Collaborative Environment Aimed to Promote Knowledge Creation

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Abstract – The paper presents the Knowledge Practices System, a virtual environment aimed to promote collaborative knowledge creation and continuous work around shared objects. The environment makes use of recent Web 2.0 and Semantic Web applications. It is designed to provide specific affordances for joint development of shared objects as well as organizing related tasks and user networks and interactions. The main focus in the present paper is on describing basic functionalities of the system and integrated tools dedicated to support innovative knowledge practices in educational and workplace settings.

Keywords – **Collaborative learning, Virtual environment.**

I. INTRODUCTION

A fundamental challenge for modern society is to organize work with knowledge in a way that supports the shared efforts of innovation, that is, collaborative efforts for developing novel objects like commercial products, scientific theories, and new forms of working or technology.

A challenge for education is to prepare learners for the emergent knowledge society through appropriate pedagogical practices that promote competencies for sharing, creating and working with knowledge and knowledge artifacts in an innovative way.

The current approaches of working with knowledge in educational and workplace settings are still focused on individuals' skills and knowledge structures (knowledge acquisition) on the one hand, or on social and cultural interaction (participation) on the other hand. The rapidly growing body of scientific and professional knowledge as well as dramatically changing work-practices call for new pedagogical approaches suitable to prepare students but also practitioners to actively participate in a knowledge-based society. Towards this end there is a need for new methods but also tools which support both students as well as practitioners in sustained efforts of innovation and knowledge creation and social participation around shared objects of activity.

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. To answer this challenge we present the KP-Lab System as an innovative collaborative environment aimed to promote knowledge creation and continuous work around shared artifacts. The KP-Lab System is currently under development in the Knowledge-Practices Laboratory (KP-Lab) project [1] funded by the European Commission.

II. THE KNOWLEDGE PRACTICES ENVIRONMENT

Knowledge Practices Environment (KPE) is designed to provide specific affordances for joint development of concrete objects as well as for planning, organizing and reflecting on related tasks and user networks [2]. KPE is a virtual environment that includes a set of basic, integrated tools (e.g., working spaces with real-time and history-based awareness, wiki, note editor, commenting, chat, semantic tagging and semantic search) for working with the shared knowledge objects.

KPE enables viewing of knowledge objects and their relations from several perspectives. Three basic perspectives are *content*, *process* and *community* views. Various tools and functionalities are highly integrated in the basic views to enable versatile and flexible connection, organization and reflection on all information related to the knowledge objects, processes and people concerned. Below, the basic functionalities of KPE that provide affordances for collaborative knowledge creation practices are described.

A. Work with knowledge Artefacts

In KPE, user groups can create 'Shared spaces' through which various knowledge artifacts can be shared and co-constructed. But instead of providing only a space to store and manage vast number of documents, KPE enables the users to organize knowledge objects (represented by graphical icons) through flexible, visual representations. A central view in KPE for working on knowledge artifacts is the *Content view* that allows free visual arrangement and linking of its content (Fig. 1).

In addition to a possibility to upload files in a Content view, some specific tools are built in or integrated in KPE to support easy production of texts and sketches as well as co-editing and comparison of text versions to facilitate idea exchanging when working on shared knowledge objects. [3].

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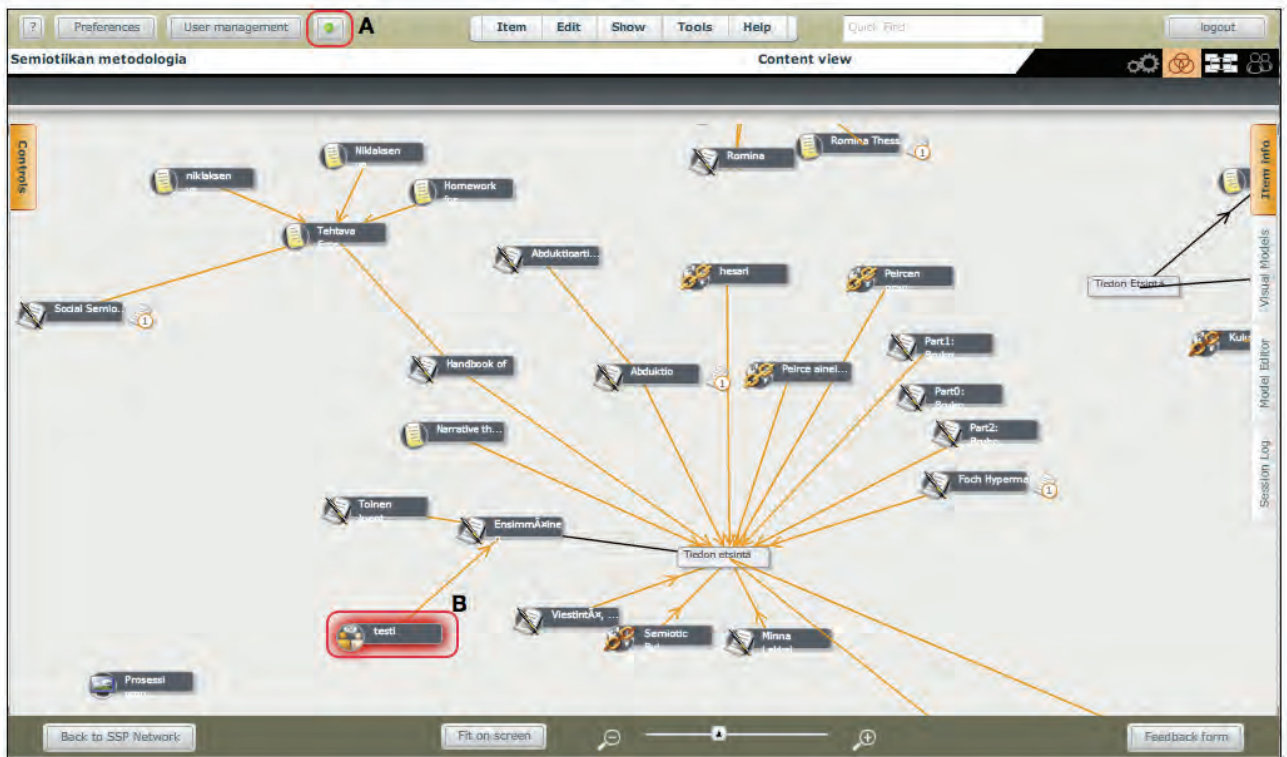
Fig.1 Visual arrangement of content items in a content view from a course held in Helsinki University

The *Note editor* supports quick brainstorming and production of ideas together and allows viewing, editing, versioning, comparing and printing of shared documents in flexible manner. With Note editor, users can directly write their ideas and thoughts as content items in a shared space, without the labor of creating and uploading an external text file. All members of a space can open and edit the created notes and view their previous versions. Furthermore, users can open many notes simultaneously for comparison and integration, and link notes to other content items in the Content view as shown in Fig. 2.

The Content view also includes a Sketch pad tool that is analogous to Note editor, but for creating knowledge through drawing instead of writing. The Sketch pad allows users to collaboratively view, create, compare and co-edit sketches synchronously or asynchronously in a collaborative manner. It provides the functionality for drawing simple graphics (squares, circles, triangles, lines, arrows, free drawing with colors and with simple editing commands) with texts added in between for sketching in white-boarding manner (Fig. 3). The Sketch pad enables easy in-context drawing to support brainstorming and externalizing ideas that are sometimes hard to explicate by only using verbal means. The drawn images can be used for semantic grouping of the rest of the material.

In addition, KPE affords groups the ability to write collaboratively in an integrated wiki. A wiki document can be created as a content item in the Content item view, which offers the possibility to access the same wiki document from a shared space. The progress and changes made to the document are visible to all group members.
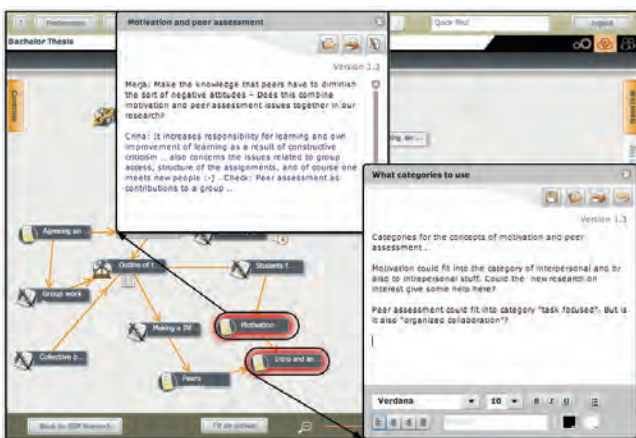

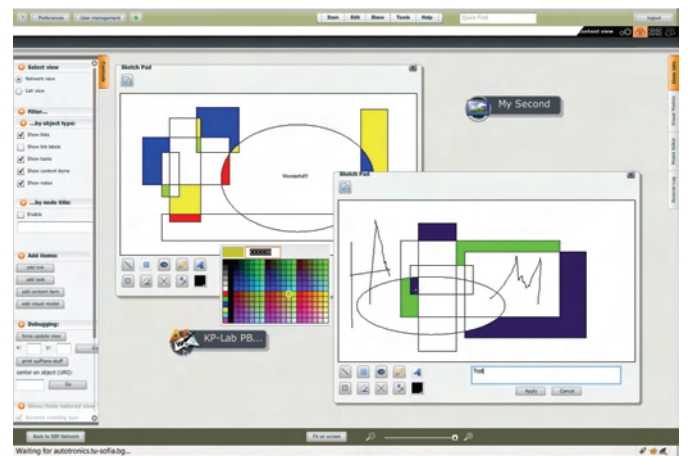Fig. 2 Note editor GUI with two notes opened simultaneously

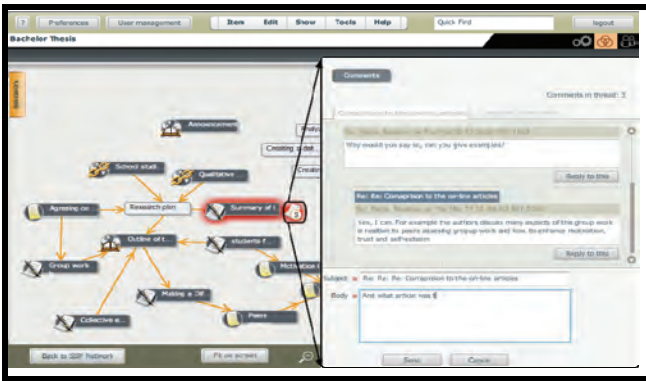Fig. 3 Sketch pad GUI with opened sketches for editing

Fig. 4 Illustration of content-bound commenting

B. "Object-bound" interaction around knowledge artefacts

KPE answers the need to have individual contributions attached in collaborative work that is organized around shared knowledge objects embedded and embodied in a shared space. In the Content view, object-oriented collaboration is emphasized by content-bound commenting functionality that allows asynchronous, threaded discussions attached directly to knowledge objects (see Fig.4). Similarly, object-bound chat enables synchronous interchange attached directly in the content items at hand. Chat log is saved and linked to the targeted content item, therefore keeping the log attached to its object for possible re-use and continuation.

C. Process planning

In addition to content items, in KPE, users can explicitly define, modify and arrange *task items* to fit their process and domain, including, e.g., descriptors of title, responsible users, start and end dates, and status. In the Content view, task items can be presented, linked and arranged in the same visual representation together with the content items, which provides users with a holistic view of their knowledge creation processes, without separating tasks from contents (see the left screen shot in Fig. 6). The same tasks that are displayed in the Content view with their relations to content items can be

Fig. 6 Right: Spatial arrangement of knowledge artefacts in the Content view including content items (black), tasks (grey) and labeled relations. Left: The Process view presenting the same tasks in a Gantt chart.
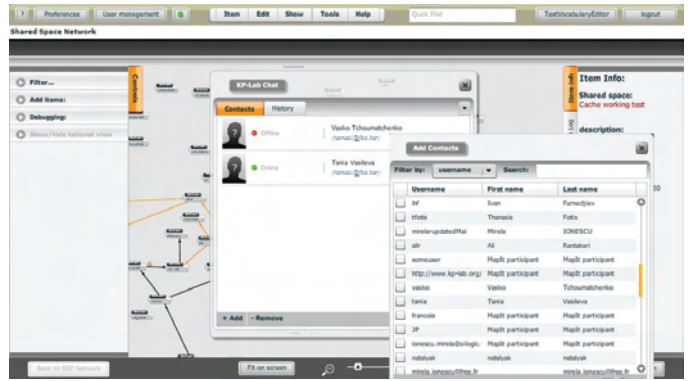

Fig.5. Chat tool integrated in KPE user interface

viewed in *Process view*, presently in the form of a Gantt chart (see the right screen shot in Fig. 6).

The Process view enables users to plan tasks and processes in a chronological manner as well as to monitor how the required tasks have been accomplished. For instance, in courses that teach collaborative design practices, where real design projects are executed, it is highly important (for flexible adjustment of the process) that participants be able to monitor the progression of the project and modify the tasks. Again, interdependencies and mutual connections between the tasks defined in the Process view are in turn automatically converted by the system into graphical constructions representing these connections in the Content view.

D. Social relations around shared objects and processes

In KPE, social mediation is envisioned in functionalities that support users in maintaining their contacts and keeping up with changing information about other participants, as well as their relations to the shared processes and content items. Social mediation provided by the tools allows users to lean on each others' competencies, expertise and experience and help them align their thoughts and actions with those of others.

KPE offers means to keep in contact with others, such are asynchronous commenting possibilities, or general chat (Fig.5) and context bound chat to enable synchronous discussions. Chat tool [4] aims to facilitate networking and community building through contextualized synchronous user communications when working on shared objects. Awareness features include clues and notifications of participants' status or past and present activities

E. Collaborative Semantic Modelling

One aspect of KPE that goes beyond current learning environments is the use of metadata and semantic features to support the usage and integration of knowledge artifacts in various ways. Tags and tag vocabularies can be created and edited by participants, or can be taken from ready-made vocabularies.

The KP-Lab system is ontology driven and provides a platform to develop advanced semantic tools for collaborative learning. The first prototypes of a semantic multimedia
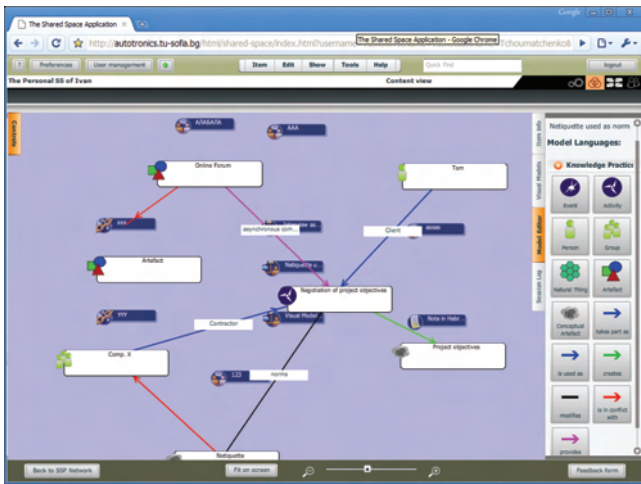
Fig. 7 Graphic User Interface of the Visual Model Editor

Fig.8. Comparing Visual Models in Visual Model Editor

annotation tool and an editor for visual models and visual modeling languages are released for field trials.

The Visual Modeling Language Editor [5] provides an extension to the basic functionalities offered by the KP-Environment and allows users to create, share, use, and update visual models as well as the underlying visual modelling languages as another type of shared artefacts.

The Visual Modeling Language Editor consists of two core components: the Visual Model Editor (VME), which allows users to create, compare and update diverse visual models and the Visual Modelling Language Editor (VMLE), which allows user to define and revise the underlying modelling languages and hence to specify the semantics of the models. Moreover the VM(L)E environment supports semantics at the Visual Model (VM) level, so that a model can be described and evolve as any other shared knowledge artifact. The semantics are accessible to the user by means of the respective visual modelling languages.

Fig. 7 depicts the user interface of the KPE Visual Model Editor. The Model Editor tab contains a library of the visual modeling language elements. Fig.8 illustrates VME ability to compare visual models. The direct integration into the KPE allows for an easy transition between modeling and other collaborative activities.

All KP-Lab tools are based on a foundational data model that provides common semantics for the tools and platform services. It is extended by the tool ontologies in order to describe the more specific semantics required.

III. CONCLUSION

The paper presents the KP-Lab System, a web-based flexible and extensible environment with a cluster of interoperable applications to foster collaborative knowledge creation and continuous work around shared objects. The system provides a coherent set of tools in order to initiate and organize collaborative processes, to support asynchronous and synchronous communication among participants, and to create, work on, share, and organize documents and artifacts collectively.
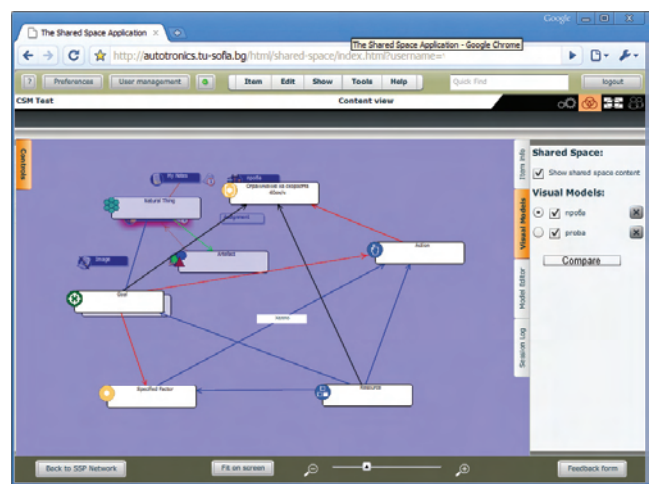
KP-Lab system is aimed to support both students as well as practitioners in their working and learning activities. The prototype and set of tools described in the paper are currently in use and under evaluation by several academic and professional partners throughout Europe and show promising results. Especially KPE flexibility, generic structure and integration of different tools for use, without loosing the semantics and metadata of the shared object under work, make it applicable to a broad range of pedagogical and professional scenarios.

REFERENCES

[1] The KP-Lab website. ICT-27490: Knowledge Practices Laboratory (KP-Lab), Available:www.kp-lab.org/

[2] Markkanen, H., Holi, M., Benmergui, L., Bauters, M., & Richter, C. The Knowledge Practices Environment: a Virtual Environment for Collaborative Knowledge Creation and Work around Shared Artifacts. In J.Luca & E.R. Weippl (Eds.) Proceedings of ED-Media 2008, Vienna 2008, pp. 5035-5040.

[3] Vasileva, T., I. Furnadzhiev, V. Tchoumatchenko, Lakkala, M., Bauters M., Tools Facilitating Idea Generation in Knowledge Practices Environment, Proceedings of ICEST 2009,Veliko Tarnovo 2009, Bulgaria, v.2, pp. 421-444

[4] Furnadzhiev I., V. Tchoumatchenko, T.Vasileva, M.Lakkala & M. Bauters, Tools For Synchronous Communications in Collaborative Knowledge Practices Environment (KPE), In A.Mendez-Vilas, A. Soprano Martin, J. Mesa Gonalez (Eds) Research, Reflections and Innovations in Integrating ICT in Education, vol. 1, 2009 pp. 588-592

[5] Tchoumatchenko V., T. Vasileva, C. Richter, H. Allert ,Visual Model Editor Design and Implementation, IADIS International Conference on Cognition and Exploratory learning in Digital Age (CELDA 2009), Rome, Italy, 2009, pp. 307-310