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Conditions for productive learning in networked learning environments – a case study from the VO@NET project

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Key words: Continued professional education, PBL, Collaborative learning, Training courses

Abstract

In this article we bring together experiences from two international research projects: the Kaleidoscope ERT research collaboration and the VO@NET project. We do this by using a shared framework identified for cross-case analyses within the Kaleidoscope ERT to analyse a particular case in the VO@NET project – a training course called “Green Productivity for Industry”. Based on the experiences from a Danish research project on workplace learning we argue that the use of ICT within training or certificate courses has predominantly focused on self-study and individual skill-acquisition, rather than Problem Based Learning and collaborative learning. The latter approaches seem to be most dominant within higher education master programmes. We argue that the GPI-course represented a more collaborative and problem based approach and that it featured a good match between structural conditions and the actual pedagogical design, which we call ‘adapted PBL’. The notion of PBL we discuss theoretically and relate to the shared analytical framework. This framework we further expand by incorporating three analytical levels or perspectives on design.

Introduction

Through Kaleidoscope (a large-scale European research network) researchers from e-Learning Lab have been participating in a European Research Team (ERT) on “Conditions for Productive Networked Learning Environments”. In this ERT one of the activities has been to develop a shared analytical framework in order to analyse different cases brought into the team by the partner institutions[1]. Simultaneously researchers from e-Learning Lab have been engaged in a European-Asian research and development project called VO@NET. The VO@NET encompassed partners from Malaysia, Thailand, Denmark and Spain[2]. The overarching objectives of the VO@NET project were to create a Virtual Open Access NETwork between the partners in the project and to develop a number of online courses.

In this article we will focus on one of the courses developed in the VO@NET-project called “Green Productivity for Industry” (GPI). As all of the courses in the VO@NET-project it was an experiment with online learning. The motivation for this concrete experiment emerged from a real life problematic situation or tension; the course is mainly intended for full time professionals who want to learn about the environmental engineering methodology Green Productivity (GP). GP is a widely

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[2] *Thailand*: Chulalongkorn University, Mahidol University, Prince of Songkla University, Chiang Mai University; *Malaysia*: Universiti Malaya, Universiti Kebangsan Malaysia, Universiti Putra Malaysia, Universiti Teknologi Malaysia, *Denmark*: Aalborg University, Technical University of Denmark; *Spain:* University of Barcelona

accepted methodology within the industry and service sector, where GP-training is encouraged and has been run primarily as short-term workshops (three to five days). However, an inherent tension has emerged from this, as short time training seems to be insufficient for efficiently learning how to apply the method, but longer term training seems to be a limitation for industrial practitioners. This highlights some wider problems and tensions, which were also addressed in a Danish research project on “Workplace learning” focusing on continued professional education (Illeris, 2002). Companies are hesitant towards doing without their workers for longer periods of time unless the focus for the learning process is clear and needed at the workplace. E-learning or online learning has been seen as a viable solution to this. However, the study also highlighted that the use of e-learning in relation to short term training and certificate courses is primarily based on more traditional pedagogical approaches, whereas approaches such as PBL and collaborative learning are predominantly employed within higher education in e.g. online master programmes. Though, the companies recognise that a focus on self-study materials and individual skill-acquisition is not satisfactory and that more collaborative and problem based approaches are needed, there have not been many actual examples of this (Elkjær, 2002). Elkjær (2002) concludes that workplace e-learning within professional education should increasingly be developed to connect people across time and space, and she argues that companies can gain inspiration from e.g. master programmes within higher education - this paper is an attempt to begin such a process. The GPI-course was an experiment aimed at identifying whether this type of training course could be successfully implemented online and if it would actually be able to overcome some of the tensions mentioned above. Our argument will be that the course was quite successful in creating a productive learning environment that fit the structural conditions of a training course, while at the same time incorporating notions of PBL and collaborative learning.

Theoretical and Methodological Framework

In Figure 1 the analytical framework of the ERT is represented (Dirckinck-Holmfeld, Lindström, Svendsen, & Ponti, 2004). The framework was developed as a tool for engaging in cross-case analyses of cases brought into the project by the partners. 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.

<table>
<tr><td rowspan="2">Theoretical Approaches</td><td>Design
Relations between technology, pedagogy and organizational perspectives</td><td rowspan="2">Methodological approaches</td></tr>
<tr><td>Indirect Design, Affordances, Design methodologies</td></tr>
<tr><td>Socio constructivism
Cultural historical approach
Situated learning & Communities of practice
Experiential learning
Critical pedagogy</td><td><u>Productive learning:</u>
Meaningful learning
Learning through engagement and participation
Learning through participation and reification
Effective adaptation of knowledge
Imagination and sociological fantasy
Identity</td><td>Ethnography
Virtual ethnography
Discourse analysis
Interaction analysis
Phenomenography
Design experiments
Action oriented research</td></tr>
</table>

<table>
<tr><td colspan="9">Structural elements of the networked learning environment</td></tr>
<tr><td>Setting/ Context</td><td>Target audience</td><td>Tools</td><td>Subject</td><td>Role of the teacher</td><td>Course format</td><td>Modes of organisation</td><td>Pedagogi-cal approach</td><td>Assess-ment</td></tr>
</table>

Figure 1: Analytical framework of the ERT

In the ERT design was defined as 'relations between technology, pedagogy and organizational perspectives' but we argue that we can further differentiate this by thinking of design at three different levels: a macro-, a meso- and a micro- level that each encompasses different challenges. The notions of macro- meso- and micro- level analyses were taken up in a paper that summarised the work of the ERT (Jones, Dirckinck-Holmfeld, & Lindström, 2005) and one of the core-notions in the paper was a critique of the micro-level of analysis in the CSCL literature:

> *"Much of the research that has taken place within CSCL has focused on the micro level of collaborative learning, on the collaborative learning in single groups. Supplementing these approaches, we would like to argue for more focus on the meso-level of collaborative learning: On how to design for collaborative learning in organisations, school settings, and in networked learning environments; On what the conditions are for collaborative learning in these settings; On how the technology and infrastructure affords, and mediates the learning taking place" (Jones et al., 2005)*

In the paper the notion of meso-level connoted an institutional level of analysis, whereas macro represented a societal level such as educational policies. In this paper we take another perspective on the three levels, which we believe should act as flexible and scalable analytical categories, rather than being confined to certain levels of analysis.

Macro-level we define as an overall design approach of a course e.g. deciding timing, number of lessons/modules, overall pedagogical approach (should group work and case studies be included), material to use and so on. This is very much connected to and intertwined with, what has been identified as the structural elements of networked learning environments (see Figure 1) and the overall theoretical approach. The challenge at this level is to identify an overall theoretical approach by weighing and critically assessing the approach in relation to the conditions and structural elements. But this is by no means a simple, straightforward enterprise, as the experiences from the ERT shows:

> *"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)*

One thing is identifying an overall approach such as Communities of Practice or experiential learning; another thing is to actually implement such abstract theoretical concepts and ideals into a material, temporal and spatial learning environment. This is what we will term the meso-level of design, which we understand as the level of actual implementation of the macro-structural elements into e.g. a LMS. It is a meso-level, because plans or theoretical approaches are seldom directly and unproblematically implemented or translated into actual course designs. Finally, the micro-level we understand as the actual interaction and course execution. What will actually be going on between students and teachers and how do they interpret and enact the course design? These levels are also inspired by Goodyear (2001), who argues that teachers/course designers can only design certain things – some elements rest in a sphere of facilitation and social dynamics. Goodyear's argument is that we can provide and design a space, some tasks and organisation, but we cannot directly design for communities to arise or make people feel they are operating in a place rather than space and how tasks will translate into actual activities. This is addressed in the model, through the notion of indirect design, which represents the idea that there is a dynamic relationship (rather than a direct, causal relationship) between overall approach, implementation in a software environment and then how the students will work with the environment and respond to the design. One thing is to design, and have a dialogical and collaborative work process in mind, but if students or teachers in practice position themselves and establish communicative relations such as experts/novices then the outcome might be different than expected. The macro- and meso-level we argue, are the levels of design, whereas the micro-level is a matter of facilitation or social interaction and how the both teachers and students in practice interpret and enact the design.

Our analytical aim in this paper is to step back and critically reflect on and analyse a specific course from the VO@NET project by employing the categories mentioned above and the concepts from the ERT analytical framework. In this process we shall also discuss different notions of PBL, as this concept is often very differently interpreted both in theory and in practical pedagogical implementations. The background of the case study is the VO@NET project, which was in many ways very different from the ERT. The project was a development and action research project comprised of partners from more than ten universities, with widely different fields of research and competences (e.g. system administration, online learning, environmental engineering and urban planning). The aim of the pedagogical resource persons was to initiate dialogues, discussions and reflections on online learning, rather than delivering a fixed manual on how to design online courses. Therefore the courses have been developed as collaborative enterprises encompassing both theoretical background knowledge of the pedagogical resource persons and the practical experiences of all the participants, though there has not necessarily been a shared discourse (or repertoire) on specific theoretical positions such as Communities of Practice, constructivism or experiential learning. The practical work on establishing and developing online courses have been arranged through small conferences with all partners as well as local workshops where pedagogical resources persons, system administrators and teachers have worked on co-constructing the courses and discussing the pedagogical approach to be taken. Especially, the pedagogical resource persons were involved in the GPI-course, where the design process was very much a collaborative enterprise. Before and during the course one of the pedagogical resource persons acted as a technical supporter and administrator of the networked learning environment throughout the course. This gave the pedagogical resource person an opportunity to act as a participant observer and to engage in what could be termed a short-termed virtual ethnography (Hine, 2000) – all forum messages were monitored and also the pedagogical resource person participated in some of the chat sessions and wrote some comments in the forums. Chats, forum messages, draft documents and assignments were all stored in the system for later retrieval and analysis. Further, all students were given a questionnaire at the end of the course, and they were asked to give some written feedback in a forum. In this article we shall not go

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into detailed analyses of chat-transcripts or forum communication, as our aim is to focus on the interplay between the different levels of design. We aim at giving a broad overview of the communicative and collaborative processes to give an idea of how the students in more general terms enacted the pedagogical design.

PBL and POPP – the problem of problems

In the following we will discuss what we understand by 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 pre-defined 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)*

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:

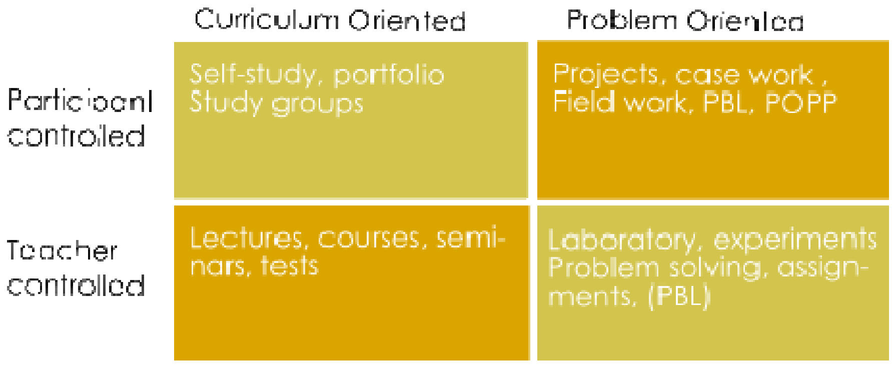

Figure 2: Four dimensions or pedagogical approaches

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

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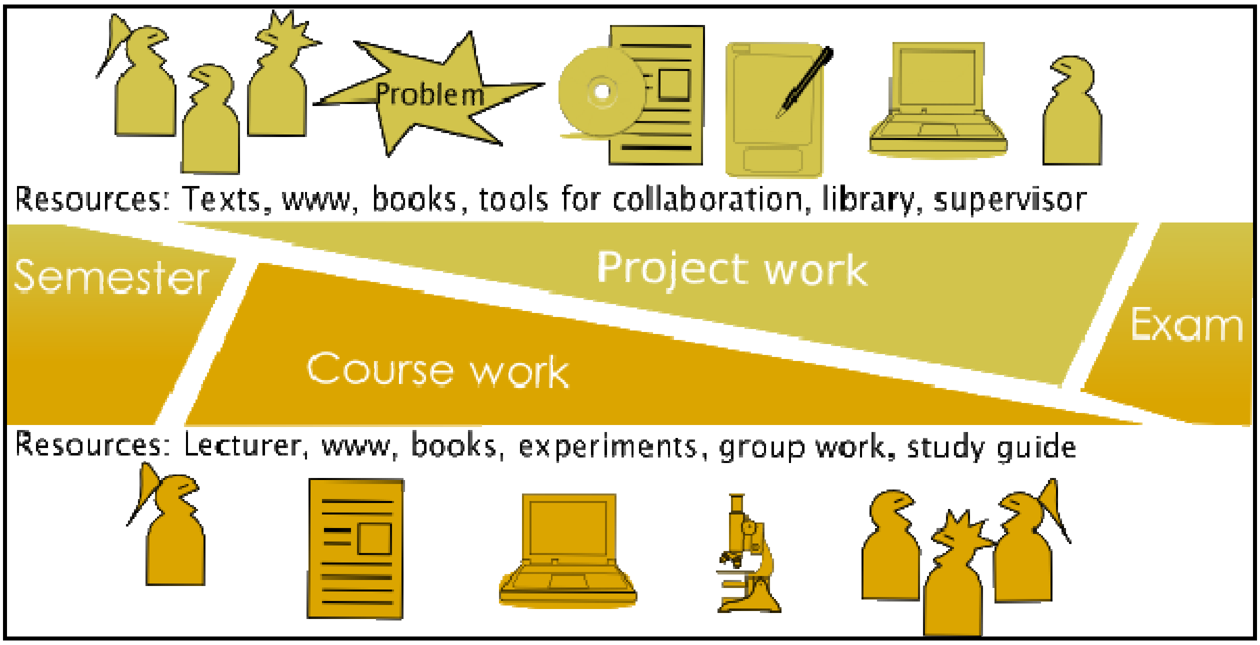

Figure 3: Model of a Semester with POPP

A semester 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.

We will briefly present some of the foundational principles, which are quite thoroughly described elsewhere in Danish pedagogical literature (Dirckinck-Holmfeld, 2002; Illeris, 1977, 1981, 2001; Kolmos, Fink, & Krogh, 2004). Some of the foundational issues are *problem formulation* and the notions of enquiry of *exemplar problems*. The point of departure is something, which make the students wonder and make them *want* to find an answer. The entire educational process is built upon the students' enquiry of scientific and social problems and it is the focal center of the students' engagement in the learning process. *Participant control* is an interrelated principle. When students themselves define and formulate the enquiry, they have a conscious relation of ownership to it and they experience it as a problem (anomaly), which implicitly encourages involvement and motivation. *Participant control* and the ownership of the problem setting are therefore seen as fundamental for the students' engagement in the learning process. POPP is *flexible* pedagogy in relation to the *curriculum***.** Together with the teachers, the students define the curriculum, the theories and methods to use in order to make an exemplary enquiry. Other central principles of POPP are *collaboration* and *joint projects* in which students have a *mutual responsibility* for creating and conducting the joint project. POPP is a *collaborative* pedagogy and the pedagogy requires and supports strong interdependence between the participants in the learning situation. In this sense we stress an understanding of collaboration as a process, which can be distinguished from cooperation, as many authors have pointed out (though some use it interchangeably). McConnell (2002) distinguishes be-

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tween distributed *collaborative* and distributed *cooperative* learning. Roughly, the distinction here is whether the work on the problem itself and the outcome is shared (collaborative) or whether individuals engage in discussions and reflection on their own, individual assignments with others (co-operation) – a similar, but not exactly the same definition is reiterated by Goodyear (2001):

> *"For example, Roschelle and Teasley (1995) say that co-operative work '…is accomplished by the division of labor among participants, as an activity where each person is responsible for a portion of the problem solving…', whereas collaboration involves the '…mutual engagement of participants in a coordinated effort to solve the problem together." (Goodyear, 2001)*

In this sense POPP is better characterised as a collaborative enterprise than as cooperation, though tasks are divided among participants negotiations of what constitutes the problem, how to investigate it and find a solution rest on mutual engagement and a tightly coordinated effort of the group.

From this discussion of POPP/PBL we can extract three dimensions. From these we can query into different theoretical and practical constructions of PBL in relation to who defines and control the dimensions (teachers, students, tutors or others); regardless of whether it is collaborative or cooperative: *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 pre-defined 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:

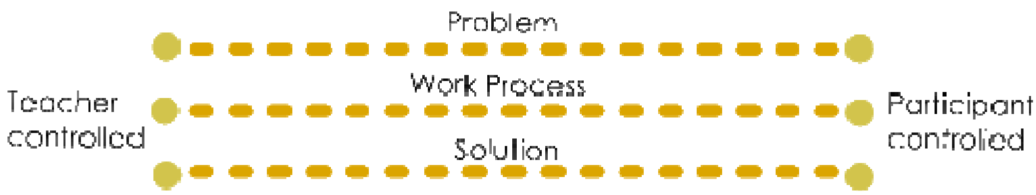

Figure 4: Continua between teacher and participant control in PBL-processes

We shall return to the concepts in the model later in the analysis where we shall position the pedagogical approach taken in the GPI-course, which is not exactly the same as POPP or the PBL approach described by McConnell (2002). These approaches cannot be directly applied in any context but must be adapted to the conditions and structural affordances and constraints of the 'unique' course. The model and the concepts can thus serve as a springboard in discussing different types of PBL-processes.

Case: Green Productivity for Industry

From the courses developed in the VO@NET project, we have chosen the GPI-course for this article. This is partly because it was the only course that was fully online and aimed at full-time professionals, whereas many of the others were mixed mode or on-campus IT-supported courses. As we shall argue we also believe that the course was a good example of a productive learning environment that fit well the structural conditions of a training course, while still incorporating notions of PBL and collaborative learning. These structural conditions we take up in the following discussion of the macro-design of the course.

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Macro-level of design

As mentioned in the citation from the ERT-project the creation of a course is a unique, situated realisation, which must fit the structural conditions in a specific context. The structural elements afford and constrain different types of designs, pedagogical approaches and types of activities in a course. In the following we shall describe the structural elements and conditions for the GPI-course, which afforded or constrained different pedagogical activities.

Institutional setting/context: The course was not formally part of any institution. Though, the teachers were from Chiang Mai University the course was not a part of any of the programmes at that university or technically/administratively supported by the institution. The original physical workshops provided by APO resource persons (Asian Productivity Organisation) are training programmes for professionals in the business or industry sector, where participants receive a certificate for participation in the course. However, the GPI-course was not institutionally integrated in the APO (though this has later been an outcome of the experiment). The course environment was technically supported and hosted by the Technical University of Denmark (DTU); and as part of the experiment the course was advertised to students at DTU and accredited with 5 ECTS. However, the course as such was free-floating in the sense that it was not a part of a programme and not institutionally integrated at either universities or the APO. This also had some consequences in relation to the *target audience* of the course. The course originally was- and will in the future be – specifically aimed at full-time professionals, but due to the experimental status of the course also university students were invited to participate. Further, participants who were to participate in a regular face-to-face training course in Malaysia and interested persons from the business sector were invited. Participants thus constituted a very mixed group both in relation to their educational background, their profession, but also people came from more than 14 different countries and were geographically scattered (primarily across Asia and Europe). Though the target group was quite clear the actual composition of participants in the course became quite different:

Participants Group	Number of participants applied for	Number that finish the course	Percent finishing
1. Registered students from DTU	6	6	100
2. Interested persons from business sector	9	4	44
Sub total (12 weeks)	*15*	*10*	*67*
3. Pre-workshop participants APO (2 weeks)	21	13	62
Total	**36**	**23**	**64**

Table 1: Number and composition of participants in the course (and percents finishing)

The target audience of full-time professionals meant that timing and workload should not be overestimated and we could not expect that they would have the same amount of time available as full-time students. Essentially the full-time professionals would have to fit in the course before or after work (depending of course on the flexibility of their workplace) and such considerations are equally important in deciding the overall structure and pedagogical design. The *tool* used for the course was primarily the learning management system Moodle, which is an Open Source Learning Management System (or course management system) that has become increasingly popular (http://moodle.org). The *subject* of the course was within the larger subject area of environmental engineering but focused more narrowly on a specific methodology within this broader area of study; namely the GP-methodology, which is an approved and successful method for increasing production, while lowering the negative environmental impact of the production. This also means that the learning objectives of the course were rather fixed or specific:

- To learn the concept of Green Productivity (GP) implementation in industry
- To learn step-by-step implementation of the GP methodology for industry.
- To provide opportunity for the participants to apply their knowledge learned from GPI course in solving the problems raised in a case study.

The *roles of the teachers* were manifold, as the teachers were to act as lecturers/instructors by making available readings, materials, answering questions and facilitating discussions of the method through both forums and chats. Also they should act as resource persons, because both teachers are also practitioners in carrying out GP-analyses for industrial stakeholders. The *mode of organisation* was pretty straightforward as the course was fully online, which meant that the participants in the course would not meet each other physically. This is to address the needs for full-time professionals and to make the course as flexible in both time and space (geographically) as possible, but it also entails some difficulties, as it can be more challenging to build up relations and trust between the participants online.

In its essence the *pedagogical approach* draws on a “learning by doing” approach, which has always been a part of the course, as the participants are expected to work practically with the methodology by applying it on a case provided by the instructors. In the physical workshops the pedagogical setup alternates between lectures from the resource persons and then group work of the participants. The group work (or team work) is important not only from a learning theoretical perspective, but also because the methodology is inherently team-based and different persons and stakeholders are involved in the analyses and execution of real GP-projects. Therefore the foundational structure of the online course is also built on a case-based approach and notions from PBL, where the students have to analyse the case and come up with solutions on how to reduce negative environmental impact, while maintaining or increasing the overall production. But unlike the PBL/POPP processes, which we described earlier, the participants do not as such define ‘*the problem*’ to work with themselves, and they do not choose the methods and theories to apply (the ‘*work process*’). In a POPP project, as it is implemented at AAU, one of the processes would be to identify the approach or methodology to use. In this sense participants would be ‘free’ to choose for example a similar method called ‘Cleaner Production’ and the students could take up a more thorough discussion of what constitutes ‘the problem’. For this type of training course with some inherent time constraints and specific learning objectives the problem area had to be delineated to the context of the case and how to apply the specific methodology. However, different and alternative methodologies such as ‘Cleaner Production’ and Sigma Six were raised by students and discussed in the forums. ‘The solutions’ to the problems in the caseworks were relatively open-ended and the participants came up with different solutions to the presented problems. Therefore we would call the pedagogical approach ‘*adapted PBL*’, as it is not a full scale PBL-process in the way we have defined this earlier. There were some restrictions in how students could frame the problem and also in the methods they were invited to apply; the latter is not exactly surprising since the course is an introduction to a specific methodology.

Another key element in the pedagogical design was to foster a learning community/community of practice among the learners and to encourage discussions/dialogues (Wenger, 1998). This draws on thoughts from the CSCL community, social theories of learning and experiential learning as to understand that the participants do not come as blank slates, but rather that they each represent unique professional and personal identities, who can mutually benefit from exchanging their perspectives and engage in discussions with others (Kolb, 1984; Lave & Wenger, 1991). Therefore notions such as participation, negotiation and reification of intelligible knowledge within a community of practitioners and connecting to the participants' experiences and professional identities was an important issue to be addressed in the actual design of the course. In Figure 5 we have illustrated the overall structural design of the course, which is a representation of the macro-level design of the course.

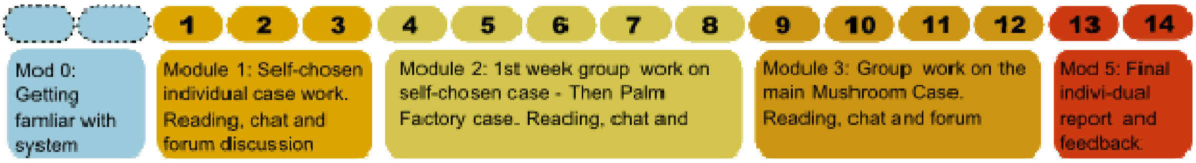

Figure 5: Structural design of the GPI-course

The course ran from 20th February 2005 to 28th May 2005 (14 weeks) where the final week was reserved for feedback to the participants. We opened the learning environment approximately two weeks before actual course start and invited the participants to familiarise themselves with the system, say hello to other early birds[3]. The design of each week featured some recurrent activities, but also the ways of working changed and progressed between the different modules, as can be seen from the illustration. The GP-methodology is a very structured, comprehensive and detailed methodology, which is composed of a series of *tasks* and *steps* that all contain a lot of different cognitive artefacts/reifications such as models, techniques, tables to structure brainstorming, diagrams and so forth. The use of these cognitive artefacts is an inherent part of the methodology. This was then represented in the course design, as the different weeks would reflect different tasks and steps of the methodology and the related cognitive artefacts. These were reified in some sheets that constituted the 'assignment' of the week. For each week there were some reading materials and an assignment, which was due at the end of the week. The assignments were small-scale PBL-tasks or small-scale cases, as in all of them the students would have to apply the tasks, steps and use the cognitive artefacts on a case, either decided by themselves or provided by the instructors. Each week on Wednesday at 8am GMT there was a chat session where people could ask questions or discuss the methodology. But all throughout the week they could also do so in the weekly forum.

The course alternated between different types of PBL processes and modes of organising the work in terms of collaboration or cooperation. The modules changed between self-chosen casework and cases given by the instructors, but in all modules the students were free to choose their own ways of organising their work and their level of coordination and collaboration/cooperation with others. Initially the work was cooperative in the sense that participants worked on their own with a self-chosen case, that they could discuss with the teachers or their peers; however, in this process the participants usually addressed directly the teachers in the forums or through the chats. The individual work was decided, as to give the participants an opportunity to start easily and do work in their own pace, without being dependent on others. We knew beforehand that few participants had experiences with online learning and some might be less comfortable with a virtual environment, using chats, downloading or posting forum messages. In this way the participants could build relations to the others, while still working at their own pace with a self-chosen case. Their mutual dependency would then be more focused on the social processes, rather than a shared task to be accomplished. In the second module the work shifted towards a collaborative mode, where the students had to work collaboratively on a shared self-chosen case and then a case given by the instructors. This shift to collaborative work also shifted their communicative patterns. From the fourth week the

[3] Participants joined at different pace as some were invited later than others. Since it was an experiment, which was not institutionally supported the teachers used their different networks to find participants.

weekly forums were seldom used and instead the participants used their group rooms and each other for support. This pattern continued in the third module where the students worked with an even more complex case given by the instructors. Initially, there was a discussion among the teachers and pedagogical resource persons, whether it would be possible to let the students define the case and do some empirical work themselves. We all agreed that collecting and identifying the data for the analyses are an important part of the methodology. But it would be very difficult to actually carry this out in practice if we wanted it to be teamwork or collaborative effort[4], as the participants were distributed across different countries. Further, it would be very problematic for them to actually collect usable data, as the data-collection is a comprehensive and very time-consuming process.

In the last two weeks (or last module) of the course the students wrote up an individual, final report, which they received feedback on during the last week. The report was based on the work they had done in the group, and though they worked alone there are some indications that they did consult their peers rather than the teachers.

Pedagogical design in a meso-level perspective – actual design and implementation

In the following we will go more into the design of the course as it was 'physically' implemented in the Moodle system. Here we shall take departure in the design of the first week of the course and an area covering the whole course – typically referred to as topic 0 by Moodlers, as it is the topmost topic usually used for e.g. course descriptions and general course announcements not connected to a specific topic or week:

[4] In a later implementation of the course a group of employees used their own hotel as their cases-study

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Figure 6: Moodle course layout - Topic 0 and the first week

Topic 0 was composed of a course description, four forums and a social chat. The four forums served different purposes. The news forum was meant for announcements, whereas there were two types of support forums (course and technical respectively). This was for both clarity but also functioned as our division of labour. The teachers would answer questions regarding the course, whereas the pedagogical designer acted as technical support. Finally, there was a 'social forum' and a social chat. The social forum was a way for the participants to engage in a more informal manner and as to get to know each other. The purpose was to ensure there would be a place for socialising and taking up non-course related topics. We hoped that reifying this and making it explicit by incorporating a social forum would send a signal to the students that we valued social interaction. Further, we encouraged people to upload pictures to their profiles and made sure it was possible to see, who was online thus creating an awareness and a sense of presence of others.

Beneath Topic 0 all of the weeks would gradually unfold as the course progressed. They all followed a similar structure and concept: a textual description summarising the goals and activities of the week and a description in a table with the learning goals, the tasks and timing for these. Also each task was created as (Moodle-technically) an assignment, which we called tasks. This was done

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because assignments in contrast to e.g. a text-label or other types of tools available in Moodle are automatically put in the course calendar. As it can be seen, each task was visually grouped with the associated tool – for the download task the folder with the files was placed below and equally with the forum and the chat – the weekly assignment was placed last. This structure also reflected the temporal aspects or 'the timeline' of the different task, which were similar each week. Monday was 'download and read'; Wednesday was the weekly chat day and Friday was the day for handing in their work. The forums were open all week.

The GPI-course was presented at the CSCL-conference 2005 in Taipei and one comment from the audience was that the course seemed to be very teacher-centred and within and instructional paradigm, rather than student-centred and based on PBL. We did not agree with the comment, but we understand why the point was made. When one takes a quick glimpse at the design of a week it does seem heavy on instructions or 'do-this-do-that'. However, the design rationale was not to be directive, but rather to create a recognisable structure with a few activities to serve as an anchorage; actually only the weekly chat and handing in of the assignment were fixed in time. Our goal was to create a clear, visible, coherent, recognisable and easily accessible design; and based on students' comments we actually did succeed in doing that. The weekly chat could also have been substituted by pure asynchronous communication in the forums, but our idea was to create a "rhythm" in the course and some temporal, spatial anchor points in time to support the feeling of being co-present with others (Bygholm & Dirckinck-Holmfeld, 1999). After the third week most of the actual work was carried out in the students' group rooms, where the GP-teams were formed. The group rooms were actually (Moodle-technically) separate course rooms, as the group options in Moodle are not yet sufficient. The rooms were structured as can be seen in Figure 7:

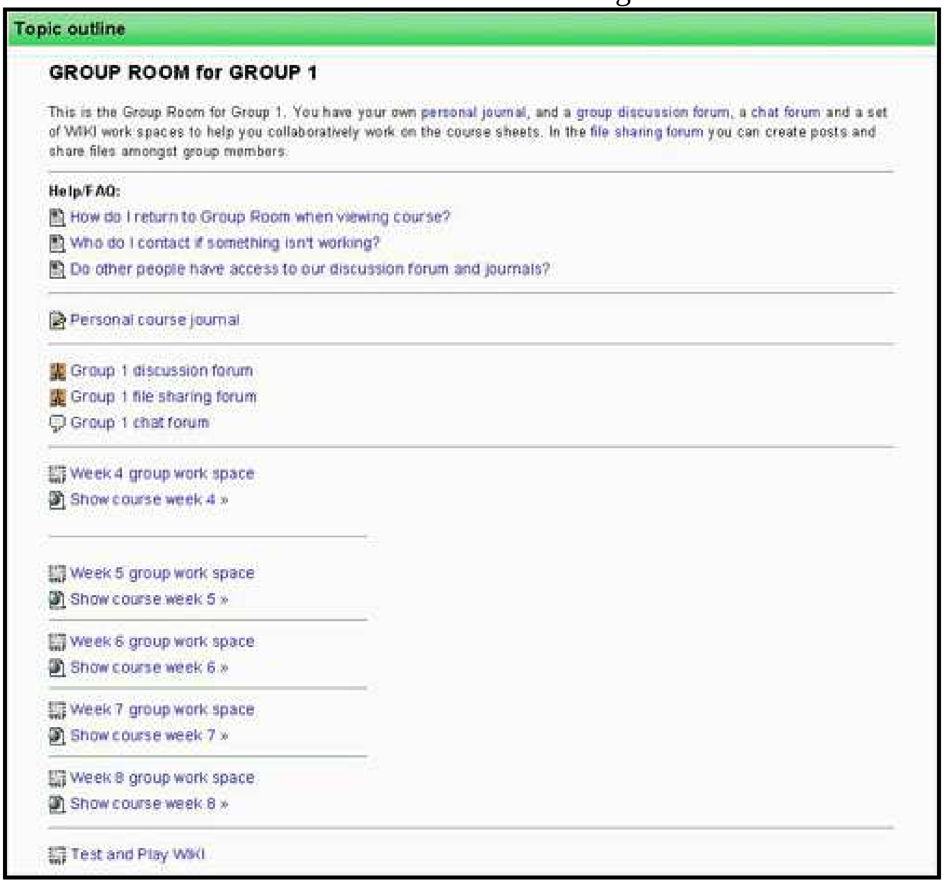

Figure 7: Group room in Moodle

Each room featured some help documents, a personal course journal, a chat, some forums and a WIKI for each week plus a link to the corresponding week in the main course room (because the group rooms were technically different courses). The WIKIs were made to allow the students to write in a shared online document, rather than sending back and forth documents as files. In general the WIKIs were only used the first weeks by the participants, which was probably due to WIKIs being a bit difficult when it comes to text-formatting, diagrams, tables and so on – but we wanted to give the participants a collaborative 'writing space' different from the exchange of documents. We had designed the group room with two different forums (a discussion and file sharing forum), as to separate the discussions from the sharing of documents – this we did from the anticipation that this would be easier to maintain for the students (it turned out, however, that all groups just used one of the forums for both purposes). In sum, the group rooms contained both asynchronous and synchronous tools for communication/collaboration and a *simulated* document management area (the file sharing forum), though as we shall now go into, these structures were not enacted by the students in the way we had expected (but this was in no way considered problematic by us and neither did we correct or intervene in the way they used the environment).

The pedagogical design in micro-level perspective

Initially the prime sites for interaction and discussion were the weekly forums but all throughout the course the weekly chat also functioned was a prime site for interaction. Apart from the four forums, there was a forum connected to each week of the course, which we chose as to minimise confusion by having too many topics and discussions going on in one forum alone. In the table below we have summarised in numbers some of the main sites of interaction – the forums and chats of the groups:

Forum	Discussion (student/teacher)	Replies (Students/teachers)
News	4 (0/4)	6 (2/4)
Course support	17 (1/16)	52 (32/20)
Technical support	10 (4/6)	23 (8/15)
Social forum	7 (3/4)	17 (12/5)
	38 (8/30)	98 (44/44)
Week 1	3 (1/2)	89 (63/26)
Week 2	2 (1/1)	29 (22/7)
Week 3	1 (0/1)	17 (8/9)
Week 4	2 (1/1)	5 (2/3)
Week 5	1 (0/1)	11 (5/6)
	9 (3/6)	151 (100/51)
Group 1 (File sharing)	18 (11/7)	76 (70/6)
Group 2 (File Sharing)	19 (12/7)	75 (73/2)
Group 3 (File Sharing)	26 (18/8)	196 (189/7)
	63 (41/22)	347 (332/15)
Chats initiated (due to system failures these numbers are uncertain)		
Group 1	5	
Group 2	7	
Group 3	11	

Table 2: Summary of interaction – number of discussion and replies initiated by either student or teacher

In Table 2 we have not incorporated the weekly forums from week 6 an onwards, because these forums were almost completely deserted. Occasionally there was a posting, but it only amounts to three or four postings in all the weeks. These rough numbers on the quantity of postings do not reveal anything about the quality of the postings. Neither do they reveal in detail how communicatively teachers and students positioned themselves in relation to the each other, or whether collaboration in the group rooms was organised around shared problem solving or reflected mostly an exchange of files. The relatively few postings in the social forum should not be interpreted as a lack of social interaction; rather it reflects that both students and teachers did not enact our initial reification of where social interaction should occur. Actually, much of the initial socialising was done through the forum in week one, where one topic was 'introducing yourself' (58 postings). Here students uploaded pictures of themselves, told about their hobbies and connected to others. The idea of a separate area for social interaction was, as said, to encourage and legitimise social interaction without students or teachers feeling that they would disturb or go 'off-topic' in a forum, with a discussion on the subject matter. But in practice neither students nor teachers ever distinguished between these 'domains', but often mixed them, without anybody ever meta-communicating on this or referring/moving the discussion to another 'more suitable forum'.

If we were to analyse these issues in detail we would have to use e.g. Social Network Analysis and content analysis coupled with other qualitative measures (Lally, 2002). This enterprise would require a full paper in itself and would not sufficiently address the aim of this article. It should, however, be mentioned that the students positioned themselves very differently to the teachers and the other participants, this was especially clear in the first weeks of the course, where in the first week a forum topic was 'introducing yourself'. In this topic people chose very different ways of addressing teachers and others – from informal (Hi all, Hellow, Hello, My name is, Hi everybody) to more formal approaches directed mainly at the teachers (Respected Sir, Dear Dr., Mr.).

What the numbers do clearly show, is a tendency towards the role of the teachers becoming increasingly peripheral in relation to the work of the students. The weekly forums reflect more teacher presence, whereas the teachers are almost invisible in the group forums. Here it should be noted that the number of *discussions* initiated by teachers in the group rooms were the weekly feedback – so the teachers would add a topic in the students' forum such as 'feed back on week 8', but these were rarely followed up by the students. The reply-structure to the discussion also clearly shows that the students were the centres of interaction in the group rooms. We will not go into a detailed and thorough analysis of how students in the three different groups organised their work or discuss whether collaboration, shared discussion and mutual engagement were predominant in the learning processes (or if the students mostly distributed the task and problem solving between them). Discussions on both content, calculations, diagrams and their analyses were in the forums, but also the participants met in the chat rooms as to coordinate and discuss their work (the numbers of chat sessions are not necessarily correct – due to unknown system complications chats were sometime not logged properly). It seems that these two modes of communication (synchronous and asynchronous) supported each other very well and especially the chat seemed to be important to the students, as a tool to negotiate and work on the assignments, at least chat meetings were often called for in the group rooms by the participants.

There is no doubt that analyses of micro-level and the actual work processes and negotiations among students and teachers could have been elaborated further. However, our aim has merely been to highlight and sketch out some of the relations between the different levels of analysis and design considerations that go into the design of a course. Through the discussion of this level we have tried to give an impression of some more structural aspects of the interaction processes and that the relation between what has been designed for and how again this design is interpreted and enacted is a relational or transactional process; rather than a directly, inferable and causal process that streams or follows from the initial design.

Concluding remarks

As initially stated the GPI-course was an experiment, which aimed at identifying, whether online learning could be a way to overcome some tensions that exist within the field of training courses for full-time professionals. We highlighted the tensions of the workplaces being hesitant towards doing without their workers for longer periods of time to which the flexibility in both time and space offered by online learning could be a viable solution. However, we also highlighted that often e-learning within short-term training or certificate courses seem to be predominantly designed around self-study and individual skill-acquisition, rather than collaborative and problem based approaches that are favoured especially within higher education master programmes. We believe that the GPI-course represented an example, which builds more on the latter approach. However, as we have argued, training or certificate courses faces different structural conditions than do e.g. master programmes within higher education; or in the terms of the ERT there are other conditions for creating a productive learning environment. We have highlighted these conditions through applying the analytical framework of the ERT on the case and further we have argued that the notion of design of productive learning environments can be viewed at three different levels between which there is a dynamic relationship. We have argued that course creation is a unique, situated enterprise and that structural conditions in different ways afford or constrain pedagogical design at all the different levels of design. We have argued that PBL or POPP processes for many different reasons such as time constraints, modes of organisation, subject matter or the target audience cannot be directly applied in all settings or types of courses. Therefore, we have discussed the notion of PBL and differentiated or crystallised these concepts into dynamic continua between teacher and participant control of three different processes: the problem, the working processes and the solution. We have then argued that the GPI-course employed as its pedagogical design, what we have termed “Adapted PBL” and alternated between differently organised PBL-processes. We have tried to highlight some of the design issues at the different levels of analysis. Though we recognise that going into each level could constitute a separate paper we hope that we have provided a conceptual differentiation that may be useful both in theoretical discussion and in practical pedagogical design. Finally, we believe we have shown that training or certification courses for full-time professionals can indeed benefit from the experiences from more problem based and collaborative approaches than what seems to have been the case so far.

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