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Experimental E-Learning - Insights from the European Project PeTEX

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Abstract

This contribution presents a new e-learning scenario in which e-learning will be connected with live experiments in mechanical engineering for different manufacturing technologies. The live experiments will be remote-controlled and monitored by the learner within the physical-real laboratory of three European countries. We call this approach “experimental elearning”. The aim is to design a new networked and distributed learning opportunity for individual and cooperative learning including telemetric experimental set-up. With this kind of learning, technical and social structures will be connected with a strong support of Internet technologies and learning management systems.

Introduction

Teaching and learning are more and more enhanced by Internet-based technologies (Jahnke & Koch, 2009). According to Collins & Halverson (2009), authors of the book “Rethinking Education in the Age of Technology”, the net generation needs particularly online social networks with 'anytime, anywhere' access. Modern day learning systems are more flexible, adaptable to different existing levels of knowledge and learning strategies, but are usually controlled by the teacher as well. They often do not implement concepts that embed the whole learning process into the given curriculum and empower the students to manage their own learning. In this contribution, we present the PeTEX project. The aim of PeTEX is to create a distributed learning community and its learning processes of computer-supported students groups. Within the PeTEX project, a new e-learning community will be cultivated in which e-learning will be connected with Internet-supported remote, real-time live-experimentation in the field of mechanical engineering for different manufacturing technologies.

Case study

The Project PeTEX „Platform for Telemetric Experimentations and eLearning”, started in December 2008, finished within 2 years, designs an e-learning community to offer students opportunities to get in contact with different learners, to communicate and share knowledge about their studies. The extraordinary in this project is that the teaching and learning arrangements will involve interactive live experiments through a video based access into three European laboratories; for instance, in two laboratories, tensile tests for testing materials and will be conducted.

The distributed lifelong learning arrangements are called ‘Experimental E-Learning Scenario’. The physical-real laboratories exist in three European countries (University Dortmund, Germany; University of Palermo, Italy; Royal Institute of Technology, Stockholm, Sweden).

The experimental design and test set-ups support observation and measurement of data. The content consists of teaching and learning objects as well as semi-automatic feedback loops to support self-directed learning.

The challenge is to implement Internet-mediated real experimentations from almost every computer workstation, and to customize the didactical concepts to such an e-learning scenario. The positive outcomes will be among other things the improvement of learning conditions for lifelong learning, the acquisition of expertise in manufacturing technologies from different institutions in Europe and a better communication and competence of cooperation.

Background

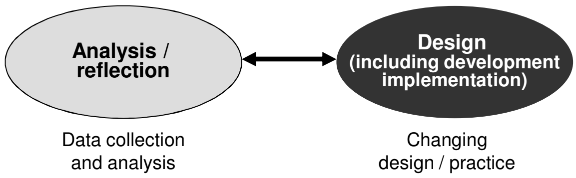
Referring to the “shift from teaching to learning” (Barr & Tagg 1995), teaching and learning are different things. It has to be supported differently. A new balance between teaching and learning are essential to support creativity and best learning effects. The learning-centered approaches promote a re-orchestration of teaching and learning arrangements. When we do so, learning has to be regarded from the viewpoint of the learners. The students should be in the middle of an e-Learning design, and should be designed from the students’ perspective.

For innovative universities it means that when reshaping blended and co-located learning we also have to analyze and design social processes, technical interactions, educational methods and cultural structures (“digital

didactics”, see Jahnke, 2009). Learning is a constructed (constructivism approach) that means: “learning is an active process of constructing rather than acquiring knowledge and instruction is a process of supporting that construction rather than communicating knowledge” (Duffy & Cunningham, 1996).
Back to our experimental learning approach in PeTEX, using Internet-connected real laboratories, the design of a socio-technical platform for distributed e-learning processes should focus learning outcomes, competency development of the students and educational objectives with the experimental learning centered inside of the e-learning scenario. The students should get the opportunity to connect the *situated application* and its transformation into others similar cases.
With regard to the mentioned e-learning scenario – embedding the possibility of live experimentation into the distributed e-learning scenario – this means following: The experimentation and the corresponding actual way of looking at a problem are moved to the center of the learning exercises (Schank, 2002). In addition, all the teaching tools, learning content as well as the learning process should be designed from this center.

Our method – the Design-Based Research approach

In recent years, the approach of Design-Based Research (DBR) has emerged (Reeves, Herrington & Oliver 2005). Its regular aim is the study of teaching and learning scenarios within school settings and “designing ways to better ensure that learning will happen in these settings” (Sandoval & Bell, 2004). The “Design Based Research Collective” understands research as a “Design-Based Endeavor”.
We extended the DBR for designing and studying a distributed learning community. According to DBR, researchers working together with educators and teachers seek to refine theories of community-building by designing, studying, and refining rich, theory-based innovations in realistic e-learning environments (Jahnke et al, 2009).
The innovation of DBR is the “systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories” (Wang & Hannafin, 2005, p. 6).
In other words, DBR consists of *several* phases of analysis (reflection) and design (interventions for improving a socio-technical system or community), which are alternated and interwoven (cycle of activities), see Figure.



The DBR is a qualitative paradigm and therefore well-suited for a long-term field study in which interviews and other forms of data collection (e.g., participant observations; written communication in online boards, interviews, talks with stakeholders, quantitative data) from a rather small number of cases are closely analyzed.

DBR in pratice: the e-learning-oriented walkthrough (eLOW)

DBR in practice means to have methods for data collection and analysis. From the domain of socio-technical systems (Whitworth & de Moor, 2009), we know that one success factor for cultivating socio-technical communities over time is a participation of future members as early as possible. Therefore, the Socio-Technical WalkThrough (STWT, Herrmann et al., 2004) is a sufficient method for applying the DBR.
We transformed the STWT for distributed E-Learning in higher education, and call it *eLearning-oriented Walkthrough* (eLOW). The eLOW method supports the communication process when developing a socio-technical e-Learning system. The main aspect of the eLOW is to do workshops – together with the target group – to design the context for their learning processes, communication and collaboration. In the workshops we support a group discussion – called Walkthrough – that is connected with the development of a graphical model. Each answer has to be visualized. The members walk through the learning processes while anticipating what they will do in the future. The walkthrough is guided by specific questions, for example, “what is an attractive e-

learning community? How does it look like?".

Since the STWT integrates activities of different stakeholders, the concepts and the plan for the distributed community mirror their different perspectives. Like Cherns (1987, p. 154) we assume that a socio-technical "design is an arena for conflict". The bringing together of different perspectives can lead to conflicts and problems which have to be dealt to "support congruence" (p. 158). With eLOW, we can handle those conflicts and find appropriate solutions. First evaluation results show that the DBR is very helpful for socio-technical designers as well as for the target group members and their needs since the DBR helps to understand the group for whom we are designing the learning processes.

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