language.
  » NBPL is very effective in building design and analysis capabilities.

- NBPL is an effective resource for organising and following students’ practical work
  » Students work on a project for all the duration of the course
  » The project is related with the course topics sequence
  » The project activity complements the laboratory sessions
  » Strict deadlines synchronise the teams’ work
ESD1: the structure of the projects (1)

- When the project is assigned, at the beginning of the semester, the team members do not possess any theoretical background.
- The nature of the projects is such as that they can be initiated with a very limited set of skills and develop the capability to apply the theory to practical situations “on the fly”,
- As soon as the lectures develop in the semester, the project guides them to new tasks.
- The continuous interaction that takes place between theory and project is useful for the learning process.
ESD1: the structure of the projects (2)

- Given the high number of participants, ESD1 was divided into **ten projects**
  - Each project is structured as an independent environment, with its own PDC and SIG
  - Number of teams in a project should be large enough to provide a discussion space (>5)
  - Too many teams in a project make SIGs difficult to manage and increase the risk of plagiarism (<12)
  - All deliverables and communication in English
  - The projects share a common learning environment
**ESD1: the Learning Environment**

- A Learning Environment is a collection of resources integrated in a NetPro course to help the student in acquiring the knowledge and the skills that are necessary to develop the project.

- We linked to the project
  - a Computer Based Learning (CBL) environment structured as an ARIADNE course (hypertext and learning tools)
  - Graphical tools suitable for the description of digital systems
  - CAD tools for simulation
    - SCD: digital circuits simulator
    - SIMFSM: finite state machines simulator
    - EMUZ80: microprocessor system emulator.
**Users Evaluation**

- A questionnaire prepared in cooperation with the NetPro Partner in charge of quality support has been used to evaluate students satisfaction.

- The following slides report the evaluation data obtained from the analysis of the “Questionnaire for Learners” filled by the ESD1 course participants.
ESD1: Users Evaluation (1)

- Students in general expressed their appreciation for the pilot course, stressing in particular:
  - usefulness of network-based project learning/project work approach as
    - a stimulating and exciting way to approach new subjects
    - an interesting experiment to find new ways of learning
    - an experience that develops knowledge and creativity
  - working in group and practising on the personal computers
  - project learning stimulates the capacity to organise one's own time.
ESD1: Users Evaluation (2)

- Comparing NBPL against traditional lectures
  - it gives the possibility to test personal skills and to learn by doing
  - it improve team working and co-operation skills
  - it improve skills to adapt to new situations and to take initiative and responsibility
  - project learning is useful for learning the theory better and prepare more thoroughly for the exam
  - some referred to project-based learning as time consuming, sometimes even detrimental for theoretical learning
  - a few difficulties with simulators, that need to be enhanced
  - insufficient power of available PCs, network not reliable
  - laboratories should have been less crowded
  - the risk of being copied is high
ESD1: Users Evaluation (3)

- Students were reluctant in using the Special Interest Groups (SIGs), for the following reasons
  - SIGs are time-consuming to students
  - sometimes students were not able to provide reliable answer to the issue being discussed
  - use of SIGs is not easy as communicate directly, face to face, with tutors and peers

- Peer Review
  - it was a good experience for half of students
  - it stimulates teamwork and enhances collaboration
  - risk of unclear and non-homogeneous peer reviews
  - teachers should have the instruments to monitor Peer Reviews functioning and should play a greater role as co-ordinators
Inter-institutional Projects

- Inter-institutional projects are difficult to set-up
  - Differences in
    - curricula and course programs
    - Lecture scheduling
  - Staff and institutional motivation

- Other forms of inter-institutional co-operation may be less glamorous but quite effective.
  - Sharing projects assignments
  - Projects reviewing projects from other institutions
  - re-use of results
Recommendations (1)

- Change in the teacher’s role should be supported
  - time, money, training, support from the management

- Integrate carefully with the curriculum
  - application of knowledge and skills learned in theoretical courses
  - specify the expected workload to the students
  - project work must be credited
  - avoid overloading of students

- Organise sufficient tutor support to project teams
Recommendations (2)

- Give time to students to learn the new method
  - an introductory lecture on NBPL is certainly not the way to go, it is a long process
  - start the project based learning early in the study programme
  - good supporting materials are required but are not enough, have PBL training sessions before first trial

- the first project should focus on learning the new learning method and the basics of the engineering process
Recommendations (3)

- Challenge the students
  - Pay attention to motivating the students (especially to learn project skills, team skills, etc.)
  - real life projects, real customers

- Extend assessment with self and peer assessment
Thank you for your attention!