Design Principles and Practices for the Knowledge-Practices Laboratory (KP-Lab) Project

Kai Hakkarainen[1], Liisa Ilomäki[1], Sami Paavola[1], Hanni Muukkonen[1], Hanna Toiviainen[2], Hannu Markkanen[3], Christoph Richter[4] and the KP-Lab Research and Development Community

[1] Centre for Research on Networked Learning and Knowledge Building, Department of Psychology, P.O. Box 9, FIN-00014 University of Helsinki, Finland
{Kai.Hakkarainen, Liisa.Ilomaki, Sami.Paavola, Hanni.Muukkonen}@Helsinki.Fi
[2] Center for Activity Theory and Developmental Work Research, Department of Education, P.O. Box 26, FIN-00014 University of Helsinki, Finland
Hanna.Toiviainen@Helsinki.Fi
[3] EVTEK University of Applied Sciences, Vanha Maantie 6, FIN-02650 Espoo, Finland
Hannu.Markkanen@Evtek.Fi
[4] FH OO Forschungs & Entwicklungs GmbH, A-4232 Hagenberg, Hauptstrasse 117, Austria
Christoph.Richter@Fh-hagenberg.At

Abstract. The poster introduces the design principles and practices for the Knowledge-Practices Laboratory (KP-Lab) project. KP-Lab is based on technological, theoretical, pedagogical, and social innovations aimed at facilitating innovative practices of working with knowledge, "knowledge practices", in education and workplaces. In order to be truly productive, collaborative technologies cannot fully be specified beforehand but need to co-evolve with social practices and be further modifiable according to the users' emerging needs and practices.

1. Introduction

Future challenges of European society require policy makers, educators, researchers, technology developers and teachers to devise ways to prepare learners to engage in intensive work focused on deliberate knowledge advancement [1], [4]. Knowledge work requires managing complex knowledge through dynamically evolving forms of collaborative teamwork and sustained knowledge sharing. Innovation and knowledge creation activities are becoming commonplace and the most important sources of new material and intellectual wealth. In terms of the educational practices, a challenge for the knowledge society is that students, teachers, professionals, designers, and researchers take part not only in knowledge acquisition or social participation processes, but also knowledge creation focusing around shared objects of activity. The *Knowledge-Practice Laboratory* (KP-Lab) project will focus on creating the KP-Lab learning system aimed at facilitating innovative practices of working with knowledge ("knowledge practices") in education and workplaces. An essential starting point for this work is organized by developing *design principles* for the

project. These design principles will be implemented throughout the project in a co-evolutionary process in order to generate four types of innovation (theoretical, pedagogical, social, and technological innovation).

KP-Lab is a five-year (2006-2010) integrated project concerning the Technology-Enhanced Learning (Information Society Technologies) program of the European Community. University of Helsinki and EVTEK University of Applied Sciences coordinate the project, involving 22 organizations from 14 European countries.

2.   Theoretical Innovation

As a theoretical innovation, the KP-Lab represents an approach to human cognition which assists going beyond acquisition (monological, within mind approach) and participation (dialogical, interactive approach) metaphors of learning to consider also knowledge-creation processes, and related tools and practices critical for answering the challenges of the emerging innovation society. According to the knowledge-creation approach, cognition is seen to develop through collaborative work in systematically developing shared, conceptual or material artefacts [5], [6]. These kinds of processes are considered to be "trialogical" in nature in terms of the participants activities mediated through jointly developed knowledge artefacts and practices. The KP-Lab project will develop and explicate the theoretical foundations of the knowledge-creation ("trialogical") approach. This work is organized around developing *design principles* for the project; these design principles are general and represent theoretical guidelines, not specific pedagogical approaches or models.

Trialogical approach provides a starting point for the design principles shaping the KP-Lab project. The design principles are as follows: 1) *Focus on "trialogical" activity*. KP-Lab courses and tools facilitate work and learning around shared objects of activity (such as articles, concepts, products, or social practices), not just individual, cognitive processing nor social interaction as such. 2) *Focus on interactions between personal and social levels*. The aim is to develop tools, models and spaces for combining developed social practices with room for individual initiatives for developing shared objects. 3) *Providing flexible, mediating tools for trialogical activities*. One basic principle of KP-Lab is to concentrate on mediating tools for fostering trialogical activities. Intelligent human activity is seen to be located as much in these tools and practices as in individual minds. 4) *Fostering long-term processes of knowledge advancement*. Real knowledge advancement and knowledge creation is a long-term process in which progress takes place through series of inquiry cycles. The challenge is to design an environment that supports such long-term work besides individual courses or projects. 5) *Development through transformation and reflection between various forms of knowledge*. Within models of innovative knowledge communities new ideas and practices are generated through interaction between various forms of knowledge and practices. KP-Lab provides tools and practices for such transformations. 6) *Eliciting individual and collective agencies*. One aim of KP-Lab is to engage students themselves in planning, monitoring, and evaluating their collective and individual activities in order to develop higher-order competencies and knowledge practices. 7) *Cross-fertilization of knowledge practices*.

KP-Lab courses and projects shall be designed to elicit cross-fertilization of knowledge practices across multiple epistemic communities, like between polytechnics and universities, and between educational institutions and professional communities.

3. Pedagogical Innovation

Innovative knowledge practices will be facilitated across multiple domains of knowledge by organizing a series of technology-mediated KP-Lab courses in which students solve complex problems for real customers (i.e., enterprises, research communities or public organizations) and pursue field training in professional communities in several European universities, organizations and institutions. This pedagogy requires teachers to function more like managers of knowledge-intensive companies than simple distributors of knowledge. Student teams supported by tools of ubiquitous computing are asked to engage in either concrete or virtual knowledge-creating activities that involve breaking boundaries of their educational institutions and building novel connections with professional communities and corresponding knowledge practices.

An example about is a course for students of educational psychology. Already now students participate in a long-term field-training, which is connected closely with other studies. It aims to cultivate teacher students' comprehensive understanding about children's learning and development. In a future scenario, supported by tools developed in KP-Lab, students will have mobile tools to provide them access to the training program's database and university databases. Students will keep a mobile log of their learning experiences by making notes, MP3 recordings, by photographing, or by videotaping situations. They will also be asked daily/weekly to reflect on their learning, the critical incidences that they think have influenced their work and participation. These notes will cumulate to shared database and will contribute to making of learning portfolios, to conceptualization of teaching practices, and addressing theories of learning and teaching by these actual examples of activities. This will enable the teachers to gain understanding of the classroom experiences the students have.

Another example is an existing course for studying Engineering for Computer-Based Learning, for which students have work in different organizations and companies, ranging from universities and non-profit organizations, to industrial and business organizations, using computer-based systems for internal training as well as knowledge-management. The overall assignment is to explore the professional practice related to computer-based learning and to identify challenges and trends. Their task is to explicitly collect and discuss knowledge and experiences gained within their internships. Students will have an e-platform, which supports the mutual exchange of knowledge and experience, allows assistance and cooperation for problem solutions, and guides reflection processes. These digital tools and practices connected to the tools will be developed in KP-Lab.

4. Social Innovation

KP-Lab's design principles emerge from two decades of educational and socio-cognitive research concerning technology-enhanced learning. These investigations indicate that technology-enhanced learning transforms educational practices only through transformed social practices. In order to deal with this challenge, KP-Lab puts reflective social practices around shared knowledge artefacts into the core of learning. The challenge is to design technical tools and solutions that encourage the users to engage in thinking and collective reflection, so as to promote organizational intelligence and deliberate transformation of knowledge practices within the social matrix of knowledge creation. Participants of KP-Lab, whether they are students of higher education or professionals, will be engaged to jointly reflect on and make visible their knowledge practices in order to set these up as objects of deliberate change and improvement.
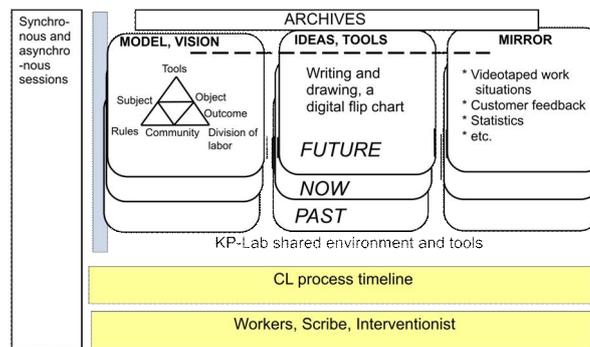

Fig. 1. Change Laboratory: A Shared Space tool

One of the concrete examples about social innovations is "change-laboratory" [2], [3]. Partners in KP-Lab project will design virtual tools that allow participants, whether they are students, teachers, or professionals, to master, together, the challenges of the current activity and to work deliberately for innovative redesign of their collective activities. Change Laboratory® is an already existing method for developing work practices by the practitioners together with the interventionist-researchers. The idea is to bring work redesign closer to the daily shop floor practice while still keeping it analytical, which means dialectics of close embeddedness in and reflective distance from work. The method supports expansive learning, which involves major transformations of the work activity within and across work units and organizations. The first field tests of the change-laboratory tools will be conducted at Pöyry Oy, a Finnish company which provides engineering and project implementation services to the pulp and paper industry worldwide.

Change Laboratory tool (see Figure 1.) describes the basic elements of a change laboratory meeting. The tool supports sharing the ideas and discussion both synchronously and asynchronously. The participants (workers, scribe and interventionist) have "digital flip charts" on which they mirror the working processes

of past, now and future. The model and vision are tools to compare the situations to an ideal solution and a theoretical model.

5. Technological Innovation

KP-Lab will be a modular, flexible and extensible system consisting of a cluster of inter-operable applications (i.e., shared collaborative spaces, semantic web knowledge services, communication platform, ubiquitous user agents, inter-institutional access) which organize participants' collaborative activity around shared knowledge artefacts.

Ubiquitous user agents provide end-users with inter-institutional access to KP-Lab services such as shared collaborative working spaces, semantic web knowledge repository, and real-time multimedia communication for individuals and groups. The KP-Lab system will be designed according to openness, modularity, and compatibility with the Semantic Web technology. The KP-Lab intends to research and develop a generic middleware supporting flexible knowledge management services for learning applications. It will be made available as an open-source software also for end-user applications beyond the present project. In order to be truly productive, collaborative technologies cannot fully be specified beforehand but need to *co-evolve* with social practices and be further modifiable according to the users' emerging needs and practical innovations.

6. The Co-evolutionary Design

To achieve the challenging goals the collaboration between technology-oriented and pedagogy-oriented partners is essential. In KP-Lab this collaboration is organized in a special co-evolutionary process, as Figure 2 presents.
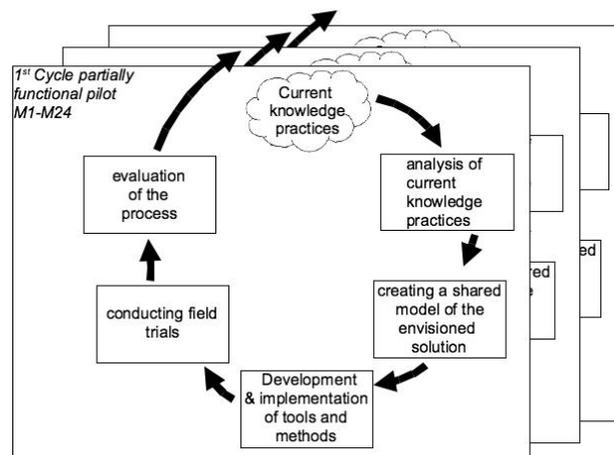

Fig. 2. Co-evolutionary design cycle during the first two years

The co-evolutionary design is conducted in design teams, which consist of pedagogical and technological partners. These teams concentrate on certain pedagogical contexts and themes, for which they create, during the project's lifespan, several digital tools and practices for using the tools. In the beginning of the project, the design themes are created around e.g. the following themes: Boundary crossing, Tacit knowledge and Transforming practices; the themes reflect the theoretical framework of the project. Design teams are flexible, which means that they will be used only if they are needed and as long as they are needed. Due to the complexity of the pedagogical needs a combination of design methods, e.g., participatory and scenario-based will be adapted. In the co-evolutionary design, the teams use various kinds of scenarios, user cases and stories, use cases and mock-ups.

An example about the co-evolutionary design is the list of the first preliminary requirements for "trialogical tools" with easy usability:

- tools are integrated, to eliminate or minimize work in different systems
- teachers or organizers of the course can decide which tools to provide for the use of participants.
- scaffolding may be focused on different parts or activities or use of tools. It is important that teachers and mentors can have tools in their use for building scaffolds during the course or collaboration.
- versatile tools to help users(teachers/students/experts) to build an overview or analyse the produced knowledge or activities: summaries or visualisations of actions, various ways to go through, collect, rearrange or link etc. the knowledge.

The KP-Lab is intended to be a "laboratory" in terms of providing a testbed for developing transformative knowledge practices and technology for educational institutions and workplaces. The project will be carried out through several stages that involve iterative technology development and empirical testing and piloting of KP-Lab's models, technologies and practices.

References

1. Bereiter, C. (2002). *Education and Mind in the Knowledge Age*. Hillsdale, NJ: Erlbaum.
2. Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki:Orienta-Konsultit.
   http://lchc.uscd.edu/MCA/Paper/Engestrom/expanding/toc.htm
3. Engeström, Y., Virkkunen, J., Helle, M., Pihlaja, J., & Poikela, R. (1996). The change laboratory as a tool for transforming work. *Life Long Learning in Europe, 2*, 10-17.
4. Hakkarainen, K., Palonen, T., Paavola, S., & Lehtinen, E. (2004). *Communities of networked expertise: Professional and educational perspectives*. Amsterdam: Elsevier.
5. Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of Innovative Knowledge Communities and Three Metaphors of Learning. *Review of Educational Research 74*(4), 557-576.
6. Paavola, S., & Hakkarainen, K. (2005). The knowledge creation metaphor – An emergent epistemological approach to learning. *Science & Education, 14*, 537-557.
7. Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal Education in a Knowledge Society* (pp. 67-98). Chicago: Open Court.