Analyzing technology-enhanced knowledge practices in an engineering course

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Abstract: The role of educational technology on facilitating advancement of knowledge was investigated in a term project “Multimedia Product” in the Metropolia (former EVTEK) University of Applied Sciences. The purpose of the study was to investigate how the technology under investigation – Knowledge Practices Environment (KPE) – facilitates working collaboratively with shared knowledge objects. It appears that students used KPE mostly for managing and sharing project documentation; and that task was usually delegated to one team member. Students found that organizing items in the content view helped them to get an overview of the tasks, knowledge objects and their interrelationships. On the other hand, the flexibility of the KPE, especially the possibility for all team members to edit and change anything openly might also be a challenge; it requires systematic organization of materials. More research is needed before KPE’s potentials and pitfalls in shared knowledge advancement can be reliably assessed.

Introduction
New educational technology provides challenges but at the same time potentialities to develop practices of working in higher education. The emphasis on knowledge work in modern society requires new kinds of competencies also from students: knowledge workers should be able to collaboratively produce new knowledge and manage increasingly complex knowledge objects (Knorr Cetina, 2001; Moukkonen, Lakkala & Paavola, in press). At the same time, modern collaborative technology requires and enables novel practices of working with knowledge. This development presents requirements to collaborative technology in educational settings: it should provide students with affordances for creating new knowledge together.

The present study focuses on technology’s role on facilitating knowledge creation in a collaborative design process. A theoretical background is provided by the so-called knowledge-creation approach to learning (Paavola & Hakkarainen, 2005) which characterizes learning as a collaborative process of advancing and producing shared knowledge objects, like documents, practices, and product designs. This approach to learning is called ‘trialogical’ because it emphasizes the role of shared objects produced instead of concentrating on individuals’ learning (a monological approach) or just on interactions between people (a dialogical approach).

The collaborative technology under investigation, Knowledge Practices Environment (KPE), is developed in a 5-year EU-funded project Knowledge-Practices Laboratory (www.kp-lab.org), that aims at creating tools, theories and models for promoting innovative practices in education and workplaces. KPE has been specifically developed to provide tools for the joint development of knowledge objects as well as for planning, organizing and reflecting on related tasks (see Markkanen et al., 2008). KPE is a virtual environment where students are able to build shared working spaces (‘shared spaces’) for managing their projects; each shared space includes a set of basic, integrated tools and functionalities like wiki, note editor, commenting, chat, semantic tagging and semantic search – for working with the knowledge objects. The design of KPE builds on the ideas of Scardamalia & Bereiter (2003), implemented in the Knowledge Forum software to afford collaborative knowledge building.

KPE has features aimed at supporting collaborative working with knowledge objects: the contents of a shared working space can be viewed from different perspectives: In the content view, the user can work on the knowledge objects (files, tasks, web links, notes, wiki pages etc) and their relations (see Figures 1 and 2); the process view focuses on tasks, responsibilities and the temporal dimension of the project; and the community view lists participating users, their current presence and their activities. Various tools and functionalities are highly integrated in the basic views to enable versatile and the flexible connection, organization and reflection of all information related to the knowledge objects and processes. Furthermore, KPE enables object-bound and threaded commenting on all items in the content view (task items, files, web-links, notes).

The present paper is based on a pilot data collected in an engineering course aimed at learning collaborative design practices. The aim of the study is to investigate the role of the new technology in supporting collaborative work with knowledge objects. More specific research questions are: 1) How was KPE actually used by the engineering students? 2) What were the experienced benefit and pitfalls of the technology? 3) How was the content view used by the students to organize the knowledge objects?
Methods

Setting
The investigated course was a higher education course, “Multimedia Product”, conducted in the Metropolia (former EVTEK) University of Applied Sciences during spring 2008. The goal of the course was to learn collaborative design practices and project-based working methods in the context of designing multimedia products for real customers. Participants were 25 international students in seven teams.

Two design teams (team 1 and team 2) were investigated in more detail. Team 1 (music video team) consisted of four engineering students whose task was to create a music video for a Finnish rock music band. Team 2 (website team) consisted of four engineering students whose task was to build a dynamic and interactive website for a health organization in Ethiopia.

Data collection
The data collected from the course included the videotaped sessions of students using the KPE, database materials from all design teams (i.e. the content and process views), classroom observations and student questionnaires after the course. The student questionnaires focused on the usability of the KPE.

In addition, combined “stimulated recall” and interview sessions with the leader of two teams were videotaped after the course. Stimulated recall was conducted by having an interactive session with the student, lead by researchers, where the database content of his group’s virtual spaces are discussed and evaluated (Lyle, 2003). Two design teams’ content and process views were used as a “mirror” stimulus to the session. The focus of the stimulated recall sessions was on the students’ actual experiences of using the KPE tool.

Data analysis
Answers to questionnaires from all 25 students and the database content of all seven teams’ shared spaces were used for analyzing how the students, in general, used KPE in their design work and experienced its benefits and pitfalls. Two team leaders’ stimulated recall interviews and their database contents were used to examine, in more detail, how the affordances of the content view was used for organizing the shared knowledge objects.

Qualitative analysis was conducted to the combined stimulated recall and interview data, and student questionnaires by choosing sections from the students’ explanations that specifically described the usage and benefits or pitfalls of KPE in the team project. The database contents of two investigated teams’ shared working spaces in KPE were analyzed qualitatively to get an initial idea on how the students organize their shared spaces. The analysis was centered in the set-up and visual arrangement of the two teams’ content views.

Results

1) The usage of KPE
Engineering students used KPE mostly for managing and sharing project documentation and setting up schedules for their projects. Only one or two team members used the environment; teams tended to divide the labor so that the members responsible for project documentation were also responsible for managing the group’s shared working space. Therefore, students did not use KPE for collaboratively working with and elaborating on the knowledge objects. The possibility to attach comments on the knowledge objects in the content view was used by the teacher; she used it for commenting teams’ design documents and giving feedback to students work.

2) The experienced benefits and pitfalls of KPE
Engineering students reported several benefits of the KPE. It facilitated the sharing of documents because there was no need to transfer documents back and forth between the team members, computers and applications. KPE also facilitated version control because it was easier to share the correct version of the document. Another advantage was that the environment afforded having a visual overview of the documents, tasks and their relationships with each other.

Disadvantages were also mentioned. KPE became available late in the course and there were still many bugs and delays. One student opined that the content view can become messy if there are lots of items. The student hoped for a possibility to lock the position of content items to better manage the shared view.

3) Organizing knowledge objects in content view
Two teams’ usage of their shared space was analyzed in more detail. The Website team’s content view (see Figure 1) was spatially divided in two parts; the task items (white rectangles) and the links connecting task items were arranged on the right side of the view; the content items (black rectangles) representing project documentation were arranged on the left side of the view. Furthermore, the content items were hierarchically
arranged so that the project definition document was placed on the top, and documents created during the design process (mock-ups, testing plans, questionnaires) were placed underneath.

Similarly, the Music video team’s content view (see Figure 1, right) was spatially divided in two parts: most of the content items representing project definition, meeting memos, mock-ups and tests were placed on the right side of the view, and the task items (white rectangles) were arranged on the left side of the screen. The music video team arranged its content items around a wiki page, containing the documentation for music video project. Overall, the organization of the shared view in the Music video team appears more elaborate than that of the Website team: it has more items (i.e. knowledge objects and tasks), the structures are deeper and most of the items are linked together.

![Figure 1. Screenshots of the contents and organization the website team’s (left) and music video team’s (right) content views.](image)

**Discussion**

Contrary to expectations, students did not use KPE for collaboratively working with knowledge objects. Lack of genuine collaboration might be partly due to the fact that KPE became available late in the course, when students had already adopted other tools. Another, perhaps more likely, reason is that for genuine collaboration to emerge, technology needs to be coupled with pedagogical practices that direct students towards collaborative working practices (Bielaczyk, 2006). This conclusion is supported by the fact that student teams appeared to resort to rather strict division of labor when organizing their work, typical for project work in engineering area.

The possibility to flexibly organize and link materials in a team’s shared space appears to facilitate creating an overview of the items, tasks and their interrelationships. On the other hand, the possibility for all team members to flexibly edit and change anything might become a challenge, because it requires systematic organization of material. More research is needed before KPE’s potentials and pitfalls in shared knowledge advancement can be reliably assessed.

**References**


