Project Component 2 - Conceptual Pedagogical Framework

Final Report Virtual Open-Access Network for Education and Training – Enhancing Interconnectivity between European and Asian Universities

Ryberg, Thomas; Dirckinck-Holmfeld, Lone

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Final Report
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VO@NET

Project Component 2
Conceptual Pedagogical Framework

Final Report

March 2006

Prepared by Thomas Ryberg, Lone Dirckinck-Holmfeld, Brian Møller Svendsen, and contributions from Laura Zurita, Ian Semey, Marianne Georgsen and Stefan Knold, E-Learning Lab, Aalborg University (AAU)

Context

This report has been produced under the VO@NET project, which is supported by the ASI@ IC&T programme held by the European Commission. The project participant's wishes to extend their gratitude to the European Commission supporting this collaboration among the project partners and for the results obtained. The VO@NET project was launched 1. January 2003 and continued to the 31 December 2005 – 3 years of excellent collaboration. The full title of the project is as follows /1/:

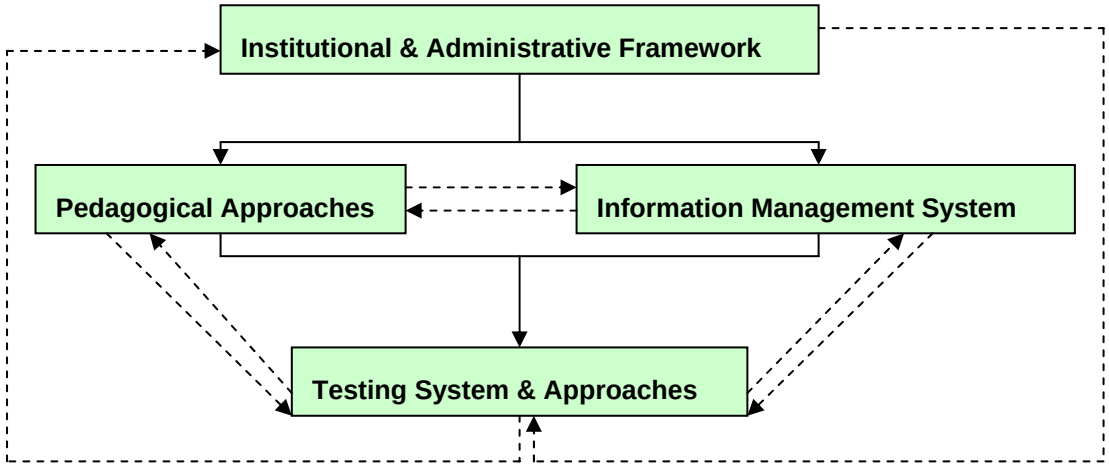
> *VO@NET: Virtual Open Access Network for Education and Training – Enhancing interconnectivity between European and Asian Universities*

The VO@NET consists of 4 project components, as follows:

- Establish an institutional and administrative framework that will ensure the sustainability of the virtual network and reinforce the existing network (PC 1);
- Establish a conceptual pedagogic framework identifying key educational and cultural approaches for a successful implementation of a virtual network (PC 2);
- Design and implement an open-access Web-based Education and Networking service (WEN) to enhance the interconnectivity and curricula development of the existing network (PC 3);
- Test the virtual network through development of educational curricula, the design of online courses and running of those courses (PC 4).

The project components and their inter-linkage are graphically presented as follows:

Structure of the VO@NET Project



The overall objective of the VO@NET project is stated in the Grant Contract as follows:

> *"To strengthen electronic interconnectivity between the consortium universities' existing network, through the establishment of a virtual network. Thereby, enhancing networking, joint course development, communication and information exchange for higher education."*

The project to a large extent took its off spring in previous network collaboration (LUCED-I&UA – Linked University Consortia for Environment & development – In-

dustry & Urban Areas) supported by Danida, the Danish development Aid organisation during the years primo 1998 till June 2004. The network collaboration continued during the VO@NET project and thus relied on an existing network. The overall project aim is to establish virtual connectivity between the partners (see above). The partners participating in the VO@NET project and their role in the project is presented in the following table.

The VO@NET partners and their role

Partner (Abbreviation)	**Department**	**Role of partner**
Technical University of Denmark (DTU)	Environment and Resources (E&R)	PC 1, 3 & 4
Aalborg University (AAU)	E-Learning Lab (ELL)	PC 2 & 4
Universitat de Barcelona (UB)	Theory and History of Education	PC 2 & 4
TUCED I&UA (Thailand) - Chullalongkorn University (CU) - Chiang Mai University (CMU) - Mahidol University (MU) - Prince of Songkhla University (PSU)	 - Architecture - Environmental Engineering - Public Health - Environmental Management	PC 1-4
MUCED I&UA (Malaysia) - University Malaya (UM) - Universiti Kebangsaan Malaysia (UKM) - Universiti Putra Malaysia (UPM) - Universiti Teknologi Malaysia (UTM)	 - Biological Sciences - Chemical Engineering - Mathematics and Science Education - School of Environmental Sciences and Natural Resources - School of Chemical Sciences and Food Technology - Educational Foundation - Civil Engineering - Environmental Engineering	PC 1- 4

This report describes the how the project component has developed, the rationale, the status and some reflections of the results achieved. The lessons learnt and the perspective for future collaboration is described, as well. This report has been prepared under Project Component 2 representing activity 2.1 and 2.2.

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1. Introduction

In this final report from Component 2 in the VO@NET project we set out to give an overview of the activities undertaken related to the objectives of Component 2. We analyse the outcomes of the work, especially through looking at the IT-pedagogical developments that have been both part of the processes and are reified in the final outcomes of the entire project. As a result of the VO@NET project more than 30 courses have been designed, run or planned for. They represent a great variety and follow different pedagogical approaches, as they have different target audiences and modes of delivery e.g. whether they are fully online courses or mixed-mode courses. This reflects also one of the core-issues in the approach of Component 2. We did not aim to 'deliver' a strict methodology to the participants on 'how to design online courses'; rather the aim has been to enable the participants to critically assess and reflect on different conditions for productive online learning environments. Pedagogical design is not a universal or de-contextualised phenomenon but depends heavily on the circumstances and conditions on many different levels. There are great differences in the needs of professionals contrasted to university students and similarly engineers teaching a course on "Waste Management" might need entirely different tools and pedagogical strategies than those teaching "Architectural Design". Therefore, in our view, pedagogical design is not only about following general, abstracted guidelines or heuristics but equally about understanding, reflecting and analysing the different conditions, which the unique course, master programme or institutional infrastructure are subject to and at the same time are producing.

This perspective on pedagogical design and the theoretical, methodological underpinnings are also reflected on a broader European level. It reflects not only the perspective of the researchers from Component 2 but is embedded and acknowledged in larger research networks and research collaborations; thus, it is a theoretically, methodologically and empirically substantiated area. Researchers from Component 2 have simultaneously with the VO@NET-project been engaged in the European Network of Excellence Kaleidoscope (http://www.noe-kaleidoscope.org/). Within this network we have been engaged in various activities:

- Special Interest Groups – SIG - on Computer Supported Collaborative Learning: http://www.noe-kaleidoscope.org/pub/activities/sig/activity.php?wp=63 and http://www.ell.aau.dk/index.php?id=243
- Jointly Executed Integrating Research Projects – JEIRP – on "Conditions for productive learning in network learning environments" http://www.noe-kaleidoscope.org/pub/activities/jeirp/activity.php?wp=15 and http://www.ell.aau.dk/index.php?id=240
- European Research Teams – ERT – on "Conditions for productive networked learning environments" http://www.noe-kaleidoscope.org/pub/activities/ert/activity.php?wp=85 and http://www.ell.aau.dk/index.php?id=234
- A number of publications have been a part of this work and an overview of these can be found at: http://www.ell.aau.dk/index.php?id=60

We mention these activities, as there has been a substantial synergy between these European Research Initiatives. The VO@NET project and the different activities in the Kaleidoscope have mutually benefited each other. The VO@NET-project, courses and methods have been presented and discussed in the Kaleido-

scope related activities and some of the research papers have the VO@NET project as a case. The experiences in VO@NET on using Open Source Software and especially have spread to other related projects, both within e-learning lab but also the ERT is disseminating their results in a Moodle environment, as it is also done in the VO@NET project. The VO@NET project has been presented in different context numerous times and on the 28th of April 2006, Thomas Ryberg from e-learning lab will present experiences with Open Source and VO@NET at the DEAN Network seminar[1]. We shall expand more on the dissemination activities in a following section. One effect of this synergy will be our inclusion of a conceptual tool to frame and understand the VO@NET-project courses. This conceptual tool or framework has been developed through ERT and JEIRP work in, which the VO@NET project has been embedded as a case in the development of the conceptual case. Now we bring this conceptual tool back to the VO@NET-project and use it to frame and reflect on the courses and institutional infrastructure that have been outcomes of the VO@NET project. In one of the final deliverables of the JEIRP and ERT it is concluded:

> *"From the collected cases, it emerges that each environment is unique and requires a specific design and realisation of the networked learning environment. Given this situated uniqueness, none of the above elements can be considered an affordance or a constraint in absolute; affordances and constraints must be considered in relation to the characteristics of the specific context, the needs, the motives, and abilities of the participants, and the kind of activity to be supported." (Dirckinck-Holmfeld, Lindström, Svendsen, & Ponti, 2004)*

We believe this to be an important insight in understanding and carrying out pedagogical design and to design for productive networked learning environments. In the following we shall sketch initially the overall objectives of Component 2 as they were formulated in the LFA, then we shall outline the approach and methodology we followed in realising these objectives. This is of course heavily interrelated with the activities and output of the various undertakings.

2. Objectives

Below we shall outline the objectives of Component 2 as they were outlined in the original project application and just add some brief comments on each objective:

2) Establishment of a conceptual pedagogic framework to identify educational approaches for the successful implementation of a virtual network

Activity 2.1 Identification of pedagogic concepts and tools applied in eLearning and identification of applicable virtual communication tools

Activity 2.2 Establishment of a virtual learning laboratory for the assessment of applicable concepts and tools

2.1. Comments on Activity 2.1

As we have written in the QTR-reports over time, we have realised and finalised Activity 2.1. which can be seen through the fact that several courses have been designed, run and planned for[2]. However, we would like to stress that we have never thought of this activity as an activity to "identify-apply-finish". Pedagogical approaches and virtual communication tools are in constant development. The

[1] Please refer to: http://www.qualityfoundation.org/ww/en/pub/efquel/news/events/dean_network_seminar.htm

[2] Some of these can be seen at: http://elearn.voanet.dk/

Moodle-environments, which have been adopted by all of the partners, have been undergoing continuous changes – new tools and functionality have been added over time, new plug-ins have become available. These changes also impact on what one pedagogically can do. For instance when the 'glossary tool' was added to Moodle it gave opportunities for teachers to define keywords within a theory or central concepts in "Environmental Impact Assessment". However, such tools are never unidirectional and even though certain tools have specific affordances and constraints as inherent properties of their design, then it is essential to understand that despite these inherent properties tools can be taken up and enacted in multiple ways. For an example the glossary tool can be used to convey certain definitions for the students to read, but it also enables different uses – for instance having the students define, what they believe are the important topics or have them define a set of certain topics; and again – a glossary tool can equally be used to keep an address list of students or contain small descriptions of them, which they write themselves. In this sense tools are always open to multiple uses and as such it is not meaningful to view such a process of "identification and application" as something one can ever finish. We therefore argue that this activity is something that has been an ongoing part of our work, namely continuously developing understanding of how tools can be applied in multiple ways and realise different pedagogical rationales.

Getting back to the example of the Glossary Tool - one approach (or way to use this tool) would be that the teacher define keywords and describe them for the students to read and remember, maybe also setting up a quiz to test whether the students can remember these definitions – this would be a classical "teacher centred" way of designing an activity involving the glossary. This draws on a specific view and set of values related to learning, which is often referred to as "the transfer model" or "read-and-repeat" – most contemporary learning researchers would consider this an old-fashioned or classical view of learning, which has been much criticised (Dirckinck-Holmfeld, 2002; Lave, 1988; Lave & Wenger, 1991). Another way of adopting and enacting the tool could be, to let the students discuss and define what are the important aspects of a theory or methodology in collaboration with the teacher. This would be a pedagogical strategy drawing more on a socio-constructivist perspective, in which knowledge is not transferred or transmitted, but rather students actively 'construct' knowledge either individually or in teams, through working and engaging actively with the subject matter (Illeris, 1977, 2001; Papert, 1983; Piaget, 1969).

We have therefore concentrated on continuously conceptualising what different tools can be used for and how the tools support different pedagogical rationales, or which pedagogical rationales that are more or less explicitly built into the tool. Therefore we have not focused on a providing the teachers of the courses with a fixed methodology on how to use different tools, but rather on providing a series of steps and questions for negotiating, reflecting and analysing what kind of learning approach and pedagogical rationale they would like to realise and then provided support on how they could realise such a design and how to use different tools creatively in such an enterprise.

2.2. Comments on Activity 2.2

The establishment of virtual learning laboratories have been coordinated and carried out in close collaboration with component 3 and there have been several runnings of different virtual labs. Initially, we ran an experiment called the LIVE-course (Learning In Virtual Environments). The idea was to give the participants in the VO@NET-project first hand experiences with online courses, through engaging in an online learning course, where the subject of the course was the design, theory and methodologies of designing online courses. Such a course was run with good success in another project called VISCA

(http://www.kommunikation.aau.dk/visca/). Likewise we aimed at delivering a course for the VO@NET partners on online learning[3]. Thereafter, both Learning Managements Systems (LMSs) and Virtual Collaboration Environments (VCEs) were established and hosted by Component 3. The VCEs have continuously been hosted by component 3, whereas the LMS have been moved to the local universities. During the VO@NET project we have communicated, collaborated and worked with the following systems:

- Virtual-U – Learning Management System[4]
- PHPBB2 – forum tool
- Owl - Document management system
- Moodle – Learning Management System

These systems serve different purposes and include different tool or very different ways of implementing the tool e.g. PHPBB2, Virtual-U and Moodle all feature asynchronous communication tools but these are very differently designed and structured. As an inherent part of communication and collaboration has been to work practically and reflectively with these tools and to identify their use in different contexts; communicative needs in managing a EU-project might differ substantially from the communicative needs of an it-supported on-campus learning environment. Further, workshops have been held in which there have been experiments with reusable learning objects, through working with both MS PowerPoint and Macromedia Flash.

The initial thought and ideas that were negotiated between component 2 and 3 encompassed that we would supply a range of systems and tools for the partners to use. However, as partners were introduced to Moodle, they all chose to work with this particular LMS. For e-Learning Lab Moodle has also been carried over to other projects and uses e.g. the ELAC and MVU project also feature use of Moodle[5]. Likewise for Component 3 who have also used Moodle for other purposes

3. Approach and methodology

As have been mentioned in earlier quarterly reports and was also the reason for the prolongation of the VO@NET-project, the project was delayed within the first six months due to uncontrollable and unfortunate events (please refer to QTR2). This resulted in some uncertainty and initial instability in the project, both in relation to what could be accomplished but also in staffing and persons available. Therefore activities started rather late (15th of May 2003 – please refer to QTR1) but a work plan was agreed on and work began.

The overall approach and methodology of component 2 reflect traditions within *action based research* and *design based research* (Bell, 2004; Collins, Joseph, & Bielaczyc, 2004; Dirckinck-Holmfeld, 2000; Lewin, 1951), but also the pedagogical approach at Aalborg University *Problem Oriented Project Pedagogy* or *Problem Based Learning* (POPP/PBL) (Dirckinck-Holmfeld, 2002; Dirckinck-Holmfeld & Fibiger, 2002; Kolmos, Fink, & Krogh, 2004). These approaches all reflect an active engagement of participants, not only cognitively but also through concrete experimentation coupled with theoretical reflections. Rather than taking an expert vs. non-expert or teacher vs. student approach where we as pedagogical "experts" would train and deliver to the participants a definite methodology on

[3] http://www.kommunikation.aau.dk/visca/org/voanet/

[4] Virtual-U is no longer being developed and the webpage for the system has sieged to exist

[5] http://www.moodle.ell.aau.dk

"pedagogical design", we aimed at involving and engaging with the participants existing experiences of teaching and doing pedagogical design through dialogue; essentially because they are all experienced lecturers and educators. One aim was to connect to existing knowledge and practices of participants as to enable a reflection on current practice and how this could both feed into online pedagogical design, but also to enable reflections on how the use of online learning could or prompts and give opportunity for changing pedagogical perspectives.

This is theoretically inspired from thoughts from Donald Schöns work on the notion of "The reflective Practitioner", which draws lines back to action research and experiential learning (Kolb, 1984). The online pedagogy of the different courses has emerged from the practical experience of teaching from both parties (teachers and pedagogical designers), the theoretical background knowledge of the pedagogical resource persons and the theoretical insight of the teachers in the subject matter. In this sense we understand the courses that have been developed as a collaborative enterprise between pedagogical designers and the teachers in the project.

Transforming a conventional course to an online environment is an opportunity for all partners to reflect *in* and *on* practice:

> *"When a practitioner reflects in and on his practice, the possible objects of his reflection are as varied as the kinds of phenomena before him and the systems of knowing-in-practice which he brings to them. He may reflect on the tacit norms and appreciations which underlie a judgment, or on the strategies and theories implicit in a pattern of behaviour. He may reflect on the feeling for a situation which has led him to adopt a particular course of action, on the way in which he has framed the problem he is trying to solve, or on the role he has constructed himself within a larger institutional context (…) When he finds himself stuck in a problematic situation which he cannot readily convert to a manageable problem, he may construct a new way of setting the problem – a new frame which, in what I shall call a "frame experiment", he tries to impose on the situation " (Schön op.cit. 61-62).*

Developing an online course for the teachers the first time is "a problematic situation". It's a problematic situation in the sense that the teachers have to imagine and "frame" the new teaching and learning practice, however it's also a problematic situation because the online environment demands of the teachers to be more explicit about their teaching and learning style and methodologies than they are used to. Changing a conventional teaching practice into a virtual environment is in that sense an opportunity for the teachers and the pedagogical designers to reflect *on* existing teaching but also to frame and construct a new way of setting the problem of teaching.

As it is clear from this description of the course development processed the course designs have been forged through collaboration between the online pedagogical resource persons and the teachers of the courses. The original design of the courses has been transformed and turned into an online course based on proposals from the teachers of the course. In this work the pedagogical resource persons have acted as reviewers and collaborators by commenting on proposals, giving ideas for design and so on. Though, in the course of the project, there have been some introductions to theories on pedagogy and learning, however the more theoretical part of learning and pedagogy has not necessarily been a shared discourse (or repertoire) on specific theoretical positions such as Communities of Practice, constructivism or Problem Based Learning. This certainly does not mean that the design of the courses has not been theoretically informed, but only that the discussions between the participants in the process have not revolved around nitty-gritty specific discussions on Piaget vs. Vygotsky, but rather discussions on practical course design. The teachers of the courses have extensive practical ex-

perience on teaching and have been working with problem-based learning within the subject area of environmental engineering, though they may not have specific theoretical pedagogical knowledge. Therefore we will describe the overall process as a dialogue between participants with different backgrounds (pedagogical researchers and designers coming from a humanistic tradition situated in a Danish context) and environmental engineering researchers and teachers coming from a technical tradition situated in a Thai and Malaysian context) with the course as a boundary object (Star & Griesemer, 1989). A boundary object is a representation that can work as a shared reference point among two or more parties, though they may view it through different lenses and derive and ascribe different meaning to it. Engeström visualises such relations as interacting activity systems collaborating around a potentially shared object:

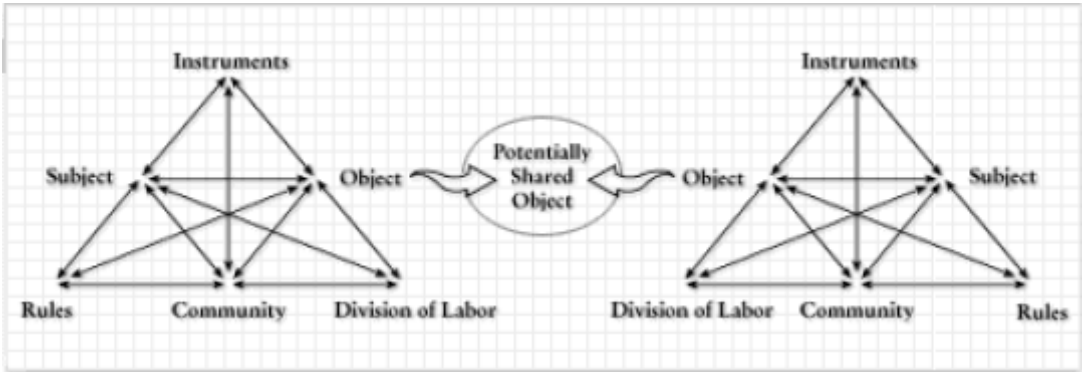


Figure 1- Interacting activity systems - illustration by Engeström

Here we are drawing on activity theory in order to represent some of the components of project collaboration. For this we use the activity triangles developed by Engeström (1987). Engeströms model draws on central insights from the cultural-historical tradition within psychology.

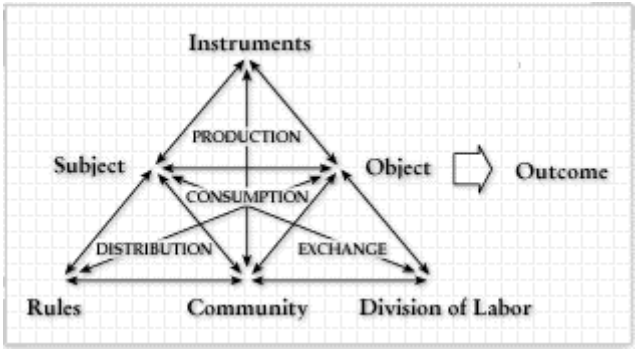


Figure 2: An activity system as visualised by Engeström, 1987

In activity theory the unit of analysis is 'an activity', which is usually visualized by a single-triangle model (Engeström, 1987). In this figure we see that a subject (or group of subjects) interacts with the world using tools (instruments/artefacts) in order to transform an object into an outcome. The object is not to be confused with artefacts, as the object is not necessarily a 'thing' as such. The object of the activity is what people collectively or individually are working on and which is transformed into an outcome. The object of the activity can be both material and/or ideal (conceptual) An object in an activity could be e.g. the transformation of a stone into a tool. Or this article during our work with the concepts and cases can be seen as our object, which has been turned into an outcome (the final article). The upper part of the individual triangles reflects the notion that human activity is always mediated by artefacts and that the psychological and cognitive processes are developed and transformed through these artefact-mediated activities (Vygotsky, 1978). The lower part of the triangle originates from the further

development of the theory by Leont'ev, who stressed the collective nature of activity systems (Leontjew, 1977), and that human activities are mediated by rules and norms, and reflect a certain division of labour. This was graphically expressed in the triangular model by Engeström (1987). A central notion within activity theory is that the driving force of development and change stems from contradictions within and between the components of the activities. Contradictions and the resolution of these contradictions are the principle of the activity's self-movement and development. This is coherent with the research that shows learning (and change) should be caused by an internal motivation, in order to get a robust, lasting process. The subject must feel the imbalance, being confronted with problems without immediate solutions. This is also expressed in Engeström's interpretation of Bateson where individual and collective learning is cast in terms of successful resolution of double-bind situations and the expansion of existing activities and practices into qualitatively new ones. This is what Engeström refers to as expansive learning. Thus contradictions within activity systems can both be understood as hindering development, at the same time as being the principle of development, which depend on whether the contradictions are resolved or never addressed.

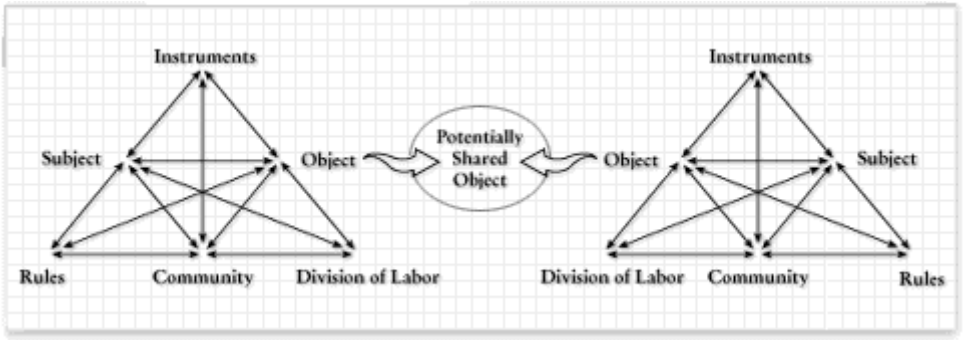


Figure 3: Interacting activity system

Recent development of the theory has suggested that the unit of analysis is to be seen as minimum two interacting activity systems as above. This addition makes good sense in relation to our cases, in that we can conceive as our work with the partners as two activity systems, potentially sharing the object of the activity.

In the VO@NET-project in general the collaboration between pedagogical designers and environmental engineers can be understood from this perspective. For the pedagogical designers an object and motive in itself was to bring about pedagogical transitions and to stress notions such as collaborative learning, PBL, student centred courses, dialogues and problem orientation. For the teachers the objects have been to deliver an online course that fit the institutional requirements, master the Learning Management System (LMS), digitise existing material and deliver a sound, satisfying course to the students. In this sense it was clear that we functioned as two different activity systems, with each our interests, goals and tools (Zurita & Ryberg, 2005).

In these processes of mutually understanding each other, negotiating and brokering notions such as group work, case work, dialogue and discussions have acted as boundary concepts between teachers and pedagogical designers, though the parties may have had different perspectives on and theoretical understandings of the terms. Therefore we shall not claim that the courses have been theoretically built on e.g. a social theory of learning, activity theory or constructivism as such – but certainly as these constitute the professional backgrounds of the pedagogical designers and pervade the teachers' practices, these concepts have informed the discussions, feedback, comments and the design – not as theoretical constructs, but through the collaborative work on designing the course.

To name but a few of the theoretical inspirations that have pervaded both the discussions of the specific courses but also the general presentations and workshops held during the VO@NET-project, then dialogues and interaction between students and teachers have been an important point. This has been both in the sense of opting for more student-centred approaches and to move from 'transmission of knowledge' to construction of knowledge, but also to stress problem orientation and group work. This is inspired both by the research area of CSCL as well as PBL or Problem Oriented Project Pedagogy (Dirckinck-Holmfeld, 2002). In the latter different principles from e.g. constructivism, activity theory (Bygholm & Dirckinck-Holmfeld, 1999; Engeström, 1987), experiential learning (Kolb, 1984) and social theories of learning (Lave & Wenger, 1991; Wenger, 1998) are prevalent. So to sum up some keywords, which have been important for the project in general and the specific courses:

- Students' and teachers' active and collaborative construction of knowledge - stressing externalisation and experimentation as important aspects of knowledge construction
- Supporting dialogue, shared conceptualisations and discussions, between students and between students and teachers
- Participation, negotiation and reification of intelligible knowledge and knowledge objects within a community of practitioners
- Connecting to participant experiences and professional identities

As has been stated the overall objective of the VO@NET project was to strengthen electronic interconnectivity between the consortium universities' existing network (DUCED, TUCED, MUCED[6]), through the establishment of a virtual network. Thereby, enhancing network building, joint course development, communication and information exchange for higher education. This objective was divided into four sub-objectives or component groups:

1. Establishment of institutional and administrative framework to ensure the sustainability of the virtual network and reinforce the existing network creation (DTU)
2. *To establish a conceptual pedagogic framework to identify key educational and cultural approaches for a successful implementation of a virtual network (AAU)*
3. To design and implement an open-access Web-based Education and Networking service (WEN) to enhance the interconnectivity of the existing network (DTU)
4. To test the virtual network through development of educational curricula, the design of online courses and running of those courses (MUCED, TUCED, DUCED)

Visually and in more concrete terms the project collaboration could be illustrated like this:

[6] These abbreviations are a part of a University Network called Linked University Consortia for Environment and Development (LUCED) – The abbreviations mean T(hai) UCED, M(alaysian) UCED and D(anish) UCED

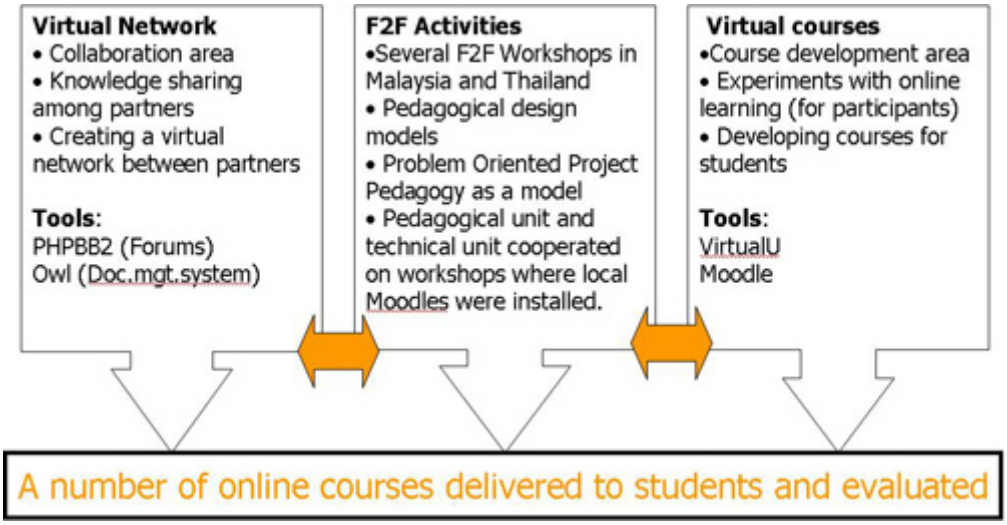


Figure 4 - VO@NET project model

Project collaboration and communication has been conducted partly online, partly through physical meetings and workshops. During the VO@NET-project several rounds of workshops have been undertaken. In relation to these workshops we developed a concrete methodology for designing and developing online courses, in which we identified central points of interest and relations between different components to take into account (such as the pedagogical philosophy of the course, the assessment methods, the content, pedagogical activities and roles and relations between teachers and students). The methodology had an inherent transformative purpose as it focused on transitions towards employing a more PBL-inspired approach. Therefore it encompassed discussions of assessment methods, power relations between students and teacher and the nature of the assignments, as transitions to PBL approaches require changing these relations. The methodology also encompassed notions of how different ICT tools could support various pedagogical constellations. It was by no means an exhaustive list or guide to construction of an online course, rather it was an emphasis of different relations and important concepts to be taken into account in the course design. Thus, it could be seen as a platform for collaborative development and construction of courses through dialogue and experimentation (Engeström, 1996). For a more thorough discussion of some of these issues we also refer to the article (Zurita & Ryberg, 2005) which describes and discuss the approach in the VO@NET and ELAC project.

3.1. Activities and expected output

In the following we outline some of the central activities that have been a central part of the VO@NET project and important outputs and events for Component 2. We do not mention small-scale meeting, as they are also duly reported in the QTR-reports and the annexes for minutes. We focus on the collaborative and "larger" events. We shall describe shortly each activity, but as they have already been reported we refer the reader to the relevant eLL-QTR reports (*it should be noted that eLL has constructed quarterly reports that fed into the final quarterly reports!*).

Dates	Activity	QTR
May 28th to June 3rd 2003	**Workshop:** Introducing Problem and Project Oriented E-Learning In Environmental Courses **Networking:** Marianne Georgsen visited Malaysian partner Universities, collected data and experiences on	eLL-QTR2

	e-learning in Malaysia through this field work. Further, this initially fertilized the ground for the LIVE-course	
August 3rd to August 16th 2003	**Workshop:** Introducing Problem and Project oriented E-learning in Environmental Courses 2nd VO@NET Workshop 7. August 2003. ELL-participant: Stefan Knold **Networking**: Sharing of pedagogical experiences, Pedagogical design, and virtual learning systems/platforms. Review of technological infrastructure. Establishment of network for the LIVE course, through the field work of Stefan	eLL-QTR3
October 1st to December 18th	**LIVE-course:** E-Learning Lab (Component 2) set up an online course called LIVE (Learning In Virtual Environments) as to give participants first hand experiences with doing online learning. 51 participants joined the course.	eLL-QTR4
November 10th to 18th 2003	**VO@NET-Workshop:** A workshop entitled VO@NET workshop was held in Bangkok on the 17th of November. Here Laura Zurita and Thomas Ryberg from e-Learning Lab gave presentations on online learning and an initial methodology was presented to the participants. The workshop gathered the Thai-participants and gave an overview of the VO@NET project also from the other components **Networking:** As part of this travel mission Thomas Ryberg and Laura Zurita visited the Thai-partners as to gather information and share pedagogical experiences, talk about pedagogical design, and virtual learning systems/platforms and to evaluate the experiences from the LIVE-course. **Attending the AAOU-conference**: Both Thomas Ryberg and Laura Zurita attended the 17th annual Asian Association of Open Universities (AAOU) conference that was held in Bangkok. The aim was to gain a broad overview of Asian experiences with online learning and different pedagogical approaches. **Setting up Virtual-U for continued collaboration:** As the Virtual Collaboration Environments from component 3 were not yet ready we decided to utilise Virtual-U for collaboration amongst the partners, until the VCEs would be ready	eLL-QTR4
January, February and March 2004	**Experiments with collaboration tools:** During January and February the VCEs that component 3 were developing and hosting were initially taken into use. So we started experimenting with Moodle, PhPBB2 and Owl – both for joint courses and project collaboration. **Supporting Joint course between AAU and Chulalongkorn University:** As part of the VO@NET project we set out to deliver IT-support to a joint course between Danish and Thai students. They were all students within architecture, design and urban planning. The Moodle was meant as a way to support student interaction between two physical workshops – one in Bangkok	eLL-QTR5

	and one later in Aalborg and Copenhagen.	
March 2004	**Travelling workshops:** During March 2004 a series of travelling workshops were undertaken especially in Thailand, but also Thomas Ryberg spent a week in Malaysia where he worked with Universiti Malaya and the Open University. Thereafter, Thomas Ryberg visited each partner in Thailand and gave some introductions to Moodle and Online Pedagogical Design. At that time the Moodles were still hosted at the Technical University of Denmark and not yet local installations. However, each university had their own Moodle-space. **Final workshops:** Two workshops were held– one in Malaysia at University Malayia and (22nd March – 23rd March) and one in Thailand at the Prince Of Songkla University (25th of March – 26th of March). The workshops were a follow-up on the travelling workshops at each partner institution and the partners from the respective countries now met up and shared their experiences and course development. At the workshops Dr. Abtar Kaur from Open University of Malaysia was invited to give an introduction to Reusable Learning Objects. Further the course featured practical work in Moodle and presentations on Online Pedagogical Design.	eLL-QTR5
April to July 2004	**Online Support of Course development:** Through use of the forums and also some face-to-face meetings with some of the partners (CU, CMU and MU). Component 2 conducted pedagogical reviews of courses and gave feedback to the partners. Also Component 2 gave advice on the use of Moodle and supported the course production process through guidance on various aspects of course development. The pedagogical designers had admin access to all the Moodle environments as to able to help with both advanced settings and practical design. **Creation of Course Production Plans**: As a follow-up activity on the travel mission in March component 2 sent out Course Production Plans (CPP's) for each institution/course. The CPP's presented a schedule for the course creation process encompassing activities and timing. **Production of Manuals and Guides**: Component 2 started to work on a number of manuals. We also identified existing available material we shared with the partners and also encouraged them to use the http://moodle.org where there are loads of online forums – even in native language (Thai and Malay). Therefore manuals and guides were small scale and more targeted. Thomas Ryberg and Brian Møller Svendsen produced a pedagogical design guide with some practical advice for course design, which was put online: http://www.hum.aau.dk/~ryberg/moodle/	eLL-QTR6

August 16h to September 6th 2004	**Travelling workshops:** Another series of travelling workshops were undertaken in both Thailand and Malaysia. This time representatives from Component 2 and 3 worked closely together and travelled together. The aim of Component 3 was to give each partner a local installation of Moodle on a local server and for component 2 to follow up on the courses, give some pedagogical feedback on the course production and introduce new features and their pedagogical use. The local workshops focused both on practical Moodle work and general online pedagogical issues, especially about online dialogues and how to work with these. The courses were scheduled to run from October 2005 and forth. **Testing procedures:** Testing procedures were given to the partners. These encompassed functionality testing but also pedagogical usability testing. The latter were aimed at testing the course design on students as to have comments from them on whether the course design was understandable. PSU did some user testing, which led to a number of revisions.	eLL-QTR7
October 2004 – January 2005	**Monitoring courses:** During this period several courses were run both in Thailand and Malaysia. The MUCED consortium produced several courses within their Moodle and it was impossible for the pedagogical resource persons to monitor all the activities, but we did look into the Moodles from time to time and of course supported the partners if they had any questions **Article submitted:** An article regarding the VO@NET and ELAC project was submitted for the WCCE2005 conference and accepted – the article was: "Zurita, L. and T. Ryberg (2005). Towards a Collaborative Approach of Introducing E-learning in higher Education Institutions. How Do University Teachers Conceive and React to Transitions to E-learning. WCCE 2005 - 8th IFIP World Conference on Computers in Education. Stellenbosch - South Africa, University of Stellenbosch" **Development of evaluation plans:** We began the work of developing evaluation methods for the courses and for the project in collaboration with the other partners **Working with CMU on the Green Productivity for Industry Course:** In this period we also worked intensively on co-developing the CMU course Green Productivity for industry. Brian M. Svendsen among other things worked on setting up a template for the group rooms	eLL-QTR-8
January 2005 - December 2005	**Course monitoring:** In the first months of the year the work of component 2 has been focused on many different activities. Initially the work was centred on monitoring the courses that have been taking place in the vir-	eLL-QTR-9 10 and 11

	tual learning environments at the partner universities during November 2004 to February 2005. This has, very luckily, been difficult, as the partners have produced so many courses at their institutions that it has been impossible to monitor all course in depth. Initially we had thought there would be 4-5 courses as an outcome, instead more like 25 have been run and prepared for. **CMU-course:** However, component 2 have played a very active part in especially a fully online course that took place from February 2005 to the end of May 2005 – this was the Green Productivity Course (Chiang Mai University). The course was hosted on DTU's servers and since there were no Moodle-responsible at CMU, Hugo Connery Component 3 kindly agreed to do the system administrative work, whereas Thomas Ryberg and Brian Møller Svendsen Component 2 acted as supporters in the course, but also helped out in the design and the implementation of the course together with Suporn Koottatep and Petch Pengchai (CMU). Therefore this course has been forming a central part of the first period of the year 2005. **Dissemination at CSCL2005 conference:** Different dissemination activities have taken place. Thomas Ryberg and others (Lone Dirckinck-Holmfeld and Brian Møller Svendsen) have frequently presented the VO@NET-project, Project Moodles and the GPI-course at various seminars and conferences. First and foremost in the International Conference on CSCL that took place in Taipei from the 30th of May to the 4th of June. The VO@NET-project in general and the GPI course was presented, both through a poster and an Interactive Event (a one day event as part of the CSCL conference). Please refer to: http://cscl2005.org/IE/ie2.htm **VO@NET-conference:** Right after this Lone Dirckinck-Holmfeld, Brian Møller Svendsen and Thomas Ryberg participated in the VO@NET conference and the working day (6-7th of June). Hereafter, Thomas Ryberg and Brian Møller Svendsen visited the different Asian partner beginning with the Malaysian partners then PSU, CU and MU because of the intense collaboration between CMU. The meetings in Asia stretched from 8-18th of June. **Gathering materials and evaluating:** During these visits Thomas and Brian interviewed some of the course teachers and gathered materials from the workshop and students' evaluations if these were available. **Article presented:** As it was mentioned earlier Thomas Ryberg and Laura Zurita prepared and wrote an article on the VO@NET project and the ELAC project. This article was presented at the large, international WCCE2005 conference (http://www.sbs.co.za/wcce2005/) taking	

	place 4-7th of July 2005 by Laura Zurita. **Article written:** As a further research dissemination activity Thomas Ryberg, Lone Dirckinck-Holmfeld, Suporn Koottatep and Petch Pengchai have co-authored an article about the GPI course – this article has been accepted for publication in a SPECIAL ISSUE OF the journal STUDIES IN CONTINUING EDUCATION - Imagining learning in the 21st century: the role of e-learning. **Online questionnaire:** Further, ELL has constructed an online questionnaire for the students that have taken part in all the online courses – this questionnaire was published in August 2005 and will form a part of the evaluation of the VO@NET-project. **Examples of other Dissemination activities:** 23rd of June: ELAC Workshop in Pedagogical Design 2005 – a teachers training course – GPI course and VO@NET project was presented together with Suporn Koottatep via skype 29-30 Sept: Kaleidoscope Joint research seminar for students and researchers October 7-8th: Second general ERT team meeting, October 7-8, London UK 25th Seminar on networked learning	

4. Achievements and results

In the following sections we shall highlight some of the most important outcomes of the VO@NET-project, which we certainly don't think can be attributed to component 2 in isolation. Rather, we perceive the results and outcomes of the project as an outcome of all components work and each participant in the project has contributed to the overall outcome of the project. The most important outcomes, from our perspective, are the many online course environments and courses that has been the product of the project. Some of these have been collected and stored at:

http://elearn.voanet.dk/course/

However, many more courses have been produced and run during the VO@NET project. At the VO@NET-site there are links to the online course environments of each of the partners – these can be found here:

http://www.voanet.dk/wce/index.php?mode=VLEs

We also list links to the environments here for your convenience:

- Chulalongkorn University (CU): http://www.vle.arch.chula.ac.th/moodle/

- Chiang Mai University (CMU) or Asian Productivity Organisation (APO)[7]: http://www.cmu.voanet.dk/ http://elearning.aponet.org/
- eCentre E&R-DTU: http://elearn.ecentre.dk/
- e-Learning Lab (eLL): http://www.moodle.ell.aau.dk/
- Mahidol University (MU): http://www.vle.arch.chula.ac.th/mu/
- MUCED: http://www.muced.um.edu.my/moodle/
- Prince of Songkla University: http://voanet1.envi.psu.ac.th/moodle/

We see these different environments and the vast number of courses as being the major outcome of the VO@NET project. The project has initiated a wave of expansion where lecturers and institutions we have never have had any contact with have created and run courses – especially at CU and MUCED. In this sense the project has resulted in many more courses than was ever expected or planned for.

When taking an analytical overview there have been primarily two approaches within the VO@NET project and among the partners: Creation of an institutional infrastructure and Creation of Single Courses. Some have put a major work in setting up a larger scale system, where different Departments, courses or universities are represented, whereas other partners have focused more on the development and deployment of fewer courses. As for the first category, one can mention both CU and MUCED:

[7] The course, which was designed by lecturers from CMU, was initially hosted by the e-centre. After the initial running of the course it has been moved to a server within the APO and will thus be run and organisationally be anchored there in the future

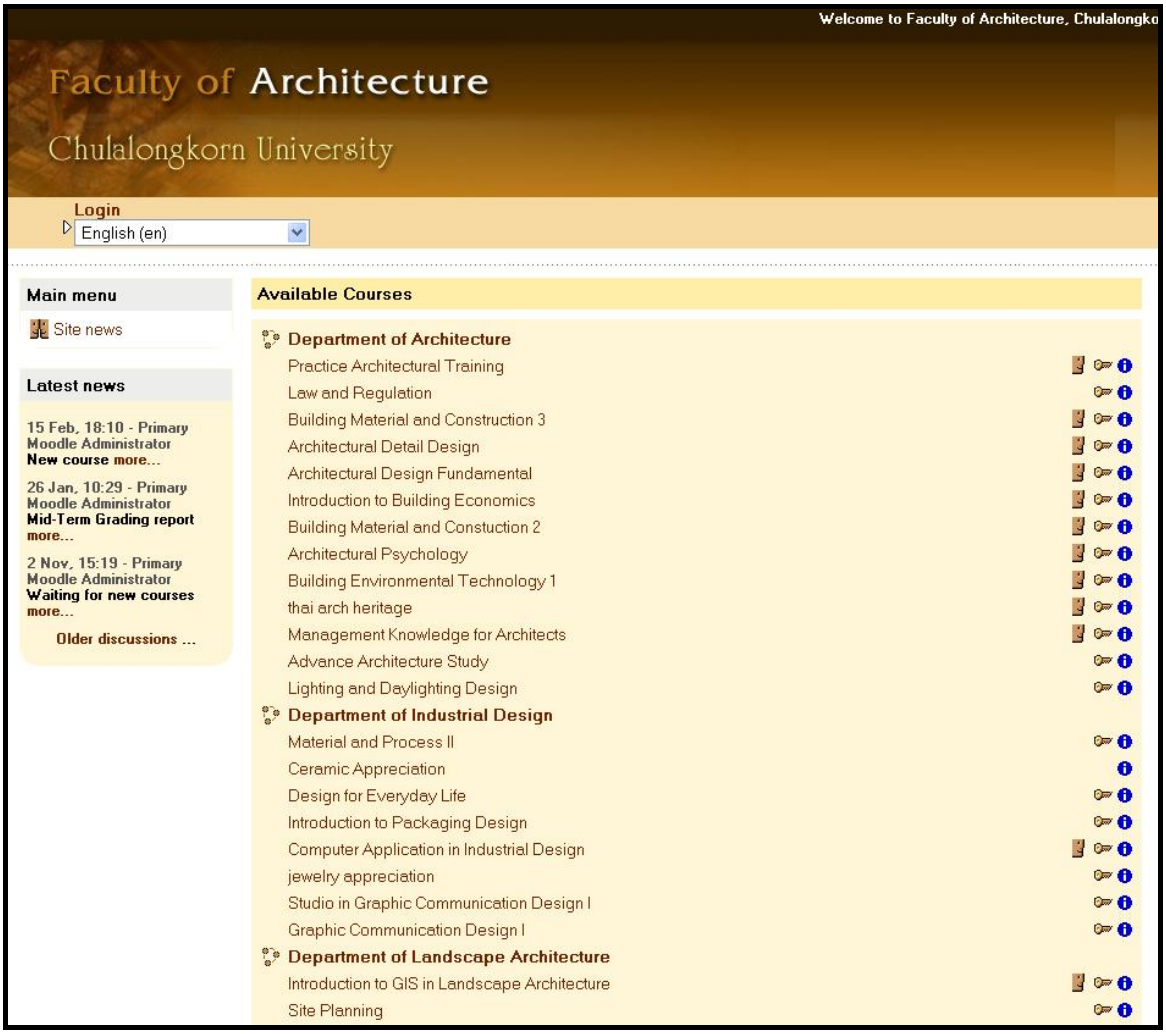


Figure 5: Some of the frontpage of CU-Moodle

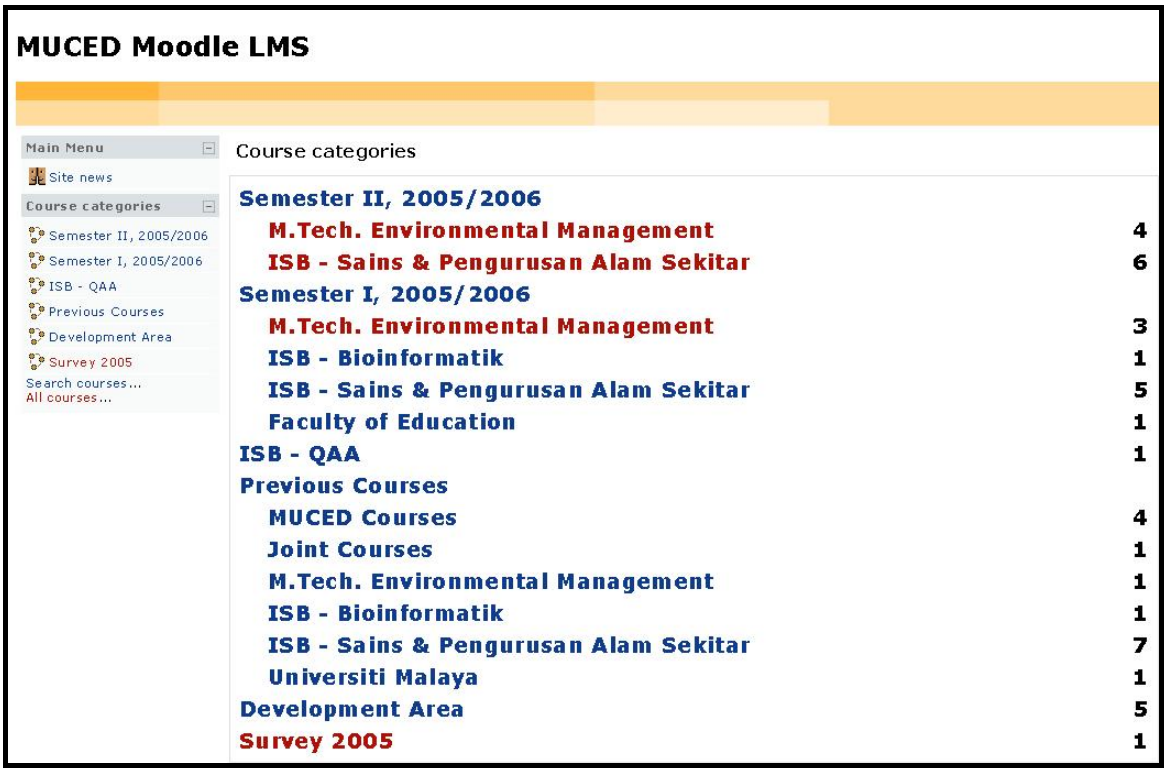


Figure 6: Some of the frontpage of MUCED-Moodle

As can be seen from the first screenshot from the Faculty of Architecture at Chulalongkorn University the Moodle environment has been deployed as an institutional infrastructure for the whole faculty. Not all of the courses have actually been taught or designed, but the environment clearly shows that this is a major part of the faculty's IT-strategy and teachers are encouraged to start using the environment. The same is the case for the MUCED environment, where there are several courses, faculties and even different universities represented. This of course reflects the MUCED constellation, and gives the different partners within this a possibility of experimenting with online learning and to run online courses. The MUCED framework in turn has developed a number of different courses that are differently organised, as we shall return to.

The second category of approaches are represented the other partners at CMU, MU and PSU. They have all focused more specifically on designing fewer or a single course as to experiment with online learning prior to taking it to an institutional level. This has resulted in some courses that, generally speaking, focus on more versatile online activities. This is also the case for some of the courses at CU and MUCED but they seem to have focused more on the use of the environment as file repositories where notes, files, presentations and course materials can be found and less on online pedagogical activities. But we shall return to these use-categories later. As can be seen from the Moodle-environments of CMU, MU and PSU they have focused more on fewer courses:

Figure 7: Some of the CMU-moodle front page

Figure 8: Some of the MU-moodle front page

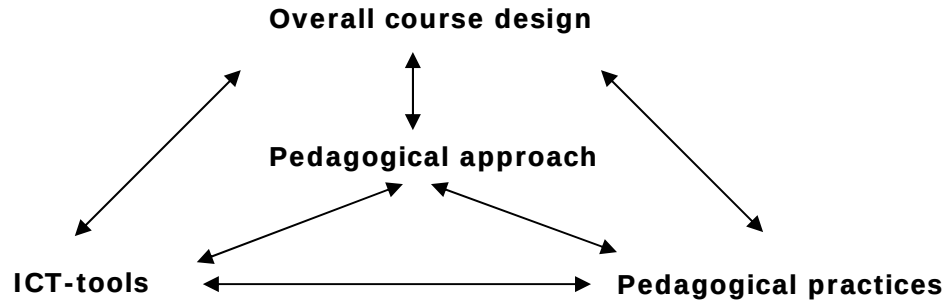
Figure 9: Some of the PSU-Moodle front page

As can also be seen in all of these environments we started using the individual Moodles for communication and collaboration with the partners by implementing the course "A help on Moodle". This was meant for communication and collaboration on the courses being developed. The module was installed in all the Moodles so we could support the partners in their own online environment.

To sum up: Partners chose two different strategies: CU & MUCED created what we term institutional infrastructures and quickly set up an online environment where multiple participants at the faculty or other universities could develop a course. In general these courses have focused on creating repositories for notes and materials and made these available to the students prior to the lectures (or after). CMU, MU and PSU focused more specifically on developing fewer or single courses, which resulted in courses that featured more online activities. These different ways of utilising the system also reflects different needs and pedagogical strategies. In the following section we shall introduce some heuristic tools, as to categorise and go more into different use-cases or archetypes, which we could also term it.

4.1. Applicable pedagogic concepts and tools

As we have stressed in the beginning of this report there are multiple ways of designing, using and conceptualising online learning. Therefore we have seen the work of component 2 not only as delivering specific heuristics or design guides on "how to create online courses", but rather to give the partners some tools to analyse their needs, their current pedagogical approaches and the available tools. There is a huge difference between designing a one-week course for on campus-students on how to use e.g. Photoshop or GIS and then designing for a semester course in which the students are meant to do field work, laboratory experiments or pursue their own projects through a PBL/POPP approach. Thus, we have not aimed at delivering a specific model, but rather to give the partners some analytical tool or sets of questions from which they can reflect on current and future practices. At the meeting in Bangkok on the 17th of November we therefore presented the following "methodology", which we shall go more into here. The methodology takes at its core the transactional relationship between three elements that affect and is affected by the pedagogical approach:



The model implies that we believe the heart of course design to be the "pedagogical approach" but the pedagogical approach is dependent on and will influence the other elements; and all of the elements also affect each other. Just to give an example: As much as we favour POPP/PBL it might not be the right approach for a one-day course where the learning objective is to learn basic Photoshop; creating groups and formulating a problem might take the whole day and nobody would ever have worked with the actual program – of course using some of the thoughts or notions from PBL/POPP could be an idea e.g. taking departure in what the students would like to produce, rather than having a fixed assignment could be a way to do it. What we mean to say is, that there are a lot of different conditions or variables to take into consideration when doing pedagogical design. Above we have taken some core elements but also we could have included other dimensions

e.g. (Hiim & Hippe, 1998) operates with 6 different elements, but these are also reflected in the methodology through the sub-points of each of the three elements. The sub-points reflect some general considerations to take into account when doing pedagogical design but we certainly do not consider them to be an exhaustive list:

1. Examples of overall course design

- Level of the course (Master, undergraduate etc.)
- Time span of the course (from/to - resources)
- Purpose of the course
- Content of the course (modules, readings etc.)
- Role of the teacher (Trainer, supporter, facilitator)
- Role of the students
- Design/medium (ICT-tools and how to use)
- Output (Quiz, test, project, individual assignment)
- Assessment/Grading (How will the students be assessed, what will the assessment be based upon)

2. Examples of teaching practices and methods

- Lectures
- Field work
- Laboratory work
- Data analysis
- Modelling
- Assignments
- Projects
- Examinations
- Tutorials
- Reference and Case material research

3. ICT-Tools

- ICT communication tools:
  - Communications: Email, Phone, SMS, Chat, Discussion forums.
  - Course material: Documents, PowerPoints, audio & video (download and streaming), Multimedia Presentations, dialogues, projects (knowledge construction).
  - Group work support: Calendars, file spaces, task overview, shared whiteboards, annotation tools.
- ICT/Learning Object Toolbox – tasks and assessment:
  - Animation, Graphics, FlashMx
  - Quiz and/or Tests (multiple choice, short answer)
  - Assignments (digital submissions)
  - Projects, case work
  - Journals/diaries, Portfolios

  - Games, Simulations

The sub-points are thus different elements to take into account or that can be included in a pedagogical design. The following is the methodology we suggested that the partners could use – it is a heuristic list of questions they could ask and discuss and our aim was to create a shared vocabulary from which we could collaborate and communicate about their courses. So the methodology was meant to enable a semi-structured discussion and practical work between partners and the pedagogical resource persons or between the partners themselves. In the travelling workshops we used the elements in that way. The stepwise process was constructed in this way:

Step 1

- An interplay between following elements:
  - Identify time span, level, resources, ambitions and purpose of the course.
  - Establish pedagogical approach
  - Negotiate teachers role
  - Negotiate students role
- These considerations are the key influentials for all the elements!

Step 2

- Learning objectives and outcomes
  - Establishing what the students should learn and what they should produce/create
  - Establish the activities from teaching and learning practices (field work, data analysis, lab work, lecture notes).
    - Balancing these in accordance with the chosen way of working.

Step 3

- Assessment and outcome
  - Identify the different outcomes of the course (if there are more than one)
  - How should the outcome be assessed?
  - Great consideration should be put into how the assessment methods fit the pedagogical approach
  - Consider if the same assessment procedures be used in virtual courses, or should they be changed
    - Process vs. product evaluation, (portfoilos, assessment of dialogues, projects, quizzes).

Step 4

- Establishment of timeline
  - Establish the Timeline/Sequential order of the course (the rhythm)

Step 5

- Transformation to ICT-environment

- Reflection on the added value offered by the virtual environment (transparency, process, reification).
- Identify the ICT-tools that can fit the conceptual outline of the course (chat, streaming video, forums and assignments)?
    - How can the different media and system components support different parts of the course?
- Important! The pedagogy should not be fitted to the web-based environment – rather the other way around

4.1.1. Comments on the methodology

Though we use the concept “steps” we made clear that all considerations should be seen as a holistic thinking process; rather than being broken into procedural steps and we further stressed that they should think of ICT through all of the steps, which is also reflected in the presentations that were part of the travel mission in March 2004 (QTR5). We suggested that the considerations should be reified in a design document so we would have a shared document to discuss between pedagogical designers and partners. We created such a design document and gave it to the partners and we also used the documents during the travelling workshops as to reify the reflections and decisions.

One could wonder why we put the pedagogical approach in the step before the learning objectives, which can somehow seem confusing. We did this consciously because we wanted people to reflect on the pedagogical approach that they would like to pursue or realise ahead of thinking of the learning objectives. This was because many of the partners chose to digitise existing courses and we thought that this could potentially inhibit pedagogical creativity as one might be tempted to reproduce the existing way of organising the course, rather than thinking in different terms e.g. more student-centred approaches. So we meant it as to stimulate conscious goals like e.g. “Shouldn’t we try to use another approach this time”, “Why don’t we…” etc.

As we have said several times the design of an online course is dependent on many different conditions – some of these are also summarised in the ERT-model, which is about “conditions for productive learning environments”.

Below the analytical framework of the ERT is represented. For a more thorough description of the model we refer to (Dirckinck-Holmfeld et al., 2004). The framework was developed as a tool for engaging in cross-case analyses of cases brought into the project by the partners of the ERT. The ERT aimed at taking a meta-ethnographic perspective on a wide variety of cases by re-investigating existing courses and master programmes from different methodological and theoretical perspectives, while still contributing to and using the shared framework as an outset and conceptual tool.

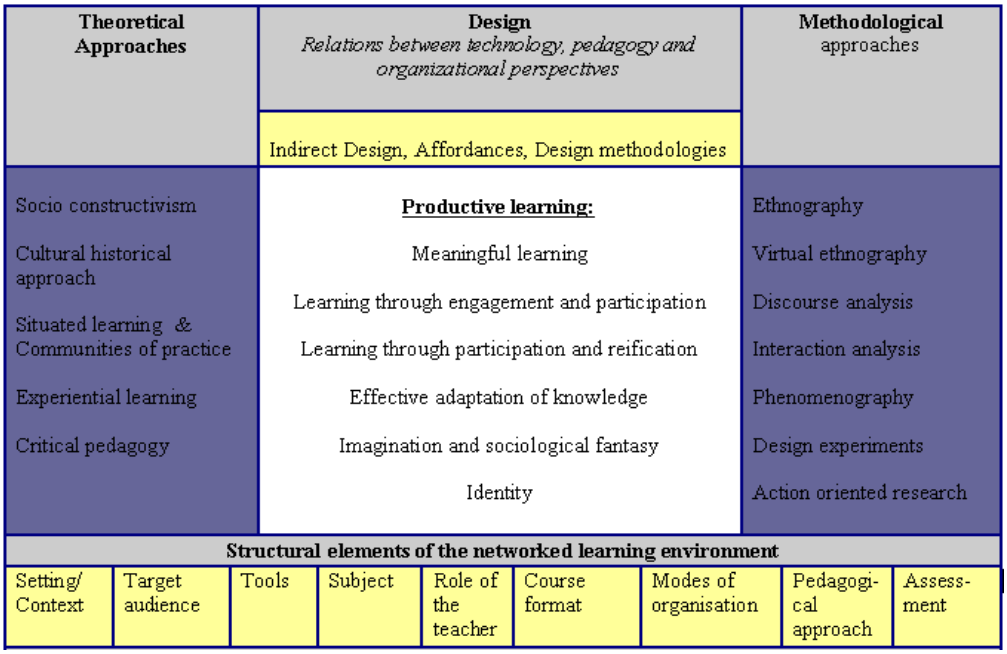


Figure 10: Analytical framework of the ERT

In the ERT design was defined as 'relations between technology, pedagogy and organizational perspectives' (Jones, Dirckinck-Holmfeld, & Lindström, 2005). As can be seen from the model it bears some resemblances to the methodology we have outlined above, though the latter goes more into details. What is important to stress again is the findings of the ERT on basis of the many cases discussed in the ERT research collaboration (one case being a VO@NET-course):

> *"From the collected cases, it emerges that each environment is unique and requires a specific design and realisation of the networked learning environment. Given this situated uniqueness, none of the above elements can be considered an affordance or a constraint in absolute; affordances and constraints must be considered in relation to the characteristics of the specific context, the needs, the motives, and abilities of the participants, and the kind of activity to be supported." (Dirckinck-Holmfeld et al., 2004)*

Another important insight is the relational and indirect approach to understanding technology and pedagogical design. Though systems might support some pedagogical approaches better than others and afford and constrain in different ways certain activities there is not a direct relationship between technology and the pedagogical approach, one can utilise a system creatively or one can use the system in other ways than might have been anticipated by the designers. Secondly, there is no direct relation between a pedagogical design and then the actual running of the course – one may find very nicely designed environments that should in principle/theory optimally support dialogues and discussions, but nothing is happening. One thing is planning and designing a course, another thing is actually carrying out, which is dependent on a lot of factors. Students might be bugged down by other obligations; they may not be interested in the topic and so on, the teacher may be to busy. These relations we have explored in more depth in the article "Conditions for productive learning in networked learning environments – a case study from the VO@NET project", which is co-authored by VO@NET participants. The article evaluates and discusses one of the courses in VO@NET (CMU-course "Green Productivity for Industry"). So when talking about pedagogical design and use of the systems one can only operate at a very general level, as the actual courses in the VO@NET project has utilised the Moodle system very differently and used online learning for a variety of different purposes, in different settings, with different target audience subject matters, pedagogical approach and so on. In the following we shall therefore differentiate between some very general

traits of all the courses, but we cannot fully unravel the pedagogical creativity or the vast number of ways all of the different courses have utilised the Moodle system. Instead we shall out line some very general distinctions and archetypes. First of all there we would like to emphasize the differences between on-campus and off-campus courses and two different modes of organisation: mixed mode or fully online:

	On Campus	**Off campus**
Fully online	Creating a "virtual classroom" - instead of the teacher lecturing or facilitating, the students do their work in the virtual environments – they don't need to meet with the teacher or come to the university, but can sit at home. Students in a class would probably meet each other or know each other as they might have other non-online courses together	Students/professionals join the course from all over the world or from different regions in a country sign up for a course. Unlike on-campus students they may never meet in real life before or after the course. There are no physical meetings at all between students or lecturers
Mixed mode	The online environment is used as a part of the course, as an extension of or add-on to the classroom. Students and lecturers meet in physical space one or more times and the online environment can be used on specific occasions or throughout the whole course to various degrees and for different purposes	Typically students and lecturers meet each other physically at the beginning and the end (and sometime midways) during a course or master programme (often off campus courses are for professionals pursuing a Master-degree)

All types of courses have been represented in the VO@NET-project. Below we have put the different modes of organisation and the partner universities taking up a specific mode (or several):

On campus

Fully online: MUCED

Mixed mode: MUCED, CU, (PSU), MU

Off campus

Fully online: CMU

Mixed mode: (PSU), MUCED

However, it is important to stress that the Moodles have been used also for other purposes than teaching courses. At both CU and MUCED different types of use saw the day. At MUCED, Moodle was used for a student organisation group so that students within the student organisation can use the forums for communication about student issues together with the teachers. At CU a forum for students about to write their thesis was put up, so they could communicate and receive information and advice from faculty. This is also what we mean by an institutional infrastructure – it is not only delivering courses but to create a communicative infrastructure for students, teachers, management and administration.

The reason why PSU appear in two categories even though they only developed one course is because the same course was run for both on-campus students and off-campus students (professionals in the region) at the same time. A sample of students were offered to follow the course as a virtual class, but were also welcome to join the lectures if they felt like it. The PSU experiment intended to identify, whether the course would be attractive enough for students if it were to be launched eventually as a fully online course in the future.

Especially interesting are the fully online approaches, as these are pedagogically and "technically" the most difficult to run and design (in mixed mode approaches misunderstandings, questions etc. can be taken up in real class and "life" goes on even though the system may experience severe difficulties – a server breakdown would be more fatal to a fully online than a mixed mode course). MUCED did some experiments with running fully online classes with on-campus students and might expand this practice for certain courses. Before going more into the various courses we will introduce a distinction between different use-cases or archetypes of use. This distinction builds on a distinction made between different e-learning systems, but they can equally be used to describe some common ways of using e-learning systems (Dirckinck-Holmfeld, Tolsby, & Nyvang, 2002):

- **Content delivery:** The main function is organization and publication of teaching material. Such use has dominated the market with the consequence that most e-learning is organized as traditional classroom instruction. Examples of systems that especially afford this type of use in this category are Lotus Learningspace, WebCT and Blackboard and also Moodle.
- **Conferencing and Communication:** The main function is dialogues in asynchronous (text) media or through synchronous chats. Such use has roots in the bulletin board systems (BBS), which existed before the WWW. Examples of systems in this category are Virtual-U, FirstClass and Moodle.
- **Group work and Collaboration:** The aim is coordination of group activities. The purpose of the activities can either be production oriented or just socially motivated. There are several Internet Service providers (ISP) providing free access to functional groupware systems e.g. Yahoo-Groups, Groupcare and iGroups. Examples of commercial groupware systems are Lotus QuickPlace and Communispace. Moodle can also support group work and collaboration, though it has certain limitations in that regard.

These use-categories are not absolute descriptions, and most courses will have use-approaches that cross the categories. Nevertheless, these are three archetypes of use that can be a more or less dominant metaphor for one's course design and pedagogical approach. These are also reflected in three dominant approaches or conceptualisations of online learning.

Focus on content and instructions: Within this area is a focus on delivering, finding and managing content. This is reflected in e.g. the notion of reusable learning objects and standards such as SCORM. The key is to give students and teachers access to multiple "objects" of pre-packed knowledge, which could be already existing pieces of a course on e.g. Photoshop, Management or Branding. The idea is that teachers can share, reuse and distribute already created resources and materials. So in this sense the teachers make available different learning objects to the students. Moodle supports SCORM packages.

Focus on pedagogical activities or pedagogical scripting: This approach is in many ways similar to the one above. It is about finding, sharing and distributing, but instead of learning objects or pre-packed resources it focuses on sharing pedagogical activities or pedagogical scripts. By this is meant a temporal sequence of activities such as e.g. Write a short note on how you define democracy,

then go to the group you have been assigned and discuss your definitions, then each of you write a short summary and hand this to the teacher. This approach is reified in the Open Source systems called “Learning Activity Managements Systems”. In this approach the teacher design a certain chain of events and activities, and these chains of activities can be shared with others as sort of pedagogical scripts. In this sense there is a movement of focus away from only content to pedagogical activities surrounding the content.

Focus on activities, collaboration and dialogue: Within research on it-supported learning the research field of Computer Supported Collaborative Learning has been very active. Within this field of research there has been a focus on group activities and shared activities among students and teachers; for example through dialogues and discussion in forums. Most often CSCL-approaches build on the assumption that learning is very much about the students being active constructors of knowledge, rather than passive recipients of information. Therefore a lot of systems focusing on dialogue, collaboration and shared activities have spawned from this area of research.

And again it is imperative to mention that these different approaches are in actual practice often mixed and overlapping, but they can be seen as useful conceptual tools in distinguishing between some general uses of online learning environments. In the section “Assessment of the Achievement and major constraints” we shall return these again.

4.2. Training approaches and programme

As we have already mentioned in section “3. Approach and methodology” we aimed at working practically and collaboratively with the partners on designing the courses and we initially tried to provide an online training course on how to design online courses. The training courses had a somewhat large body of participant but some joined in rather late and there course was not well grounded, by which we mean that the reasons for joining the course were not immediately apparent to all participants. This was probably due to the late start of the project and the fact that the different groups and participants had not really settled within the project. The Thai-partners had not really been addressed or drawn sufficiently into the project at that time and we ourselves experienced some changes in available personnel, as did DTU and the other partners. The first three visits and presentations from AAU and others were rather abstract and not really grounded in a specific tool, as this had not yet been implemented due to the late start of the project (therefore, we initially used the Virtual-U environment for the LIVE course, as this tool was ready-to-hand at AAU, but was a bit more complex in its structure and functions than is Moodle). We believe that this initial focus on abstract and conceptual issues would have been much better had an actual tool been available to anchor some of the conceptual issues. Some teachers had no previous experience with online learning environments and therefore may have had trouble connecting what we said to anything practically, visible or imaginable to them. As we have said we favour learning processes that go both through observation, practical experimentation and theoretical reflections and initially in the project it was unfortunately very difficult to provide the participants with a tool for practical experimentation. We meant to do this through the LIVE course, but for reasons already mentioned this course never really flourished and the online interactions slowly faded out.

However, we believe the project gained quite a momentum when we initialised the March travel mission, where Moodle was presented to the participants and we did small-scale workshops where we could combine the conceptual issues with an online “experimentarium” or virtual lab that became a shared resource or boundary object between the teachers and the pedagogical resource persons. In this sense it was much easier to ground pedagogical issues when there were some

concrete tools to refer to e.g. the concept of online dialogue becomes immensely more understandable and practically observable, when people can see an online forum in action and when different tools are introduced. It also becomes easier to understand differences in different approaches when one gets the opportunity to reflect on one's design of a concrete environment and when questions are asked for the design. With these things in mind we would like to introduce some important conceptual tools, which were also presented in the article by Zurita and Ryberg. These are developed by Bygholm & Boisen (2004) where they arrive at a model for what they coin 'digital competence' in relation to development and change processes involving ICT. They describe three different dimensions of this 'digital competence':

- *Factual knowledge*: This concerns factual knowledge on how to use the IT-system e.g. its functionality or hardware. It can be conceived as knowledge of *what* the system is and can do. The subject masters the system
- *Knowledge of the tool in context*: This refers to the competence of being able to use the system in a concrete praxis. It can be conceived as knowledge of *how* the system is used in context/within a practice. The subject understands the system in context
- *Constructive knowledge*: This comprises knowledge of how to use the IT-system to develop and change the work practices and the goals of these. It can be conceived of as knowing *why* the system should be used for such and such in the work practice and being able to question and change this. The subject becomes an agent of change and development

In a sense it would be fair to say that the initial presentations and meetings took their departure in the overall project descriptions and the overall goals, and also the pedagogical ideas were sketched at a level of constructive knowledge "how one can use IT in relation to pedagogical change processes and in employing more student-centred approaches", whereas some participants really needed to gain a basic overview of the tools and environments available to anchor these conceptual changes. This was also what we aimed to do through the LIVE course.

However, as for the March mission we began to focus even more on the practical experimentation and use of the concrete tool we had at our disposal and when the partners has their own local of the environment at the end of the August-September travel mission the course construction process and mutual dialogue on course design became more and more efficient and focused. This encompassed sessions and dialogues that were both aimed at very down-to-earth "how to do this and that in the system" alongside discussion of the overall pedagogical approach taken.

4.3. Approach and procedures for evaluation of courses

Apart from the evaluation and procedures we have already described throughout this report, which forms a major part of the evaluation, there are also the reports from each university describing the local evaluations and reflections on the course production processes and the outcome of the courses. As pedagogical resource persons it is difficult to evaluate whether the material used and the subject matters have been presented well and given better results for the students. This is partly because we are not environmental engineers, but also because there are local evaluation and test practices, which better shows whether the courses have been successful. What we have initiated is a questionnaire especially aimed at the students on the courses in more general terms. Though the number of replies for the questionnaire has not been as high as we had hoped, we will describe some overall patterns of the questionnaire below – in all 35 students answered the questions. In this sense this is far from representative, as a much larger body of students have participated in the courses. Most of the answers are from CU and

MUCED, so in that sense it does not cover broadly the possible answers from all the institutions – here we must refer to the local evaluations for a better overview.

The questionnaire was split into sections (please refer to QTR9-10-11 for an overview of the results). In the first part of the questionnaire we queried into trouble in accessing the course from a technological perspective. This meant e.g. trouble due to bad internet connection or problems with the course environment. We asked about this to be able to see if an eventual dissatisfaction would be more rooted in technical trouble, than in the design of the course and the materials. The majority of students did not experience trouble or only minor troubles and those all seemed to be related to connection issues and slow computers, more than the course environment being slow or unavailable.

The next session asked about students' perceived competences with IT and how they would judge the "ease-of-use" of the Moodle environment. On a scale from 1-10 with ten being the highest the majority judged their own general IT-competences to be more than average to high and the students judged the ease-of-use of Moodle to be quite high app. 30% gave a 10 in score, which was the highest ease-of-use. This of course from a project perspective is a very good result and at the same time, even though some students did experience some trouble in using the environment, they felt overall satisfied with it.

The section following, queried into perceived benefits of online learning – both before and after the courses. Here is a small movement towards a more positive attitude towards using online learning after the courses, than before. On the question of whether the students on an overall scale thought that online learning has been an improvement the majority of students judged it to be an improvement to the existing courses, which of course is a very positive result. Some of the most interesting questions from our (pedagogical perspective) were about the students view on themselves as more or less active and engaged than in normal courses. We asked them to rate the following statements on a scale from 1 (strongly disagree) to 5 (strongly agree):

Statement	Rate
Online learning has changed my role as a student to be more active	(3.9)
I have been more active and engaged than in normal class	(3.5)
Online learning was more informal than ordinary courses	(3.9)
Communication online has been an improvement	(3.9)
I was more in charge of my own learning	(3.9)
I have collaborated more with other students than normally	(3.5)
Online learning has improved the relations between teachers and students	(3.3)
Online learning has improved class-room teaching	(3.7)
Online learning has made learning more enjoyable	(4.1)

The figures show a small move towards the students feeling a bit more active and engaged than in normal classes and they judge the courses to be more informal and online communication to be an improvement. It seems especially that they simply find it to be more enjoyable as the last question indicates. These are of course very positive results, but once again we must take into account, that it is a relatively small group of students that have answered the questionnaire.

In the second last section we asked about their general satisfaction with the courses and also here it seems that there is quite a high satisfaction both with the courses, the quality of the material and the relevance of the courses. Based on this small sample of students' opinions, the courses seem to have been quite successful. We would also like to point to the evaluation of the CMU-course, which is represented in both a local evaluation report of CMU, a draft paper for a journal and a final revised version of the paper (these are all available through the VO@NET documentation Moodle).

5. Assessment of the Achievement and major constraints

We believe that the achievements of the VO@NET project far exceed what could ever be expected, both in terms of the "mass" of the course production, but also the richness and creativity that has gone into the pedagogical designs of the institutions. In terms of sustainability and impact we can now conclude that all partners have created online environments, which will live on and be used. As far as we can tell from the partners' feedback, they will all continue using the online environments and expand both the production of courses and the institutional spread. Thus, the initial experiments of the VO@NET will be taken further and many students to come will gain from these experiments – both on-campus students and those in need of continued professional education. Even though the project started late and there was an initial instability and insecurity, which was a major constraint, the project has managed to get back on track and produce a successful result, as we believe this report shows.

It should also be mentioned that even though we often mention, "what the partners have done" it is quite essential to stress that e-Learning Lab and the pedagogical resource persons have gained a lot from this project. Our experiences with using Moodle in the VO@NET project has influenced a number of other projects and the experiences with using and engaging with open source software has become almost a policy in e-Learning Lab. We have for example opened a section on Open Source software on our website (which is based on an Open Source Content Management System): http://www.ell.aau.dk/index.php?id=242

Further, we are currently doing experiments with another open source system called Tikiwiki (http://tikiwiki.org), so this is certainly a thing that has caught on locally. Apart from this, we have of course learned a lot from all of these experiments. In the next section we return to the three archetypes of use in the VO@NET-project, where we shall discuss advantages, disadvantages and lessons learned.

From this a constraint in relation to the possible pedagogical approaches that could be undertaken will become visible. This has to do with the POPP or PBL approach that we have aimed at promoting. PBL approaches are already implemented in many of the courses but as we shall describe in the final part this section, there are some institutional constraints. We shall return to this after describing the three major archetypes of use of the online environments.

5.1. The three archetypes in the VO@NET-project

- **Content delivery:** Main function is organization and publication of teaching material.
- **Conferencing and Communication:** Main function is dialogues in asynchronous (text) media or through synchronous chats.

- **Group work and Collaboration:** Main aim is coordination of group activities. The purpose of the activities can either be production oriented or just socially motivated.

In the following we shall give some examples of the different approaches and the advantages and some possible barriers in the approaches. From a pedagogical point of view we have said that we favour and have argued for approaches that are more student-centred and coupled with notions of Problem Based Learning. However, such a pedagogical approach may not be easy just to apply to a single course, especially not when the course is already a part of a semester, where there may already be certain materials and testing practices that have been institutionalised over time. Further, there may be requirements outside the control of the teachers e.g. national curricula or simply an amount of time for the course, which is not compatible with a PBL-process. Our own university (Aalborg University) is fundamentally built on a PBL approach, which means that a semester is composed of 50% course work and 50% project work, where the students work on their own with a project. In this sense PBL/POPP is a part of the institutional structure, but it may not be a part of the various courses that form a semester. These are most often a series of lectures, where students read before the lecture and then show up in class, so most of the course work does not necessarily reflect a PBL approach, but rather traditional classroom lectures. Therefore the institutional infrastructure employed at the education “Human Centred Informatics” is mostly used as a file repository where lecturers upload presentations and describe the courses. Also it functions as a communication environment among students and between administration, teachers and students. Further, the project groups can apply for a group room in the system. But the dominant uses are announcements to students and as a file repository, where also course descriptions are available. As we in the following describe the archetypical use-cases it is important to keep in mind that such a use-case is seldom the only approach to the course design but rather it is mixed with the other categories. Therefore a course may very well have adopted use-strategies from one of the other archetypes, so the categorisation should be understood not as fixed categories; they only point to the dominant use-strategy of a course.

5.1.1. Content delivery:

All partners have utilised this mode of using the online learning systems and it is also an important part of an online learning system that students and teachers have access to files, presentations and so on. Most noticeably CU and MUCED have taken this approach and produced a large number of courses where students can download files and materials. This is also because the two partners have mainly concentrated on *on-campus* students and making existing courses available online. Two examples of this can be seen below:

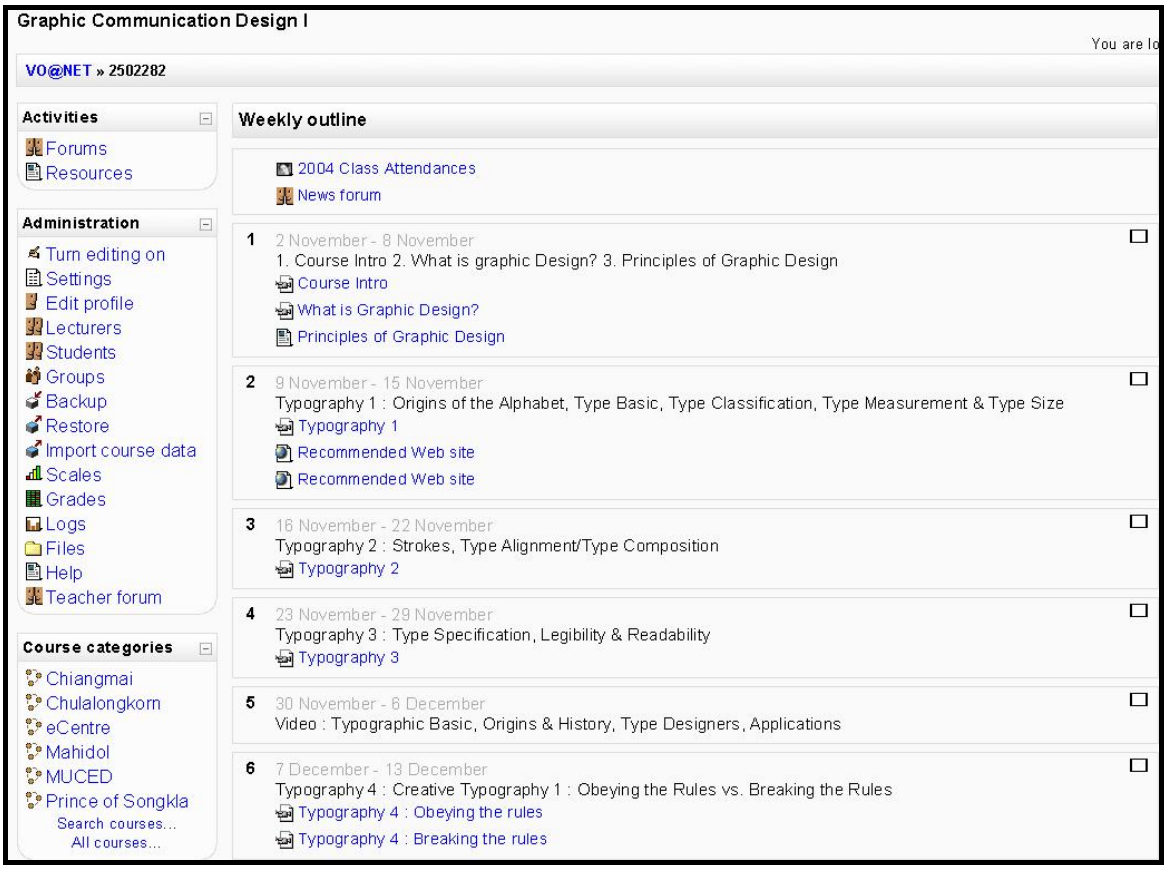


Figure 11: CU-course: Graphic Communication Design

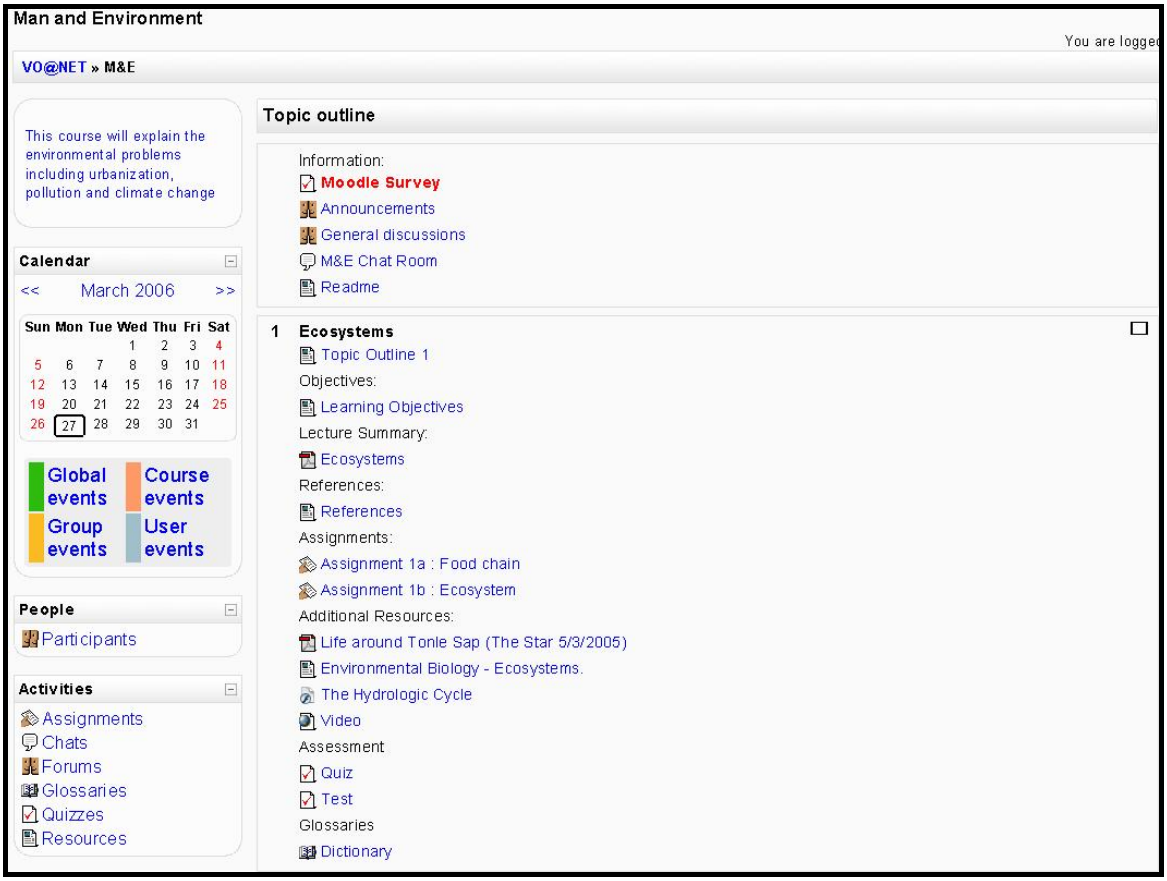


Figure 12: MUCED-course: Man and Environment

As can be seen from the examples a typical use pattern is the use of different topics in Moodle for a lecture. Each lecture features some material, maybe an assignment and a quiz is added. In both examples there's a title for the lecture/module and more or less elaborated descriptions of e.g. the topic or the learning objectives. In the examples there are one or two forums for announcements and for general discussion, also some have used the chat-facility. Though this use-case on the surface seems to enforce a more teacher-centred than student-centred approach in that it is built around teachers making available material for students to read; and subsequently be tested in some cases, we will argue that it has encompassed a major pedagogical change and that it has several advantages and positive outcomes

Pedagogical outcomes, changes and advantages:

- For both CU and MUCED the availability of the material online ahead of the lecture has meant that the class-oom lectures have increasingly been moving away from the teacher lecturing towards featuring more discussion and problematisation of what is being taught. Traditionally, the teachers have spent their lecturing time on communicating what the text is about. Putting the text online ahead of the lecture, means that the students are better prepared and then rather than being passive recipients of the text in the class, they can enter a more active role and discuss the content and conceptual issues in the texts.
- Increased communication between students and lecturers has also been a general outcome. Quite plainly an online environment allows both students and teachers to communicate with each other across time and space. Between lectures students can ask questions or engage in chat with the teachers if they have questions, are in doubts or just for socialising. Some teachers have reported that they actually feel there are getting closer to the students through the use of the online environments
- The use of digital material opens for use of more *multimodal representations* of conceptual issues. In the MUCED course above quite a lot of material has been produced in Macromedia Flash. For an example an ecosystem or the process of acid-rain can be much more easily explained through the use of pictures and animation, than half a page of written text accounting for such a process.
- For all participants it seems also that the "pressure" of having the material ready ahead of the lecture and to plan the course more thoroughly (to be able to describe and account for it online) have made the teachers feel more prepared themselves and created better and more structured lectures/discussions. Some mention that they have become better at "housekeeping" and also it can be said that Moodle provides a good fundamental structure for lessons. It creates a certain order and also a history of what has been done.
- Some have mentioned that the online environment makes better use of the lecturer as a resource, rather than being an "information provider". MUCED have plans to increase students self-learning through providing them with material for some courses, where it is actually expected that the students can figure out things for themselves. So, rather than having to spend lecture time on topics, which the students are capable of doing themselves, the teacher can act more as a resource if there are questions or doubts. In this sense time can be allocated to focus on more conceptual, theoretical and methodological issues. For an example students could learn basic GIS functions on their own – that is – how to basically use the program and then the teacher can spend more time on the more important issues surrounding the use of GIS.

- For those employing quizzes as part of the courses, which can be mandatory. There's a huge time saving issue with Moodle. Essentially one can design a quiz in Moodle and there would be no need to spend time looking through all of them and calculate grades and performance as the quiz module in Moodle does this automatically.
- Reusability is of course also a time saver; a course that has been run in Moodle once can be reused, copied and essentially used for the same course the next semester or year. This also release time and energy as to constantly improve and tweak the course, when time is not spent on doing the same thing all over again each year.

In sum – the use of the online environment as a content delivery system for students have multiple positive outcomes. Though, the pedagogical frame on the surface seem to be teacher-centred and built around delivering content to passive students, the use of the online environment as an institutional infrastructure and content delivery system create changes that are not only connected to the online space; rather it changes the classroom lectures and enables both students and teachers to better prepared and to focus more on discussion, conceptual issues and problematisations. Further, it releases time from routine tasks of the teachers, which benefits both students and teachers, as the latter can spend more time on facilitating and acting as resources for the students own learning processes.

Lessons learned:

- One thing that seems to be a general lesson learned is that providing descriptions and explanations in the online environment are important. Even though misunderstandings or faulty descriptions can be mended in the actual classroom teaching it is important to provide some description on what the course is all about, what are the learning objectives, what is the individual module about. As a teacher it is important to remember that though one may have a "mental" complete overview and idea of the course it is important to communicate this to the students through text, descriptions, plans and so forth. It is important that the students can infer from the descriptions what they are supposed and expected to do and read, what is their role and how they are thought to be acting.

5.1.2. Conferencing and Communication

In this section we describe some use-cases, which especially have been taking up by the partners who have produced a single or two courses, but instead have focused more on creating some online pedagogical activities. These examples also encompass the elements from the former section as they have also made material available. The difference is that in the former example the online environment have more been designed towards supporting the activities in the classroom/lectures. In the examples we show here some of the pedagogical activities e.g. discussing, working on a project and so on were also designed to happen online. Thus, it can be said there is a small difference and move from online-support for classroom activities towards it-support for online activities. There are really not such big differences between the courses in the former and in this category but for analytical purposes it can be useful to distinguish:

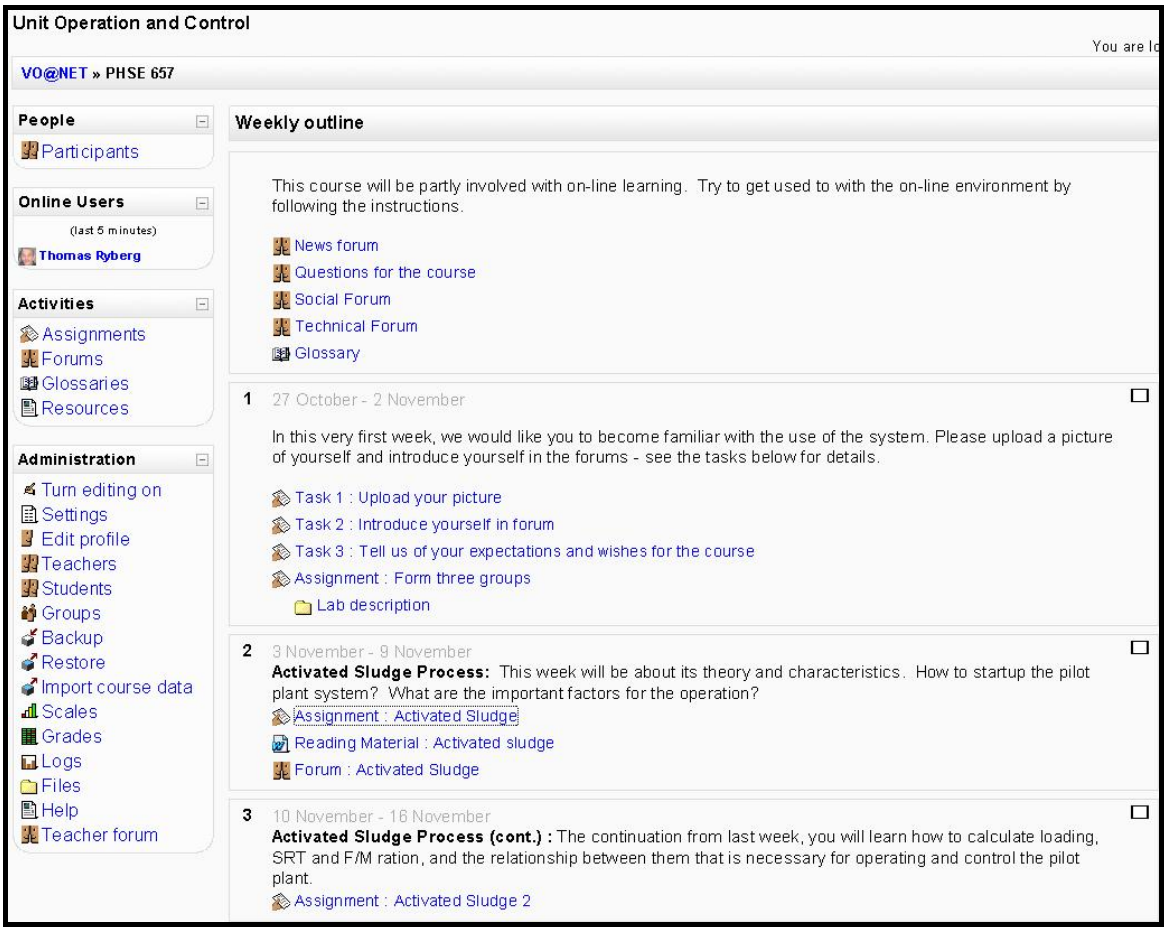


Figure 13: MU-Course: Unit Operation and Control

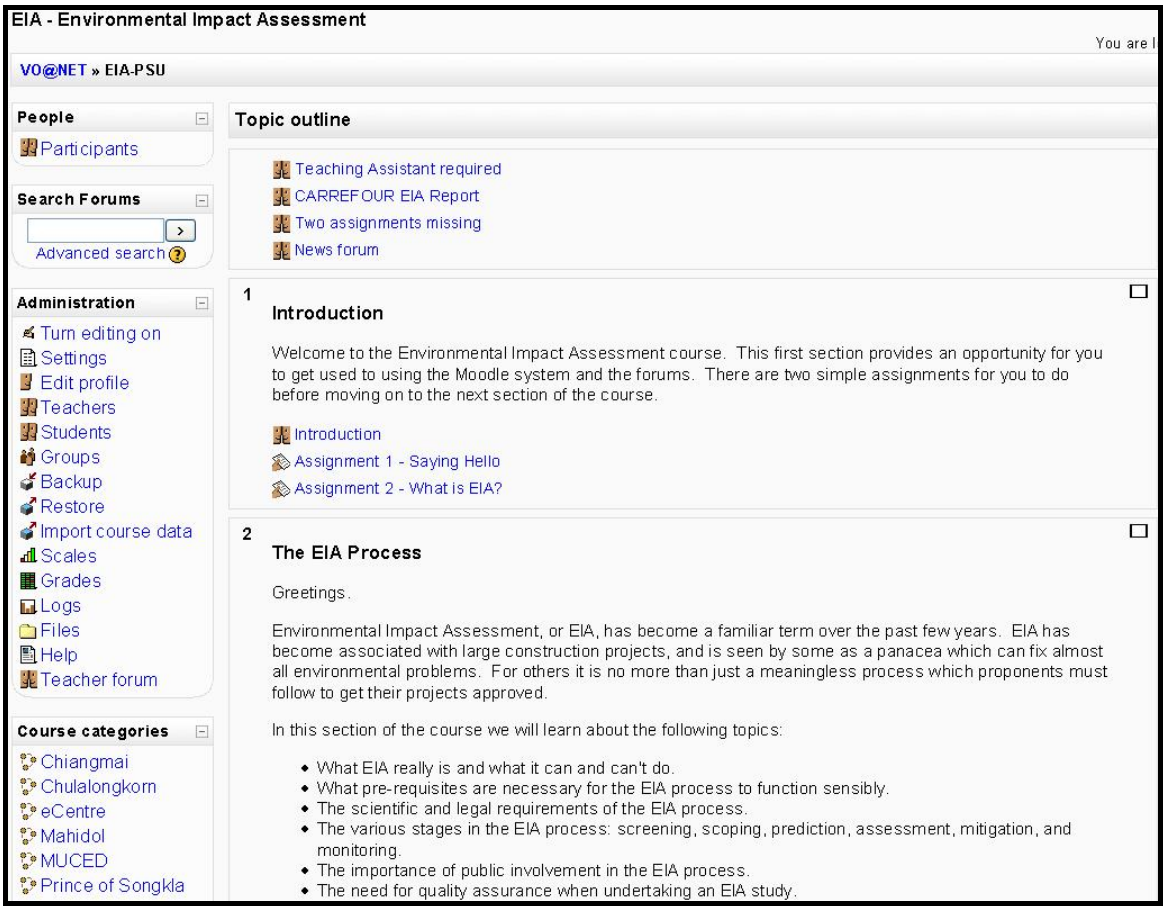


Figure 14: PSU-course: Environmental Impact Assessment

As can be seen from the examples above, the courses also encompass material and the same elements as in the former section. What is different is the more "mandatory" use of e.g. forums, which are embedded in the assignments. An assignment could e.g. be about reading a text and then raise three questions in the forums, or chose what one EIA to be and write this in the forums, as for the other students to see and maybe comment on. In this sense there is an increased focus on doing some online activities, such as discussing or making points clear to others.

Pedagogical outcomes, changes and advantages:

- The reason for adopting such an approach is of course to centre the students as more active in the learning process. Rather, than having the teacher to explain and deliver information, there is a move towards focusing on problematisation and discussion of relevant issues. Students and teachers thus act as discussant and negotiate understandings of a particular area of study or a method. This reflects a more student-centred and Problem Based Learning approach, as it is assumed that students must work actively and critically with the subject matter, rather than passively receiving the rights and wrongs from the teacher.
- Designing for different types of online activities can prompt more student reflections, as the task of formulating something as a written argument and proposal often requires the student to reflect and critically assess their own contribution while producing it. Further, it opens to more knowledge sharing among students and what can be termed collaborative learning. The latter means that students can build on the initial work of others and expand on arguments, counter them or it might prompt some other ideas. So for an example rather than each student gives a 100 word description

of EIA the students as a group can collaboratively produce a shared representation that builds on and extend the contributions of others

- This type of online dialogue or other activities also creates a visibility and shared memory, in that the different contributions to an online dialogue is reified in the system, so students and teachers can read them again. Classroom or face-to-face discussions are often faster and more dynamic, but they also disappear if nobody writes notes or in other ways summarise or reify the results of the discussions (but most often people rely on their ability to remember). Further, the dynamics of face-to-face discussion also makes them less prone to deeper-level reflections and more prompts quicker reactions as to move the discussion forward (2 minutes silence for somebody to think of a counter argument or another example are less bound to be successful in f2f-interaction)
- Online discussions and the lack of face-to-face communication can often empower students that may not be very comfortable speaking up in class. This may not always be an outcome, but it does seem a general experience within e.g. CSCL-literature that online discussions can empower the "silent students".

In sum – there is a lot to be gained from doing online discussions in terms of reflection, knowledge sharing, deeper learning and better argumentation. However, it is very difficult or can be very difficult to make such discussions happen – especially in an on-campus setting, as we shall look into:

Lessons learned:

- As it is clear from the evaluation from MU, where teachers tried to make the students discuss online and use the forums a lot, this did not happen as much as expected. This is understandable and we want to stress that it can be very difficult to do and facilitate this. Having elaborate knowledge sharing and reflexive dialogues is very much an ideal that can be hard to live out, which is especially true for on-campus students and on-campus courses. There are several possible reasons for this:
    - Students like everybody else functions from the formula "least effort and maximum gain". Online discussion, reflections and argumentation require quite a lot of effort; though from a learning perspective quite a lot can be gained, students (as well as all others) are goal-oriented. For example in the course on unit operation one might find a student asking what is wrong with their experiment and what to do (this is a hypothetical case). This would be a problematic situation and a teacher could respond: "You know what – try to think of what might have gone wrong – so you write there is too little oxygen in the water, what could possibly be the cause of that?" – Here the student will be offered the opportunity to reflect, infer and gain a deeper insight, but often this is not what the student intend in the first place – they are looking for a way to solve their problem in the quickest and easiest way. It must be made visible to the students from the beginning that such discussions are in themselves valuable and are actually the goal in itself. This can be difficult in student–teacher communication, as most institutionalised communication between students and teachers build on the premise that the student must deliver the right answer to the teachers question, rather than mutually discussing possible solutions and arriving at a shared understanding. Students will most probably expect that if they ask the teacher, they will get "the right answer" and if the teachers ask them a question, it is not open-ended but something where they must come up with "the right an-

swer" as to satisfy the teacher. These patterns of student-teacher interaction are deeply rooted in both institutions and educational culture in general and they are very difficult to transcend. For dialogue and discussion to flourish it is important to state that the objective is not to come up with a right answer but instead is about reflection, problematisation and deeper-level inquiry. This might also better fit some types of courses than others.

- Quite banal and also in line with the former; students may have other obligations such as homework for other courses, family, friends and so on. Sometimes students simply find it too time-consuming to discuss
- A third and also very mundane reason for the difficulty of establishing online dialogues is the fact that on-campus students meet each other every day. At our own institution we have also have had courses featuring online dialogues. Students report that even though they know the advantages of online dialogues, they find it to be artificial because they basically meet every day.

There are many barriers to making such initiatives succeed and we would like to stress that the reasons why we have very much encouraged teachers to experiment with these online pedagogical activities are because these are important in doing fully online courses, which was actually the initial plan in the VO@NET project. We have stressed notions such as creating a social atmosphere in an online course and also stressed the usefulness of dialogues and online pedagogical activities. This is because we believe these to be essentially very important if one wants to expand from e.g. on-campus courses to off-campus fully online courses. Finally, doing online activities can be one way to engage students and position them as more active participants by focusing more on designing activities for students own work, than only providing content and materials to students. However, to meaningfully engage students in online activities the activities also need to be relevant and address important matters within the subject. There are no easy ways to say in which contexts one should or should not initiate online activities; it takes some consideration, some thinking and analysis to identify both if and how one can undertake meaningful online activities with the students.

5.1.3. Group work and Collaboration:

This last category or use-scenario has mainly been deployed in the fully online course for professionals, which was designed and deployed by teachers from CMU. Such a mode would also often be employed if students need to collaborate intensively on e.g. collaboratively writing a report or work in groups on a specific assignment; for example we have mentioned that the students at Human Centred Informatics can apply for a virtual group room where they can share files, have a shared calendar and discuss and coordinate their work. This was also the case in the fully online course that was built on a PBL-approach and case-based learning:

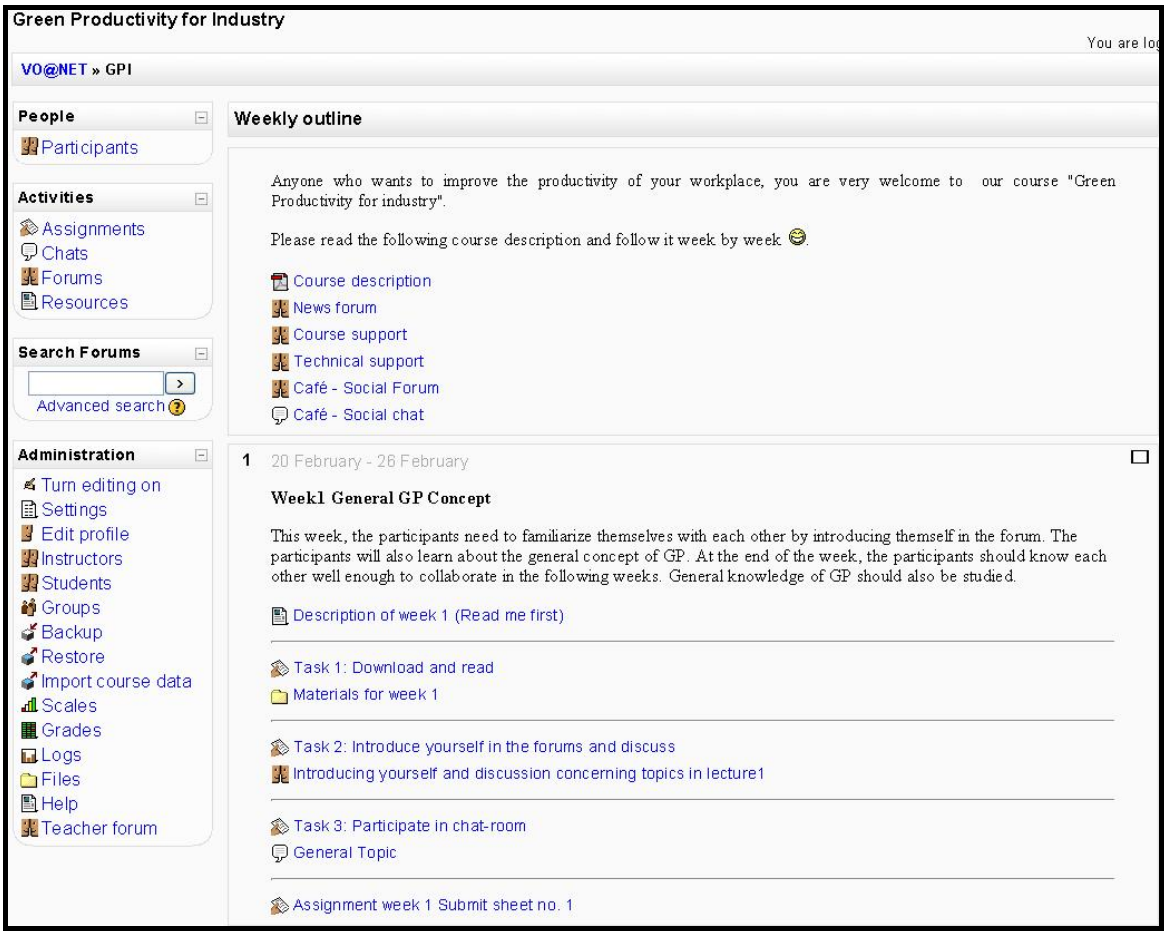


Figure 15: CMU-course: Green Productivity for Industry

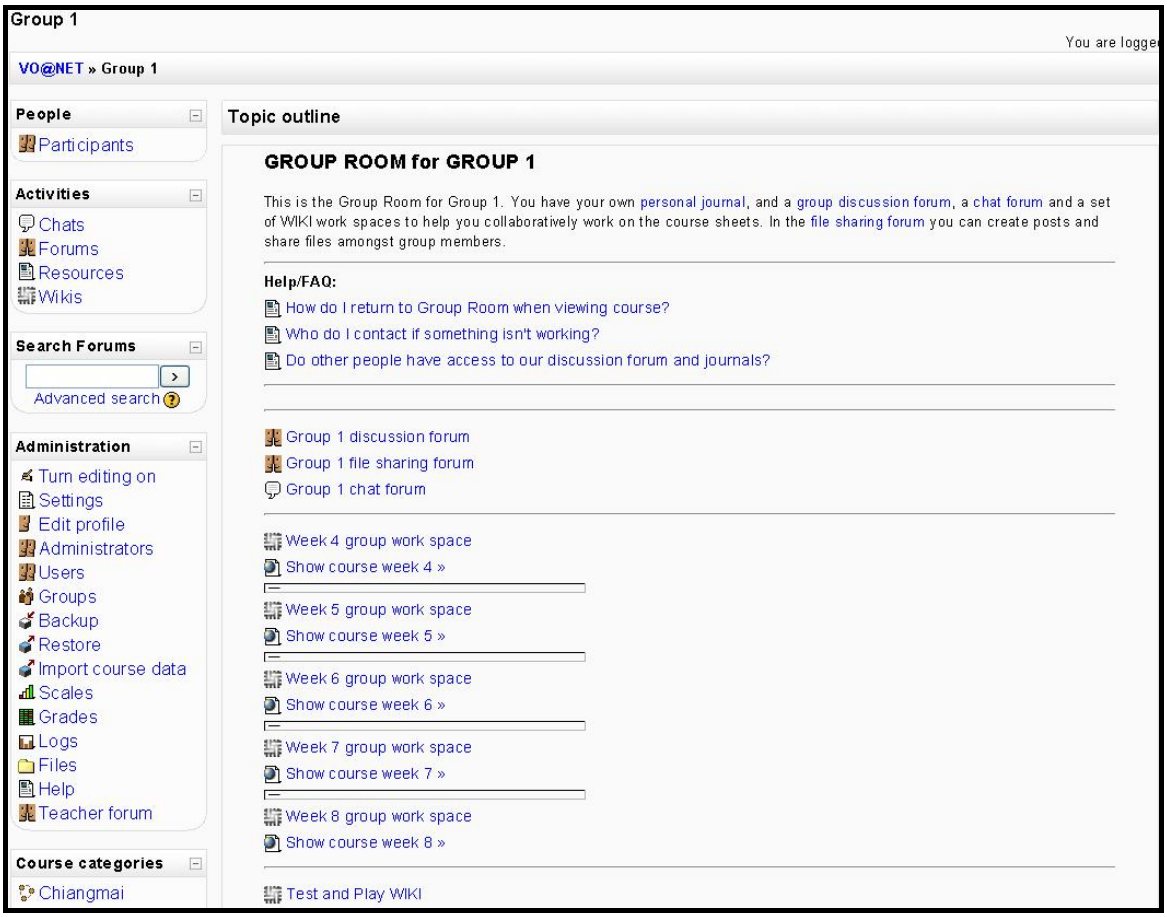


Figure 16: CMU-course: Group room from course GPI

This course was the only course in the VO@NET project that was a fully online course for off-campus students and more specifically it is aimed at full-time professionals who do not have the time (or possibilities) to come to campus. However, in the experimental running of the course some students from DTU participated. This course has been more thoroughly evaluated in two versions of an article which will appear in a special issue of the journal of "Studies in Continued Education". Therefore we will only cite some of the conclusions here and refer to the paper for a more thorough description.

Pedagogical outcomes, changes and advantages:

- The course featured an introduction to a mature methodology within environmental engineering for professionals, so it does indicate that online learning can successfully be made a part of ongoing professional development and lifelong learning for professionals – even in an international context. The course may enable participants, who would not otherwise be able to participate in continued professional development courses, either because of geographical or economical constraints to engage in lifelong professional learning.
- The original course, which was organised as 3-5 days workshop, was extended to a 12-week fully online course. It seems that the extension in time and flexibility also yield better results for the students, as the final assignments were of higher quality than in the normal training courses of shorter duration. This, however, does not indicate or prove that online learning in and of itself is better than the traditional training course. One can't directly compare the two different settings, but it gives some evidence that one can arrange for successful online learning courses within

the context of continued professional education, which can transcend to some degree economical, geographical and time-related barriers.

- The overall pedagogical approach, was inspired by PBL/POPP and collaborative learning. This was very much embedded in the original design of the training courses as well. This has been reified in an overall design, which focuses on group work and the students' collaborative work with weekly assignments and a three weeks pre-designed case study. Though, the case study was pre-designed on basis of an actual case carried out by the teachers, the students identified different problems and came up with different solutions to these. For the course pre-designed case studies was chosen, as it seemed difficult for the participants to find a shared empirical case, as they were a mixture of students and professionals; and further were geographically separated. However, courses with a more homogenous group (from the same work place) have later been established. And here they are working with their own workplace as case.
- The course aimed at stimulating notions of dialogue and mutual construction of knowledge through an assessment strategy, which valued participants' engagement in shared activities such as chats and forum discussions. In relation to this it should be mentioned that a strong focus on group work did seem to take the momentum out of the shared activities in the forums. Whether, this was because of the "physical" separation of group spaces and main course space or a common property of group work is hard to say for certain, and it is not necessarily problematic, but should be taken into account when designing fully online courses.
- The work on co-ordinating, collaborating on the assignments over a lengthier period of time did seem to give better results in the final reports – especially when it comes to the solutions of the problems but also in the analytical process of identifying these.
- The course was built on a design that was termed "structured freedom" to give the flavour of a design that was very elaborate in descriptions and guidance, but still very flexible in time and space and solidly based on students collaborative problem solving processes.
- The anchorage in time and space of e.g. the chat and other activities gave a sense of a routinely, shared practice, which we believe gave the participants a sense of order and 'security'. Actually, the course was very flexible in time, but still maintained the feeling of recurring events that acted as anchors, or knots on a disparate number of threads, which were connected occasionally. The design metaphor of 'structured freedom' is actually a valuable experience, as a clearly communicated design should not be confused with a teacher-driven, instructionalist design. Rather, we believe that the clarity and structure provided a 'safe' frame for the participants to enact their collaboration and problem solving without being confused and frustrated by lack of overview, navigational problems and not knowing what to do and where.
- The successful collaboration between the participants we would also ascribe to the careful considerations on creating a social atmosphere and a friendly environment. This was reified in the social forums and the social activities, which were implemented, but certainly also in the weekly chats that functioned as a shared space or 'class room' where a feeling of other persons actually being present was manifested and routinely reconstructed each week of the course. In relation to this, it should be emphasised that this probably would not have happened without the facilitation and social interaction. The teachers of the course put an extensive effort into being present, both as teachers, but also as persons, whether this

was the chat rooms, the forums or in the feedback to the students on their assignments. The importance of creating and no less to sustain a sociable atmosphere should not be underestimated, especially not when engaging in or designing a fully online course.

Lessons learned:

- This type of course was a success, but it must be taken into account that the teachers spent quite a lot of time on the course, both before and during the course. Doing a fully-online course with group work, discussion and case-work puts a big workload on the teachers both in being present and in giving feedback on assignments
- PBL-processes and establishing collaboration, dialogues and group work are very time-consuming processes, both for teachers and students. It demands a somewhat bigger construction and design process at least if it is for fully online courses, as it is more difficult to mend misunderstandings on the fly as e.g. can be done in classroom lectures.

It should also be noted that one can work with PBL at different levels of scale; from using problems as an outset for discussion or for small group work assignments as part of courses - to working with PBL and POPP as an institutional overarching strategy. As we have mentioned, the courses at Aalborg University may or may not include PBL-tasks, assignments or modes of working; but AAU is principally founded on a Problem and Project Oriented Pedagogy. In the following we shall take up this issue, which can be seen as a constraint in working especially with a focus on developing individual or a series of courses.

5.1.4. PBL and POPP

In the following we will discuss what we understand by POPP/PBL, which is rooted in what we call the “Aalborg model” or Problem Oriented Project Pedagogy (POPP) (Dirckinck-Holmfeld, 2002). POPP has been the pedagogical foundation for establishing Aalborg University (1974) and Roskilde University Center (1972) in Denmark. The approach represented a radical change in the teaching and study methods applied at that time. The emphasis shifted from a model based on delivery of information and knowledge towards a critical, experientially based pedagogy favoring learning as knowledge construction through genuine collaboration. In the late 1980s, open education programs and research within the field of virtual learning environments also became based on the POPP-approach. Today Problem-Oriented Project Pedagogy (POPP) can to some extent be compared to Problem Based Learning (PBL) and case-based learning which both are internationally applied pedagogical approaches. These approaches build on the same constructivist learning principles as Problem-Oriented Project Pedagogy. However, there are – or at least have been – some fundamental differences between the two approaches. PBL initially took its point of departure in the solution of a predefined task or problem set by the teacher or the textbook (Pettersen, 1993). This distinction is also noted by McConnell (2002):

> *The focus is not on the usual PBL approach […] where a problem is defined by the tutor and given to the learner as their starting point for PBL. In this traditional model, students acquire knowledge and skills through staged sequences of problems presented in context, together with associated learning materials and support from teachers […]. The kind of PBL examined in this paper occurs in an open, adult learning context where learners, who are already professional people, work in small distributed e-learning groups and negotiate amongst themselves the focus of the problem (McConnell, 2002)*

Though the citation refers to adult learning this can be equally true for undergraduate, graduate or post-graduate students; at least at AAU this mode of enquiry is implemented already from the first semester.

To distinguish between different pedagogical models and also the distinction mentioned above we believe it can be useful to highlight two different tensions: teacher vs. participant control, curriculum orientation vs. problem orientation. Graphically this can be represented as below:

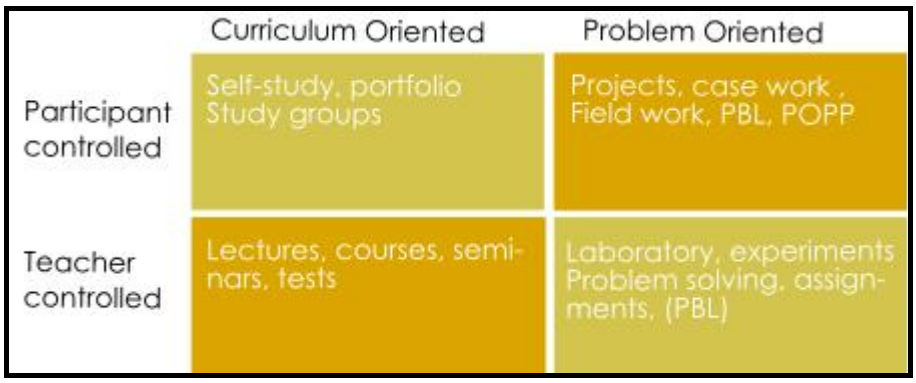


Figure 17: Different modes of pedagogy

We do not mean to say that these approaches are mutually exclusive; on the contrary these different approaches are often mixed in practice, but the different dimensions/tensions can be more or less dominant in an overall pedagogical approach. PBL can be put in two different categories based on who defines and decides the problem to be worked with, whereas POPP is situated within the field of problem orientation and participant control. However, one can also utilise PBL-strategies within a curriculum as a way to work with the curriculum. These are often shorter processes of work, where the teacher brings to fore a problem to be solved and delivering the tools for the problem-solving context as to accommodate to the curricular requirements.

In this sense one can query into different theoretical and practical constructions of PBL in relation to who defines and control the dimensions (teachers, students, tutors or others): *The problem*, *the work process*, *the solution*. "The problem" opens questions about who controls or owns the definition and framing of the problem: teacher, student or others? "The work process" is concerned with how working processes are organized and who controls them. Who chooses in which way to investigate the problem (theories, methods, empirical investigations etc.), and who is in control of the collaboration/cooperation? Finally, one can query into who owns "the solution", by which we mean whether the solution is open-ended or fixed. To which degree are the students expected to come up with a predefined solution and to which degree is the process one of exploration and genuine knowledge construction. The three dimensions then can be thought of as stretched out between two ends of continua between teacher and participant control:

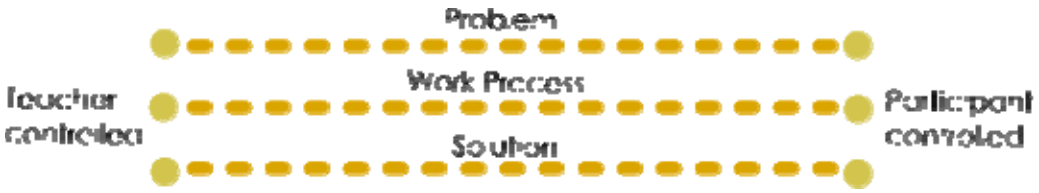


Figure 18: Continua between teacher and participant control in PBL-processes

The model and the concepts can thus serve as a springboard in discussing different types of PBL-processes.

In the following we shall give a brief introduction to the foundational principles in POPP and how it is implemented at Aalborg University:

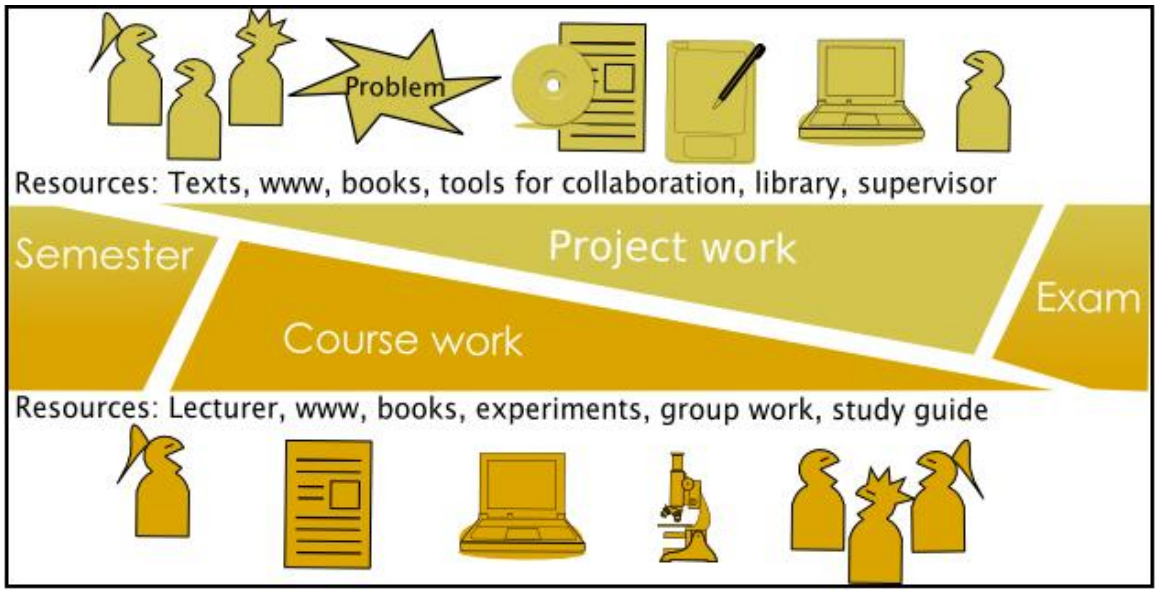


Figure 19: Illustration of Semester structure at AAU

A semester at Aalborg University is organized around approximately 50% course work and 50% project work. Early in the semester students brain-storm on a problem to work with for the entire semester (4-5 months) and they form groups around these different problems or topics. The problems that they can choose to work with are only delineated by a broad thematic framework, which could be e.g. “ICT as a medium”. From this initial problem formulation students continuously work during the semester on defining, sharpening and addressing the problem they have chosen. In order to understand and find a solution to the problem, the students have to go through different stages of systematic investigations: preliminary enquiry, problem formulation, theoretical and methodological considerations, empirical investigations, experimentation, reflection and analysis of data. This work occurs simultaneously with the regular courses, which are organized to address the thematic framework from different angles or providing lectures and workshops.

From this it becomes clear that when taking a course approach in VO@NET and working on constructing individual courses it becomes difficult to work with POPP or large-scale PBL. The teachers can orchestrate smaller cycles of PBL as part of the courses but implementing a more radical version of PBL – such as the Aalborg Model is something, which is not possible in a single course. One can be inspired by the principles in POPP, but to take it further is a part of a larger institutional process of change.

These examples sum up some of the experiences and lessons learned in the VO@NET-project. It is almost impossible to give a full account of each of the courses produced during the period of the project, but we hope these general experiences and use-cases provides an overview; and that this overview can both shed light on the outcomes of the project, as well, as they can be used by the partners for reflection on their own current and future courses.

6. Recommendations

As we have described above, quite a few courses have been produced and further different pedagogical approaches have been applied. Further, the online environments and tools have been used in a variety of ways. As we have also written early on in this report the use of pedagogical approaches, environments and tools

is an enterprise that should be under continuous development. The online environments and tools change and make possible new ways of designing, teaching and supporting student activities. We would therefore like to stress the importance of also building up local IT-pedagogical competence. Though the VO@NET project has been successful in building up sustainable online environments with a high level of impact, the project was not initially aware of the importance of building up local centres of IT-pedagogical competence. The pedagogical resource persons have been working directly with the teachers of the courses, who are all within environmental engineering or architecture and urban planning. This work has been both fruitful and inspiring for us and we hope the teachers feel the same. However, in spite of the teachers' pedagogical competence and skill in designing online courses, we believe that to further enhance and create also a more widespread institutional impact, it would be wise to connect to people from the educational departments. This has to some degree been the case in Malaysia, where connections to the educational faculties or instructional designers were already established. In Thailand there has not been much connection to educational faculties, though we believe some teachers have tried to contact local pedagogical staff.

We believe that such connections are important in order to ensure a continuous pedagogical reflection and development. This is certainly not to say that the teachers are not capable or competent within this area, but their field of research and interests lie more within environmental engineering, biology and doing field studies of environmental impact, than in how to facilitate online dialogues, design courses or bringing in new pedagogical approaches, which are connected to secondary activity of teaching. We therefore believe, as to create an even more sustainable use and development of pedagogical approaches, online environments and tools, that there is a need to:

- Ensure continuous IT-pedagogical development, through local anchorage and contact with educational departments or IT-departments working with online learning and course construction.
- Ensure continuous development in the use and application of IT-pedagogical approaches and the utilisation of a variety of online tools. By this we do not necessarily mean the technical development of software, but rather utilisation of existing tools (such as viable open source software) and continuous experiments with new environments, approaches and tools.
- Ensure or connect to institutional units or labs with interdisciplinary competences within IT-pedagogy, online learning, software development, system administration and knowledge of organisational development and implementation.

The points above all seem to refer to the development of tools and environments aimed at teaching or constructing courses. However, we would like to stress that we also believe a major effort should be put into empowering the students, not only by bringing online teaching to them, but also by providing tools for students own projects, groups and activities. As mentioned systems and environments can also be used to provide collaborative tools and communicative platforms for students – this could, as in the case of MUCED, for student organisations, but also in relation to scaffolding project work, shared construction of reports, discussion groups, coordinate activities and so on. The teachers are an important group to address in order to ensure an institutional spread and use of IT-tools, but it is important to remember that such tools and environments are also, in themselves, an important part of becoming a competent worker and participant in the knowledge and information society. Thus, giving students access to experimenting and working with online technologies also in non-course environment and scaffolding

students' individual and collaborative work on projects, fieldwork and laboratory work is important.

This could also encompass for example embracing a more project and problem oriented view. Though, we have presented the pedagogical model of Problem Oriented Project Pedagogy (Dirckinck-Holmfeld, 2002) during the VO@NET-project the focus on individual courses in the VO@NET project has rendered it difficult to actually embrace the pedagogical model of POPP, as we wrote in the previous section. This is not due to lack of interest on part of the teachers, who were interested in PBL and POPP, but working with such a pedagogical transformation is something, which should be coordinated at an institutional level and must at least be applied at the level of a full semester.

7. Future perspectives

On basis of this report and the recommendations we have described we believe there are fertile grounds for enhancing and extending the results of the collaboration from the project. This could be done either locally or as new collaboration projects between Asian and European partners; also existing master programmes could be interesting in relations to build up capacity and competences. From our point of view we see the following areas as being important future perspectives and development:

- Establishing, sustaining or connecting to local competence centers within online learning or "e-learning labs", which support teachers and students, helps and develop expertise in pedagogical design, and conduct developmental research on the integration of ICT for teaching and learning in order to further develop the pedagogical practice
- These e-learning labs could establish a systematic training programme for all university staff to integrate ICT for learning. A number of fiery souls leading this process and acting as change agent in the organisation should be trained at Master level within university programmes which integrate technology, communication, learning, design and human computer interaction, and based on an action learning and problem and project based learning philosophy, so they could work systematic with the development and transformation of the teaching and learning programmes. An example of such a programme is the European Master in ICT and Learning for professionals (www.mil.aau.dk).
- Experiments on working with POPP and PBL as an institutional strategy could also be strengthened through a systematic action learning approach where a number of fiery souls and managers got an opportunity to participate in international master programmes at the same time as running pilot experiments integrating PBL in courses or at department levels. An example of such a programme is the International Master in Problem Based Learning in Engineering and Science (http://www.mpbl.aau.dk).
- Establishing, sustaining or connection to local educational environments that work with interdisciplinary approaches on technology, communication, learning, design and human computer interaction (HCI). In order to sustain the integration of ICT and learning more broadly in the university, but also in other institutions and the society as such, the universities could consider strengthening already existing interdisciplinary teaching and research programmes on technology, communication, learning, design and human interaction.
- Finally, the methodology of the VO@NET project making demonstration projects to get concrete experiences on the use of ICT for learning should be used more widely, and linked with systematic local and regional spread

of the VO@NET-experiences and results. This could be initiated by teachers and participants from Thailand and Malaysia engaging with the Thai and Malay groups that are already established at (http://moodle.org). Here user groups within different levels of education are working with Moodle and online learning.

8. References

Bell, P. (2004). On the theoretical breadth of design-based research in education. *Educational Psychologist, 39*(4), 243-253.

Bygholm, A., & Dirckinck-Holmfeld, L. (1999). Pædagogik i det virtuelle læremiljø - metodiske overvejelser · (pedagogics in the virtual learning environment - methodological reflections). In O. Danielsen, L. Dirckinck-Holmfeld, B. H. Sørensen, J. Nielsen & B. Fibiger (Eds.), *Læring og multimedier* (Second Edition ed.). Aalborg: Aalborg Universitetsforlag.

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of the Learning Sciences, 13*(1), 15-42.

Dirckinck-Holmfeld, L. (2002). Designing virtual learning environments based on problem oriented project pedagogy. In L. Dirckinck-Holmfeld & B. Fibiger (Eds.), *Learning in virtual environments*.Frederiksberg C: Samfundslitteratur Press.

Dirckinck-Holmfeld, L., & Fibiger, B. (Eds.). (2002). *Learning in virtual environments*.Frederiksberg: Samfundslitteratur Press.

Dirckinck-Holmfeld, L., Lindström, B., Svendsen, B. M., & Ponti, M. (2004). *Report on theoretical framework on selected core issues on conditions for productive learning in network learning environments* (No. Deliv. No. 24.3.1): Kaleidoscope, Deliv. No. 24.3.1, 2nd revision. Jointly Executed Integrating Research Projects (JEIRP) on "Conditions for Productive Learning in Network Learning Environments".

Dirckinck-Holmfeld, L., Tolsby, H., & Nyvang, t. (2002). E-læring systemer i arbejdsrelateret projektpædagogik. In K. Illeris (Ed.), *Udspil om læring i arbejdslivet*.Frederiksberg C: Roskilde Universitetsforlag.

Dirckinck-Holmfeld, L. N., J, Danielsen, O. (2000). *From action research to dialogue design - mutual learning as a guiding principle.* Paper presented at the NordiCHI 2000, Stockholm.

Engeström, Y. (1987). *Learning by expanding - an activity-theoretical approach to developmental research*.Helsinki: Orienta-Konsulitit Oy.

Engeström, Y. (1996). Developmental work research as educational research. *Nordisk Pedagogik, 16*(no 3), 131 - 143.

Hiim, H., & Hippe, E. (1998). *Undervisningplanlægning for faglærere*.København: Gyldendal.

Illeris, K. (1977). Problemorientering og deltagerstyring. *Dansk Pædagogisk Tidsskrift*, 25-37.

Illeris, K. (2001). *Læring - aktuel læringsteori i spændingsfeltet mellem piaget, freud og marx*.Roskilde: Roskilde Universitetsforlag.

Jones, C., Dirckinck-Holmfeld, L., & Lindström, B. (2005). Cscl the next ten years - a relational, indirect and meso level approach to design. In T. Koschmann, D. Suthers & T.-W. Chan (Eds.), *CSCL 2005 - the next 10 years*.Taipei, Taiwan: Lawrence Erlbaum.

Kolb, D. A. (1984). *Experiential learning - experience as the source of learning and development*.New Jersey: Prentice-Hall, Inc.

Kolmos, A., Fink, F. K., & Krogh, L. (Eds.). (2004). *The aalborg pbl model - progress diversity and challenges*.Aalborg: Aalborg University Press.

Lave, J. (1988). *Cognition in practice*.Cambridge, UK: Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning - legitimate peripheral participation*.New York: Cambridge University Press.

Leontjew, A. N. (1977). *Problemer i det psykiskes udvikling* (C. Bendixen, N. Svendsen, J. Olsen & A. Holmgren, Trans. Vol. 1 - 3). København: Rhodos.

Lewin, K. (1951). *Field theory in social sciences*.New York: Harper & Row.

McConnell, D. (2002). Action research and distributed problem-based learning in continuing professional education. *Distance Education, 23*(1), 59-83.

Papert, S. (1983). *Den totale skildpaddetur - børn, datamater og kreative tanker*.København: G.E.C Gad.

Pettersen, R. C. (1993). *Problemet først: Problembasert læring som pedagogisk ide og strategi (the problem first: Problem based learning as pedagogical idea and strategy)*.Oslo: Tano Aschehoug.

Piaget, J. (1969). *Barnets psykiske udvikling*.København: Reitzel.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in berkely's museum of vertebrate zoology, 1907-39. *Social Studies of Science, 19*(3), 387-420.

Vygotsky, L. (1978). *Mind in society. The development of higher psychological processes.*Cambridge: Harvard University Press.

Wenger, E. (1998). *Communities of practice - learning, meaning, and identity*.New York: Cambridge University Press.

Zurita, L., & Ryberg, T. (2005). Towards a collaborative approach of introducing e-learning in higher education institutions. How do university teachers conceive and react to transitions to e-learning, *WCCE 2005 - 8th IFIP World Conference on Computers in Education*.Stellenbosch - South Africa: University of Stellenbosch.