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**Knowledge Practices Laboratory**

Integrated Project

Information Society Technologies

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**Executive summary**

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| The present deliverable provides a revised version of the KP-Lab's research strategy. After the third review we closed all research cases and started four new, more extensive cases. In this revised Research Strategy we explain the research focuses in the four research cases for the coming period, and how they are connected to the advancements in the trialogical theory, dissemination, and in the use of KPE functionalities.  This revised version of the research strategy includes:  In section 1 and 2 an updated presentation of the four cases. The fourth case (section 2.4) details a workplace study. All case descriptions specify the indicative number of students, teachers, and other professionals that will be involved, specification of the pedagogical model that will be employed in the case, the main learning activities as motivated by the model, as well as information about how the case studies contribute to the improvement/validation of the pedagogical model.  In section 3, Table 3 summarized the time of introduction of KPE tools and functionalities in the four research cases.  Section 5 further details how the Visual Analyzer and the Knowledge Evolution Analysis tools are expected to exploit the underlying semantic layer.  In section 6, the forthcoming analysis of all cases conducted in the KP-Lab project is introduced in the frame of the project research and dissemination. |

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# Introduction

The KP-Lab project is now entering a crucial and at the same time exciting phase in the research. We can now put the trialogical approach and KPE to real test when KPE is developed and stable enough to be used in an integrated way in authentic and complex pedagogical settings. There is now accumulated understanding on the pedagogical practices supporting trialogical processes, and on those challenges which must be focused on in the pedagogical settings.

Within the KP-Lab project much research has been finalized and terminated, especially concerning workplace studies and teacher training, and on the use of many tools developed in the project (ASDT, CASS, Map-It, SMAT). The results of this research will be disseminated to a wider audience, at least partially, through dissemination.

The pedagogical research will be organized within four cases focusing on key features of the trialogical approach and on the use of KPE and semantic services. The cases have been chosen to have sufficient complementarity and overlap with each other (to ensure integration on results) but with different emphases; one case focuses mostly on teacher practices, and on student agency, another more on types of mediation supporting trialogical processes as well as on the external stakeholders, the third one on increased understanding by students in relation to object oriented inquiry, and the fourth on workplace practices of producing document management solutions and practices for distributed work settings. We expect to learn about how teachers and mentors can support and enhance trialogical processes and practices, how to reflect and monitor trialogical processes (as users and as researchers), how to model trialogical practices, and how KPE and especially semantic services can support these processes.

The three higher education courses represent ambitious courses where the aim is to provide concrete means to change existing knowledge practices of the participants (students, and teachers) to include more elements of modern knowledge work, as exemplified by the fourth case. It means new kinds of knowledge building practices where the work is organized not just on shared knowledge artefacts but also on organizing the whole process accordingly and being able to monitor and reflect these activities. All the courses have an element of inquiry but not in the sense of traditional “inquiry learning”, but by combining elements of inquiry to trialogical processes with shared objects and project-work called “object-oriented inquiry” here (see a comparison between different learning approaches from the point of view of the trialogical approach: Deliverable 3.3).

All the cases will have interventions testing functionalities of KPE (with an emphasis on semantic support) by the participants as support in their trialogical processes. One focus is on teachers’ perspective to provide support for trialogical processes, and “mechanisms” and processes advancing collaborative knowledge creation around shared objects (i.e. trialogical learning). Second focus is on student perspective learning to engage, monitor and reflect collaborative knowledge creation. A third focus is on the ways how the KPE and the trialogical approach may support professionals in collaborative knowledge creation. The main outcomes shall be research-based and refined guidelines, principles, and models to support the trialogical approach (if something seems to work or not) in such a format that the results also can be presented outside the academic community to teachers, policy makers, and users in general.

The *KP-Lab vision* (presented e.g. in DoW2.1, Part A, p. 4) is still valid in presenting the main aims of the KP-Lab. According to it, the project:

*“aims at understanding how people collaboratively, in long-term processes, develop novel epistemic things and transform their knowledge practices, and how students in higher education do the same by cross-fertilizing professional and educational practices and solve complex, authentic problems with the help of innovative knowledge practices and educational technology. The modern information and communication technology not only facilitates knowledge creation around shared objects but also puts forward the need to develop this kind of an approach about trialogical learning.”*

In this document we will first present four research cases in detail, present their contribution to the trialogical approach, summarize important methodological openings in the project, present shortly analytic tools based on semantic services, and lastly, the impact of the KP-Lab research and dissemination.

# Empirical research – the new case studies

The higher education sector could be seen as a conservative sector with several constrains when it comes to trying out new pedagogical approaches and as an environment for innovation. In the three higher education research cases, KPE will be used in combination with tools that the higher education institution use to enhance learning in the knowledge domains involved. The cases focus on authentic tasks, and the knowledge structure or the involved disciplines are means and resources in the student’s inquiry practices. This type of open-ended inquiry involves the students and teachers in very complex problem-solving in order to develop novel solutions and to learn and teach advanced skills of modern knowledge work. The fourth case with its two projects will demonstrate actual challenges and practices at workplaces and enable comparisons between educational and workplace settings. Altogether, these ambitions make the pedagogical approach of the KP-Lab project novel compared to the predominant practices in the higher education sector. This contributes, in particular, to understand learning and working as collaborative knowledge creation, increased ownership, learning scaffolded by different mediational means to improve agency, and processes where activities in different institutions and groups influence each other.

We describe four empirical cases where we will study how to enhance trialogical knowledge practices (see Table 1). The focus of this work is to analyse, compare and contrast across the cases how students and teachers organize their work around shared knowledge artefacts and practices, use KPE, the semantic services, and the analytic tools.

In *Case 1*, where UU and UiO lead the work, the activity investigates changes in teachers’ coaching practices supporting productive interactions supporting trialogical work in students’ activities.

*Case 2*, where UH and Metropolia lead the work, is an iteration using KPE compared to a previous study where KPE was not used, investigates support for enhancing trialogical processes, and analyses institutional issues in a course where cross-fertilization of knowledge practices in multi-institutional networks is strongly emphasized.

*Case 3*, where FHOÖ and KI lead the work, investigates ways of enhancing open ended inquiry in trialogical activities in design projects by using KPE and Visual Model Language Editor.

*Case 4*, where Pöyry, UH and KI lead the work, investigates whether and how the KPE and design of working practices guided by the trialogical approach can support professionals in collaborative object-oriented inquiry.

**Table 1**. An overview of the cases.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Case** | **Partners** | **Timeframe** | **Research foci and interventions** | **Research questions** |
| Case 1: Trialogical work in higher education; creation and use of knowledge objects in knowledge creation practices | UU and UiO | Data-collection in 2 successive phases September 2009 till July 2010 | **Teacher intervention** using object-oriented collaborative inquiry;  **Student intervention:** collaborative creation of knowledge object using technological support;  **Transformation of practices** | 1. To which extent does our approach for the collaborative creation and use of knowledge object, supported by KPE functionalities, foster a process of transformation in teachers’ practice?  2. To which extent do these changed coaching practices afford students’ collaborative creation and use of knowledge objects?  3. To which extent does the collaborative creation and use of knowledge objects, supported by KPE functionalities, produce productive interactions in students’ learning activities? |
| Case 2: Knowledge creation practices in customer projects in higher education | UH and Metropolia | Data collection in 2 courses from September 2009 to June 2010. | **Student intervention** with tools and TI model;  **Teacher intervention** with tools and pedagogical design;  **Cross-fertilization** in multi-institutional networks | 1. What is the relationship between the trialogical inquiry indicators and the quality of the outcomes?  2. To which extent do the semantic functionalities and Analytic tools support the reflection of the process?  3. What kinds of institutional practices support or impede cross-fertilization of practices and creation of courses in multidisciplinary teacher teams with external customers? |
| Case 3: Conceptual modelling in Design Projects | FH OÖ and KI | Data collection from September to December 2009 and from March to June 2010 | **Student intervention**: model of design as open-ended inquiry;  visual modeling language;  analysis of activities | 1. Does an open-inquiry strategy lead to more knowledge creation than a solution driven strategy?  2. What is the relation between the way students use artefacts and the strategy of students in design projects?  3. Does the pedagogical model i.e. the interventions by the teacher facilitate open-ended inquiry? |
| Case 4: Producing document management solutions and practices for distributed work settings – Perspectives of KPE usage in two work organizations | UH, Pöyry, KI | Data-collection in 2 successive projects:  Project 1:  9-11/2009  Project 2:  1-4/2010 | **Professional worker intervention:** collaborative creation of knowledge object using KPE  **Project management intervention** Trialogical project learning | 1. How does KPE support the collaborative problem solving  2. How does KPE support managing the collaborative problem-solving?  3. To which extent does semantic functionalities and analytic tools of KPE support the reflection of the process? |

The four cases have in common that they all employ mixed methods to assess practice transformations and knowledge creation practices. The mix of methods consist of techniques which makes it possible to explore the processes involved in the designed field trial, like log data, interviews, observations, and the products of the (collaborative) activities. The confirmative part of the studies uses techniques and analytic methods so that research question related to the impact of pedagogical models and the KPE can be addressed.

We will next present the four cases in more detail, with context and intervention (including the use of technology and semantic tools), pedagogical models, research questions and our expectations, types of data to be collected and approach to analysis.

# Trialogical work in higher education; creation and use of knowledge objects in knowledge creation practices (Case 1)

**Context and setting of the study**

This study investigates how collaborative development and enhancement of knowledge objects affects coaching and learning practices in higher education. To further understand the role of knowledge objects in trialogical activity, we analyze and compare creation of knowledge objects by both teachers as well as their students in the following three steps. First, we study to what extent an intervention that is based on the pedagogical model of open-ended, object-oriented collaborative inquiry instigates transformations in teachers’ coaching practices. Second, we investigate students’ collaborative development of knowledge objects and their role in producing productive interactions. Third, we study the impact of teachers’ interventions on the aforementioned processes. KPE, analytic tools and semantic services support collaboration, production and reflection on the knowledge objects.

The study will be conducted in collaboration between Utrecht University (UU) and University of Oslo (UiO). The empirical site will be Stoas University of Applied Sciences and Teacher Education in the Netherlands. Stoas offers professional studies for teachers, trainers, and specialists in knowledge management in agriculture, horticulture, food technology, animal breeding and keeping. Their curriculum is based on Professional Situations (PS) wherein students are stimulated to mobilize knowledge and practice skills during projects in authentic work environments.

Our intervention aims to increase teachers’ understanding of knowledge creation through the development and experimentation with new knowledge objects (such as instructional material, tutorials, technological support) in their coaching practices, and to improve students’ learning by eliciting productive collaboration. The first iteration of this study will take place within the PS “Learning situations with learning and behavioural problems”. In this PS, students analyze a problematic learning situation at a particular authentic site (schools and pupils with learning or behavioural problems, or with handicap) and design educational material that can be used by teachers or pupils in that context. The intervention uses KPE to enable teachers and students to create, organize, discuss, revise and comment on their knowledge objects. Furthermore, KPE analytic tools can enhance awareness and shared understanding of these object-related activities (see paragraph: Exploitation of Semantic Technology).

**Expectations**

First, we expect that the intervention brings about a process of transformation in teachers’ practices, as a result of the construction of and the experimenting with new methods and instruments and the subsequent collective reflection on the results obtained. Interaction with colleagues results in the extension of existing knowledge and the collaborative construction of new knowledge. The collaborative creation and use of shared knowledge objects triggers teachers to explicate and negotiate tacit knowledge, which enables them to systematically analyze and reflect on current practices, and to move beyond their epistemological understandings, norms, routines, and attitudes. In addition, we expect that the collaborative production of knowledge objects (i.e. coaching instruments) will increase teachers’ sense of ownership over their own professional development, their willingness to reuse the developed objects in other (comparable) contexts, and their collective responsibility for these objects, which can strengthen the perceived sense of collegiality.

Second, we expect that object-oriented activities support students to incorporate knowledge practices as they occur in professional communities. This means that developing knowledge objects to solve complex problems stimulates students to engage in productive interactions that serve the iterative elaboration of their own ideas and externalization and concretization their knowledge. These processes enable them to collaboratively reflect on and revisit goals, plans, and strategies motivating them to become agents of their own learning and development.

Third, we anticipate that students’ activities will benefit from changes in teachers’ practices. This will be expressed in a positive relation and cross-fertilization between teacher interventions and productive interactions in students’ collaborative object-oriented work. We conceptualize productive interactions as epistemic actions in collaborative groups, which lead to conceptually richer knowledge objects. Moreover, we expect that knowledge objects that involve a great deal of productive interactions have a stronger impact on both teachers’ coaching and students’ learning practices, compared to knowledge objects that are exploited less intensively. In this context, learning is accomplished when these processes lead to reconceptualization of the object and motive of a particular activity to embrace a more diverse horizon of possibilities and opportunities than the previous activity.

**Research questions**

1. To which extent does our approach for the collaborative creation and use of knowledge object, supported by KPE functionalities, foster a process of transformation in teachers’ practices?
2. To which extent do these changed coaching practices afford students’ collaborative creation and use of knowledge objects?
3. To which extent does the collaborative creation and use of knowledge objects, supported by KPE functionalities, produce productive interactions in students’ learning activities?

**The intervention – specification of the pedagogical model**

Intervention at Stoas will take place at two interconnected levels, at the one hand we have developed a pedagogical model to foster practice transformations of *teachers’* coaching practices and at the other hand we intended to provide boundary conditions for stimulating *students’* knowledge creation processes.

First, we intend to actively engage *teachers* in processes of object-oriented inquiry to consciously and collaboratively develop knowledge and skills that foster transformations of their practices. The change in teachers’ practices will lead to productive interactions in students' knowledge creation processes. During the intervention, a community of teachers will create knowledge objects for advancing their practices based on dilemmas identified in current practices. They will transform their coaching practices following the construction and experimentation with new methods and instruments for their teaching and based on collective reflection on the obtained results. This intervention is strongly related to the trialogical design principles, since it involves the collaborative and long-term advancement of knowledge objects emphasizing development through transformation and reflection between various forms of knowledge and practices. The intervention is an iterative cycle of several phases where KPE will support planning, organisation and structuring of performed activities.

1. *Problematizing*: involves the collaborative identification and investigation of problems teachers experience. The goal of the collaboration between the teachers will be formulated based on the problem(s) they agree to tackle. At Stoas one of the main issues is to create shared objective(s) for the coaching of students’ knowledge creation processes;
2. *Exploring causes of the problem(s)*: this activity involves a collaborative, intensive inquiry of the rationales, routines, and conventions that could possibly explain why and how the identified problems persist. The analysis of the problems results in a preliminary working hypothesis;
3. *Negotiation on possible solutions*: generated in a creative process where teachers can capitalize on theoretical knowledge from researchers to complement and cross fertilize their experiential knowledge. The proposed solutions will be subject to critical analysis to negotiate their potentialities as solution(s) to the group’s work hypothesis;
4. *Modelling of the solution(s)*: collaborative development and improvement of concrete products that materialize the solution to the group’s problems. Moreover, these products can be reused by other teachers or stakeholders encountering comparable problems in the future. The outcome of this activity is the description of the way(s) in which the proposed solutions tackle the identified problems;
5. *Operationalizing the solution(s)*: during this activity, teachers will collaboratively materialize the knowledge and insights exchanged in the other activities in concrete instruments that can be used in teachers’ coaching. This means that, based on the solutions that were generated in the previous activity, concrete and usable instruments are developed that teachers can deploy in their professional development and coaching practice. In addition, teachers will develop evaluation criteria to assess the extent of success of their intervention;
6. *Implementing the instruments in practice*: the instruments developed in the previous activity are implemented in practice and teachers negotiate about the conditions for implementation of instruments in small-scale experiments to improve coaching practice and knowledge creation of the students, and about how to assess the effectiveness of the designed instruments;
7. *Monitoring and determining the effect(s)*: teachers will collect, analyze and interpret data to ascertain the impact of their interventions;
8. *Reflection*: reflection on performed activities, the constructed solutions, instruments and interventions. This process allows them to reflect on their practices and to decide whether and/ or how to continue or to transform them.

Second, the pedagogical model that aims at fostering students’ knowledge creation involves a generic frame which explicated how learning through knowledge creation is implemented at Stoas. This means that the focus is on accommodation and recreation of authentic practices of particular professional communities through supporting object-oriented collaborative activities in PS “Learning situations with learning and behavioural problems”. Groups of students will develop, advance and report on knowledge objects that materialize knowledge of the particular professional domain. These objects will be consequently employed as tools in the knowledge practices belonging to the respective domain. This section of the pedagogical intervention draws upon (and uses) ideas based on some of the trialogical design principles. Of these principles, the one of organizing (learning) activities around shared objects is most evidently represented. Also, aspects of the intervention aim to elicit and support interaction between individual and social aspects of learning and collective (epistemic) agency; it brings about cross-fertilization practices; and it provides students with flexible tool mediation. Students’ *activities* will be organized according to three general phases in their project work:

1. *Project initiation*:involves that the student groups write a proposal that specifies how they propose to tackle a particular (educational) problem during their project and how the development of knowledge objects contributes to that. This proposal includes a problem statement and a provisional planning of the project, to be further negotiated and explicated with the external client;
2. *Designing and conducting the project*: this is the activity in which the groupsplan and design their knowledge creation work and which expresses the collective envisioning of the object-oriented activities laid out in the proposal. Students elaborate on the educational resources and tools to be used when developing their knowledge object, and negotiate with teacher(s) and external client(s) to deepen their understanding of the domain and of the knowledge object; also, they deliberate on requirements for the practical usage of the object. The students will produce and elaborate various artefacts that they will use to develop their knowledge object; meeting notes, analyses reports, prototypes of design proposals, drafts of the object, or recorded discussions.
3. *Synthesis: reporting and delivery*: is dominated by the collaborative activities of reporting of the performed activities and of the outcomes. Artefacts created by the student group feed into the final report. During the process, the report and the main artefacts are published for teachers, other student groups and client for evaluative feedback. The project and the final outcomes are presented to the client, together with guidelines on how the produced knowledge object can be used in practice.

**Timeframe and participants**

The study will take place in two successive phases covering the period September 2009 till July 2010. For both phases a group consisting of 8 teachers will actively participate in the case study. The number of participating students will vary depending on the project phase. In total, X students will participate in the one-year study.

* The *first phase* lasts from September 2009 till February 2010 and involves two main complementary activities. To start with, we focus on preparatory activities for the participating group of teachers, such as: training activities, planning and organizing of students’ work and data collection. In September 2009 a pilot study will start where teachers coach knowledge creation processes of approximatively 10 students (two student groups, consisting of 4 to 5 students each) in line with the pedagogical model defined in the intervention. Data capturing the teachers’ design and coaching work and student knowledge creation activities will be collected;
* The *second phase* spans the period February 2010 till July 2010, comprising a new iteration of Professional Situations projects. This will include a larger number of students, approximatively 25 in total (5 to 7 groups, consisting of 4 to 5 students each). During this period this new group of students will work in the professional situations which will be developed by the participating teachers based on principles of knowledge creation and employing the knowledge, experiences and objects produced during the previously performed object-oriented inquiry. Teachers will continue to advance their coaching of their students’ knowledge creation processes supported by the pedagogical model.

**Exploiting semantic technology**

During the two phases of the project, both teachers and students use KPE as arena for their trialogical work. Semantic technology integrated in KPE will provide support for activities that are essential for both teachers and students to review and analyze their collaborative development of knowledge objects. Both the Visual Analyzer and the Timeline View support this by visually representing the activities based on information stored in the produced logs. The Visual Analyzer visualizes frequencies of object-related activities in KPE, and provides detailed information on the nature of the activities performed on particular knowledge objects. These visualizations stimulate teachers and students to reflect on object progression, and on their coaching and learning practices.

The Timeline view enhances teachers’ and students’ understanding of the nature and intensity of their object-oriented activities, since it allows them to directly annotate these events, to define and to compare activity patterns themselves. This enables teachers and students to trace changes in their knowledge objects, stimulating them to evaluate and subsequently improve their collaborative activities.

In addition, the Semantic tagging functionality in KPE provides teachers and students with the additional means to actively provide semantics to their knowledge objects. This enables them to collaboratively explore and organize the meaning(s) they have assigned to their knowledge objects themselves. Furthermore, Comprehension services employed by the Semantic tagging functionality supports teachers and students in their work with knowledge objects by providing suggestions for tags based on comparisons of the contents of these objects.

**Overview of empirical data**

The emphasis of data collection and analysis will be on *the development and advancement of knowledge objects* by teachers and their students. Consequently, data on object-oriented activities will be collected from the following two complementary sources:

1. *Technology*: From *KPE Content* view, we will retrieve the following data: the creation, editing, versioning and commenting on content items. From the *Process View in KPE*, data will be collected regarding the creation of tasks and milestones. In addition, from both Content and Process View metadata related to content items and tasks will be collected. Finally, we will retrieve data mainly focusing on development of content items from the *Analytic Tools: Data Export, Timeline view* and *Visual Analyzer*;
2. *Field activities*: We will include supplementary data about the activities performed within KPE. We will collect the following data:
   1. *Interactions*: Transcribed recordings of interactions of meetings between teachers and researchers, coaching sessions and student meetings;
   2. *Reflections*: Teachers’ reflections in diaries, students’ answers to reflective questions, and semi-structured pre-and post interviews with students and teachers;
   3. *Knowledge objects*: Reports, meeting notes, concept maps, and handwritten comments

From these data, critical events will be abstracted reflecting how the collaborative creation and use of knowledge object produces changes in teachers’ practices, students’ knowledge creation and in the interplay of teachers’ coaching practices and students’ knowledge creation process. Data reflecting collaborative work on knowledge objects will be analyzed and related to episodes indicating productive interactions in students’ collaboration. The analyses of the empirical data will commence in parallel, starting September 2009 until May 2010.

# Knowledge creation practices in customer projects in higher education (Case 2)

**Context and setting of the study**

The goal of this study is to investigate student teams that design innovative problem-solutions for a customer in two courses: business plans, marketing-strategies, conceptual designs, and small web-applications. We examine the support from the KPE environment and the analytic tools for these knowledge creation practices. Further, we create an intervention for teachers in co-designing the use of the KPE environment. Finally, we address conditions for cross-fertilization in multi-institutional networks taking place in these courses.

*Student intervention*. Students come from different (undergraduate) backgrounds, and work in teams of 5. Their working is based on an open-ended assignment; students have to appropriate multidisciplinary, distributed project work practices. In earlier iterations of this study it was shown that students had problems with the open-ended epistemic challenge, although their customers valued the products. In addition, virtual working setting and collaboration was experienced as problematic by teachers and students because the used Web-based tool (Optima) was not flexible enough for organizing the virtual project work and co-constructing knowledge artefacts.

In the current iteration, KPE is introduced. We claim that better support (compared to the previous iteration) both for epistemic advancement and for organizing and monitoring the virtual working process requires several types of functionalities from the tool. We expect the views and functionalities of KPE to be beneficial for the process in the following way:

* Content view (content items, links, tasks), object-bound commenting and chat, Google-Docs /wiki, semantic search, and tagging support epistemic advancement;
* Process view (task, milestones), to-do-list, Google-Calendar and process awareness and history features support pragmatic planning, monitoring and coordination;
* Community view, group formation, and social awareness features support social community building and awareness;
* Analytic tools (Timeline view, visual analysis of logs, data export) support reflection of knowledge practices.

We suppose that engagement in a trialogical process is exemplified as more collaborative versioning of knowledge objects, more object-bound commenting and discussion, less disconnected work, and more modified process plans during the process. We translate these to indicators of trialogical inquiry (e.g., degree of versioning, etc.), which are compared to the quality of teams’ outcomes (e.g., with end-scores from teachers and customer evaluations for each team) to obtain a cross-reference on their advancement in design and inquiry.

*Teacher intervention*. In addition to the students’ activities, we create an intervention by training and co-planning the use of KPE with the teachers. We examine how teachers from different departments together plan the introduction of KPE in a joint course, which brings about a clear change in their practice, in the way of structuring and coaching student work. We expect that teachers find it useful to have:

* A main Shared space common for the whole course where teachers share instructions, activity structures, templates and documents for students, and a child Shared space for every team, organization of which is the responsibility of teams themselves.
* The Content view of each team which enables the teacher to get an overview of the kind of development and activities taking place
* The GANTT chart Process view of each team which enables the teacher to examine and refine with students the timeline and milestones of their work
* An alternative process view (in iteration 2) that enables the teachers to present the activities (planned and enacted) in relation to a conceptual model of the process (project work, Trialogical inquiry).
* The semantic functionalities to monitor and evaluate the process by searching and viewing materials tagged by students (both domain related and process related tags).
* The Analytic tools to examine team and individual activities as well as development of artefacts during the course.

These will be examined by analyzing the activities and outcomes in the database and by teacher interviews and stimulated recall sessions on the use of the KPE.

*Cross-fertilization in multi-institutional networks*. The design of the joint course requires not only collaborating between teachers from different departments, but also between external institutions represented by the customers. We examine the scope of negotiations and decisions that are needed before such multi-institutional collaboration takes place and is considered valuable; by analyzing the preplanning and post course evaluations, and post-course interviews of the teachers and customers.

**Development of pedagogical model**

The Trialogical Inquiry model is employed in the case. The process of the first iteration will be examined by identifying the central elements regarding epistemic advancement, foci of coordination of activities, and process outcomes. These will be compared to the current version of the Trialogical Inquiry model to pinpoint to discrepancies and alternatives to produce a revised model. The second iteration in the case will employ this revised Trialogical inquiry model in KPE’s ‘alternative process view’ as scaffolding for students’ activities. The main learning activities scaffolded by the model are expected to be:

* Engaging in collaborative knowledge creating activities around shared objects
* Setting up a context with complex problems
* Questioning and problematizing
* Constructing working hypotheses and solutions
* Deepening analysis
* Creating knowledge artefacts for subsequent use
* Critical user evaluation of artefacts and solutions
* Reflecting on and transforming knowledge practices

The main benefits of introducing the model are expected to be that the students experience it positive to have facilitation of epistemic aspects of knowledge advancement in addition to the project communication and management aspects as was the case in a prior study on this course.

**Research questions**

The following research questions will be addresses:

1. What is the relationship between the trialogical inquiry indicators and the quality of the outcomes? Do more collaboration around versions of shared artefacts, object-bound commenting and discussion, connectedness of activities, and revisions to process plans in teams relate to higher scores in evaluations by teachers and customers?
2. To which extent does semantic functionalities and Analytic tools support the reflection of the process? Do the teachers and students report them to provide added value for monitoring and coordinating the design and inquiry process?
3. What kinds of institutional practices (resourcing, partnerships, networking strategies) support or impede cross-fertilization of practices and creation of courses in multidisciplinary teacher teams with external customers?

**Timeframe and participants**

Course 1 starts in September 2009 and continues till end of March 2010. Indicative number of students and teachers that will be involved in this iteration is 45 students, 5 teachers, and 5 professionals. Data analysis starts in December 2009 and report of first results will be available for the next deliverable in spring 2010.

Course 2 starts in January or March 2010 and lasts for three months. Indicative number of students and teachers that will be involved is 50 students, 4 teachers, and 2 professionals. Data analysis starts in April/June and report of first results will be available in fall 2010.

**Overview of empirical data**

Data will be collected from complementary sources:

1. *Technology*: From the KPE we collect all materials produced by participants. To follow the development of artefacts, we will retrieve from the Content view the following data: the creation, editing, versioning and commenting on content items. From the Process views in KPE, data will be collected regarding the creation of tasks, milestones, and Google calendar. Other Log data on activities conducted in KPE, and how the Analytic tools and other tools have been used by students and teachers.
2. *Field activities*: Additionally, we will collect data that are external to activities performed within KPE. We will collect the following data:
   1. *Interactions*: Transcribed recordings of: planning sessions and meetings between teachers, customers, and researchers; selected course and team meetings
   2. *Reflections*: semi-structured interviews with student groups, teachers, and customers; stimulated recall sessions with students and teachers, students’ answers to reflective questions.
   3. *Knowledge objects*: teacher and customer evaluations, other materials related to the courses

**Exploiting semantic technology**

The functionalities for semantic tagging and vocabulary-editing, available in KPE Content view, are expected to be used for managing and coordinating the artifact production in teams, both by using domain related and process related tags. Collaborative tagging of collected resources and produced artefacts by team members will support systematic structuring of the joint knowledge creation processes. In addition, they allow the teachers, team leaders, and in Course 2 also a specific coordination team to supervise the team processes by following their advancement through tagged materials. Further, we expected the semantic search to be an important functionality for participants in searching materials based on the rich metadata.

The tagging complemented by the use of analytical tools (Timeline view, VALS, data export) are expected to be used by the participants to reflect on their individual and team knowledge practices. To manage professional, multidisciplinary knowledge practices is a central learning goal in both investigated courses, therefore it is important to engage students and student teams in explicit and intentional reflection of their own practices throughout the courses. Also teachers, and in Course 2 a research team of students, will use the semantic and analytical tools for evaluating the team processes.

# Conceptual modelling in Design Projects (Case 3)

**Context and setting of the study**

In this case we investigate the design strategy(ies) of students (e.g. open-ended inquiry or solution driven). We assume a relationship between an open-ended inquiry strategy and knowledge creation. One characteristic of the strategy is the way artefacts will be used. Therefore development and usage of artefacts will be investigated. Furthermore we suppose that particular interventions and supportive function of tools; KPE and Visual Model Language Editor, facilitate open-ended inquiry processes. Additionally, we are interested which pedagogical interventions (e.g., peer review) facilitate an open-ended inquiry process.

We will focus on the further development of the pedagogical model in the context of design. We started with a baseline study in winter term 2007 (the first E-Moderation study). This baseline study helped us to specify the pedagogical model (Design as Knowledge Creation) and to test some assumptions in the accomplished E-Moderation study 2008. In case 3, two iterations will be carried out to further refine and test the pedagogical model. The first iteration of case 3 will take place in winter term 2009/2010 and a second iteration is planned to take place in summer term 2010 (a course of the study program “Communication and Knowledge Media”). The description below is about the first iteration “E-Moderation 2009”. Based on the results (analysing empirical data) of the first iteration (course “E-Moderation” in winter term 2009 a detailed research plan will be worked out. For the study in the summer term 2010, we will use KPE and Visual Model Language Editor. Also, interventions based on the pedagogical model will take place.

The study “E-Moderation 2009” will be used as a next iteration in this context. Project E-Moderation is a compulsory first-year course in the bachelor program “Communication and Knowledge Media” at FH OÖ. Throughout their first semester students are asked to work on a complex design issue in the fields of E-Communication and E-Moderation. One teacher and about 30 students in ca. 5-6 project teams take part in this course. The reorientation of this first-year course towards “design as knowledge creation” is in line with the overall curricular development of the study program aimed to prepare students for rapidly changing work practices in the field as well as inquiry-oriented development methods. On the individual level the aim of this course is to broaden the perspective on what design and the designers’ role is or could be and to empower and encourage students to become knowledge creators rather than consumers. Experiences from previous cases indicate that students have a quite narrow understanding of what design is about and expect the teacher to provide rule-based guidelines on the design process as well as on the qualities of the design product. They tend to resist transforming their knowledge practices in design and more likely argue to modify the task assigned to them. In the next iteration in the summer term, the pedagogical model will be further tested and developed. In this study 1-2 teachers and 15-30 students will participate in the course.

*Assignment and Tasks [meso-level]*

The overall assignment for the students will be to design a “seminar room in Digital Land”, i.e. to develop and test an understanding of learning in the digital age and the affordances for new practices provided by advanced ICT. The main tasks for the project teams are (1) to create a local theory of the design space, (2) to explore and implement possible solutions in the sense of working hypotheses, and (3) to evaluate the viability of the proposed solution and revise the local theory of the design space accordingly.

Throughout all phases of the project the students will use the KPE to share, organize and explore the experiences they make while working on possible problem solution. In addition, the Visual Modelling Language Editor will be used in parallel for the conceptualization of the structure of the design space. The tools should support students in explicate, visualize and document their own learning needs which will be the initial point to design the seminar room.

*Scaffolds and Interventions [micro level]*

In order to scaffold the students design activities and to foster deepened investigation of the design space, the following interventions are foreseen:

* A heuristic model of design as open-ended inquiry is introduced to the students and used as an orienting scheme throughout the course. The aim of this model is to provide students with guidance and orientating without prescribing a strict course of action.
* In order to scaffold the explication of the students’ local theory about the design space, a particular visual modeling language is provided to the students, which builds on existing schemes used in design and program evaluation.
* Peer-based design reviews are carried out to support critical assessment and deepened analysis.
* The teacher aims to challenge the students about their ideas, particularly trying to question and explicate hidden assumptions during face-to-face interactions with the teams as well as in plenary.

Main tasks for the students are the following:

***Reflection on own needs and experiences:*** At the beginning of the course the students are asked to individually prepare a poster presenting a learning experience they remember. The question to be answered is: What made the experience important/impressive/meaningful to you? This is meant to trigger reflection on students’ own learning needs and experiences.

***Looking into the design brief:*** Students are provided with an initial design brief prepared by a client. The aim of the design brief is to motivate the assignment and to encourage the envisioning of qualitatively new solutions. To do so, the design brief is presented by video that introduces a kind of cover story. This cover story is meant to have an alienating effect and hence to make it easier for students to develop new perspectives.

***Collaborative exploration of the “application domain”:*** Students are asked to collect and share data, snapshots, sketches, or notes they find interesting while exploring “digital land”. To foster comparison and identification of patterns, students are encouraged to annotate and shortly describe the resources they found by answering questions such as: “What does it mean to you?”, “What makes it meaningful regarding the design task?” Respective functionalities in KPE such as content view, semantic tagging and search are explained.

***Conceptualization of the design space:*** Students are asked to explicate and elaborate on their understanding of the design space in form of a visual model, reflecting their insights gained from exploration but also outlining envisioned solutions. Towards that end, the VME and a particular modelling language will be introduced as a common tool. The aim of the visual models is to provide common point of reference throughout the course and to foster more systematic reflection on the concrete design solutions development.

***Development and (partial) implementation of a design product:*** Besides creating a model of the design space, students shall also develop and (within given limits) implement their ideas in the form of concrete design products. Students are explicitly encouraged to adopt a bricolage strategy, i.e. to reuse existing technologies for new purposes, and to experiment with different solutions rather than striving for “high gloss” products.

***Peer- and teacher-based design reviews:*** The (intermediate) outcomes of the design process will be subject to peer- and teacher-based design reviews. The aim of the design reviews is to support critical assessment and deepened analysis of the proposed solution. Peer- and teacher-based design reviews are carried out as frequently as possible, to stimulate an iterative design process and develop a reflective attitude among students.

All this is complemented by lectures (“inputs”) at the beginning of every class session. Issues on design- and media theory such as “What is design?”, “The long tail and weak ties” are presented in a traditional lecture. In the middle of each session students explore, discuss and conceptualize. At the end of each session there is a wrap up within the class.

Students are assigned to groups randomly, in order to increase internal heterogeneity with regard to students’ backgrounds and preferences.

*Expected outcome*: Transforming students’ concept of learning and design as well as understanding practices, principles, and mechanisms of digital land (social web).

Based on their first exercise, students will get an elaborated idea about what the digital seminar room might be.

*Artefact development*

Based on previous results we assume that artefacts can be used in quite different ways, e.g. they can be used for communicative, archival, accounting and/or knowledge creation purposes. Artefacts can be used to organize project activities (e.g. protocol for meeting minutes) or the artefact will be used for the development of other artefacts (color for the logo). It can also seen as an essential artefact which will used to come up with the final product (e.g. logo produced and used by the group for the final product i.e. website with logo). We assume, that the way students use artefacts is correlated with the chosen strategy (i.e. open-ended or solution driven). We expect students who adopt an open-ended inquiry strategy, a) to work more actively with core artefacts, b) to work on these artefacts collaboratively and c) to use these artefacts more continuously (incl. reuse at later stages). In addition we assume that there will be more qualitative changes in the contents of these core artefacts. We expect students with an open-ended inquiry will do following activities: more use of artefacts in different ways and more collaborative activities regarding artefacts.

**Research questions**

1. Does an open-inquiry strategy lead to more knowledge creation than a solution driven strategy?
2. What is the relation between the way students use artefacts and the strategy of students in design projects (open-ended inquiry or solution driven)?
3. Does the pedagogical model i.e. the interventions by the teacher facilitate open-ended inquiry? We assume that the Visual Model Language serves as scaffolds and facilitates students’ open-ended inquiry process. Tagging serves as scaffolds and facilitates students’ open-ended inquiry process. Peer-reviews facilitate students’ open-ended inquiry process.

**Timeframe**

The first iteration will start in October 2009 and ends December 2010. In this time period following activities will take place:

* Introduction to the project task, introduction to KPE, students exploring their learning needs and are collecting ideas for the “Digital Land”.
* Based on students’ activities different interventions by the teacher will take place (introduction of a heuristic model of design, VME introduction, tagging, peer-reviews, and feedback).
* At the end of the seminar, experts will evaluate students’ work and outcome.

The next iteration will start in March 2010 and ends June 2010. KPE usage will start in March, VMLE usage in April.

**Overview of Empirical Data**

During the time period October-December different data will be collected. The analysis of data will start in December. A report with first results will be available for the next Deliverable in spring 2010.

The teacher will be interviewed (semi-structured interview) to get information about the interventions. After each intervention we want to make a short interview with students (audio recording of students statements). The artifact development will be investigated by collecting data from data export tool and Timeline view (create content item, modify content item, comments on content item, chat about content item, versions of content items, create notes, modify notes, comments on notes, chat about notes, add links, modify links, add different types of visual model elements, modify visual model element, comment on visual model element, chat about visual model element, milestone, tasks, process view). Furthermore screenshots of the visual model will be collected. To identify the students’ strategy we will use a project diary. Students are assigned to protocol project activities. The final solution and product produced by students will be evaluated by different experts.

Based on the results of the first iteration the second iteration will be planned and will consist of similar data collection

**Exploiting semantic technology**

The Visual Modeling Language Editor VM(L)E will provide a core tool for the project teams to explicate, share and negotiate their evolving understanding of the design space they are operating in. Besides providing a set of scaffolds in the form of predefined modeling languages, the VM(L)E allows students to explicate different perspectives on the design problem in a flexible and unambiguous way. Due to its integration in KPE, models can be directly linked to the information assets stored in the Shared Space, allowing to create shared abstractions of the resources collected. Furthermore, the versioning of visual models and logging of changes enables students to easily revert to previous versions and to trace the evolution of the models in time. In particular, these features are supposed to foster students’ reflection on but also to encourage exploratory use of the models they produce. Drawing on the semantics defined in the visual modeling language, the VM(L)E checks the consistency of models and provides students with feedback when inconsistencies arise.

In parallel, the functionalities for semantic tagging and vocabulary-editing, included in KPE, will provide an additional means for the students to organize and explore the information they collect in the field. Collaborative tagging of data collected and resources produced by the different team members will allow the students to search for underlying patterns and hence create or test ideas about the design space. A predefined but extensible vocabulary will be used in addition to scaffold the exploration of the data collected.

# Producing document management solutions and practices for distributed work settings – Perspectives of KPE usage in two work organizations (Case 4)

**Context and setting of the study**

The study investigates the use of KPE in work life context by exploring two development projects. Both projects address the challenges involved in distributed work settings, which are being subject to radical changes in the opportunities presented by and dependence on ICT systems and digitalized documents. A top-down manner of managing and coordinating a project, which is typical for corporate development processes, would entail that consultants, managers and strategic leaders nominate the change in a top-down manner. In these projects, the practitioners together with managers discuss about the aims of the project, explore and concretize the problems, and have an important role in presenting their root-level experiences, and participate in constructing new solutions in a bottom-up manner.

The project to be organized first during early autumn of 2009 will be carried out in a large international consulting Company. The project team’s aim is to find technical document management solutions, and accordingly, create new work practices in the context of globalizing design engineering. The project will involve circa 10-12 participants: users of project documenting tools, Company’s project managers, higher management participants and a representative of a third party ICT development company. The project to be organized secondly, starting in the beginning of year 2010, aims to investigate a development project in the context of medical information systems development at a hospital concerning patient data. This project at the Södersjukhuset hospital in Stockholm involves circa 6 core project members and 60 peripheral members. They represent various disciplines around the patient data document systems.

From the KP-Lab research perspective, the aim is to examine whether and how KPE supports the development project. The affordances provided by KPE, are expected to support the project team participants to jointly represent, discuss, comment, revise and organize the knowledge (ideas, solutions, suggestions, reports). The expectations are built on the previous KP-Lab results (e.g. ‘Globally distributed design work), which have indicated that the traditional work practices following the expertise-specific organization of work, need to be organized around shared objects in order to utilize the experiences from different parts of network and expertise fields. Following these themes, the KP-Lab research interest is in examining the technical support that KPE offers, and in the pedagogical organization of interprofessional work-composition. The pedagogical organization becomes visible by exploring the structures built for the collaborative reflection of practices and creation of work related objects, such as plans and tool user-cases, and in describing the trajectory of the interprofessional and collaborative learning process.

#### Intervention with the KPE and the Trialogical approach

KP-Lab offers to the development projects KPE-tools to support the participants in reflecting on their practices of project document management and on the technical functionalities of the prevailing and future project document managing tools. Besides the tool intervention, the trialogical approach of working on developing shared objects will be introduced for project teams and facilitated by co-designing the knowledge creation activities together with the project representatives and KP-Lab researchers. We assume that technology and pedagogical organization of the team work according to the trialogical design principles will support the project teams to explicate the ideas, connect related materials and resources, collaborative and iteratively construct new solutions, and reflect on working practices.

We expect KPE to be beneficial for the process in the following ways:

* The Content view provides support for producing and elaborating new ideas by visualizing, relating, structuring and labeling ideas and their relations (cf. content items, links, tasks, object-bound commenting and chat, tagging, and linking  
  functionalities);
* Process view (tasks, subtasks, milestones), process awareness and history features support the pragmatic planning and coordination of the project’ teams iterative and collaborative activities. These consists of defining tasks, deadlines and responsibilities to the whole team and each member, as well as revising the plans when necessary;
* Community view features support community building and awareness, and group formation in the multidisciplinary development team. Awareness features of own and other’s activities are required to link social activity with epistemic advancement, e.g., the Community view awareness tools support in mapping the individual actors’ activities (listing participants’ materials and tasks/responsibilities);
* Analytic tools (Timeline view, Visual Analyzer, data export) support reflection of the work around knowledge objects. Open search supports mapping and searching objects and activities by using several parameters offered by KPE ontology.

#### Pedagogical model of Trialogical project learning

The pedagogical organization of the workplace cases can be presented as trialogical project learning. Trialogical project learning aims at transformations on the following aspects; from individual to collective knowledge creation, from expertise specific to multiprofessional expertise, from discursive knowledge sharing to discursive-material knowledge creation, from local networking to boundary crossing between networks, and from top-down given problems to bottom-up explored problems. A central aspect in the facilitation of the project work, which may already include some elements of trialogical learning, is finding ways of extending the face-to-face meetings by asking the participants to collaboratively describe, explain, comment and revise their ideas and discussions into artefacts during and between the meetings. This serves the purpose of advancing shared knowledge objects by collectively contributing, even by small notes and questions, to the formulation of problems and solutions.

In the following particularly the setting of the first project is presented. The description fits both cases in a sense of having interdisciplinary F2F meetings, and KPE usage in between and during the meetings. The first project under study involves the following elements; the kick-off of the project introduces the main object of the work, the roles, the division of labour, and the overall organization of managing the project knowledge. Kick-off meeting will present the main ideas and tasks for the whole project and the different stakeholders. Pedagogically, this serves for the setting of the context, sharing the idea of the main problems at the moment, and setting a main object to be achieved during the project. The project has weekly F2F-meetings, in which the work done between the meetings is presented. The work between the meetings is done the by using KPE, whenever suitable. KPE aims to serve the collaborative construction of ideas, revisiting the problems, keeping track and commenting other stakeholder group work. In the F2F meetings the outcomes of the work are presented by using KPE as a shared point of reference. Also in the meetings, KPE is used to manage the reflections, ideas, keeping meeting memos. In this manner, the main elements of the knowledge construction are stored and available in KPE for later use. The ‘main-user’ of KPE from the project will be working closely with KP-Lab researchers in planning and coordinating the process in KPE.

**Research questions and their connection to data**

By studying iteratively two successive projects, the aim is to use the results from the first project for specified research questions and research setting for the second study. Also, the experiences from training and pedagogical arrangements will be carefully reported from the first project and carried over for constructing the second project.

The following research questions will be addressed:

1. How does KPE support the various forms of collaborative problem solving (i.e., using KPE to organize and produce epistemic artefacts, which mediate the reflection and construction of new solutions for the company or the hospital)?

As a hypothesis, KPE offers a platform for collaborative work, which differs from traditional discussion and/or from presenting ready-made material. and/or distributing and preserving the materials in

Q1 will be studied by identifying instances of cross-fertilization, operationalised as problem statements, re-conceptualized problems, and new suggestions (collaboratively developed outcomes in KPE as, comments or versions of content items). The identification will be based on the imprints of the participants’ usage of Content items, object-bound commenting and chat, and versioning functionalities of KPE.   
Q1 will also be analyzed from participants’ use of KPE; organizing and finding the material, production of Content items, and object-bound commenting and chat of KPE.

1. How does KPE support managing the collaborative problem-solving process?

As a hypothesis, Process view functionalities (e.g. GANTT organization, Tasks, Subtasks and their metadata) will be a tool for managing the project that involves participants working in temporally and spatially distributed setting.

Q2 will be studied by analyzing the KPE-data of the participants’ usage of the functionalities in Process view

Q2 will be studied from participants’ interviews of the use of Process view

1. To which extent do semantic functionalities and analytic tools of KPE support the reflection of the process?

As a hypothesis, the semantic functionalities support monitoring and coordinating the collaborative problem-solving process.

Q3 will be studied through participants’ stimulated recall sessions focusing to KPE semantic functionalities and reporting of the added value of KPE semantic functionalities and Analytic tools.

These research questions are connected to other new research cases of the KP-Lab. In particular the Case 2, Knowledge creation practices in customer projects in higher education, resembles Case 4 by having a similar kind of project work setting. Both Cases aim offer KPE to support trialogical processes of joint problem solving and innovation. Whereas Case 2 supports the students to approach and train professional expertise and practices, Case 4 represents the professionals’ joint efforts. Case 1 and Case 2 offers similarities in supporting the participants in reflecting the work.

**Timeframe and participants**

The projects will last approximately 3-4 months, during which the (weekly) F2F-meetings and virtual work in KPE take turns. Between the meetings the participants will be given tasks to work in KPE. These involve producing and making material to KPE, and commenting on ideas and materials produced by other participants. Shared material in KPE will be covered again in F2F-meetings.

Project 1 will last from September till early December 2009. The project 1 team consists of multiprofessional participants; the users of project tools who are engineers from different expertise fields representing the current usage problems), project managers representing the project coordination level, higher management participants representing the company’s strategical roadmap and the third party ICT development company responsible for developing the new ICT tools.

Project 2 will start at the end of 2009 or early 2010. The project team will consist in 4-6 persons representing the care-giving professions involved in inserting the data as well as at least one IT specialist. A requirement is that the participants have insight into both the medical and healthcare world as well as into information technology. A larger interest group of perhaps 60 persons will have access to the team’s work and its progress consisting in care-giving professions, secretaries, managers, software developers etc.

**Overview of empirical data**

Data will be collected from complementary sources:

1. *Technology*: From KPE we collect the materials produced by the participants during projects. To follow the development of artefacts, from the Content view we will retrieve the following data: the creation, editing, versioning, tagging of and commenting on content items. From the Process view, data will be collected regarding the creation of tasks and milestones. Other Log data represents various other activities conducted in KPE, and how the Analytic tools have been used by the participants.
2. *Field activities*: we collect the following data that are external to activities performed within KPE:
   1. *Interactions*: recordings of planning sessions and meetings between the project leader and researchers, selected project meetings where KPE is used in F2F sessions.
   2. *Reflections*: stimulated recall sessions and interviews with selected participants; the participants’ answers to reflective questions about the use of KPE, e.g. describing: their intention and actual use of KPE, the problems of using KPE according to the collaborative organizations of trialogical project learning, suggestions of the improvements of KPE functionalities and the pedagogical setting

**Exploiting semantic technology**

The semantic functionalities in KPE are expected to be used for managing and coordinating the artifact production in the project team’s problem-solving process. These include semantic tagging and semantic linking of various content items produced during the process to represent conceptualizations, models, ideas and solutions for the team’s target problems. Semantic functionalities linked with analytical tools are supposed to support the participants in finding and re-using the produced knowledge objects and managing and reflecting on the process. Analytical tools involve the Open search tools, awareness functionalities (of epistemic objects, session activities and individual participants’ activities), Data export and Timeline view.

# Contributions to the trialogical learning approach

All research cases concentrate on the use KPE and on semantic services supporting the trialogical activities (a more elaborate table of new tools and functionalities used in the research cases can be found as an Appendix). The trialogical learning approach supported by KPE is expected to provide means for strengthening the aspects of collaborative knowledge creation (see Deliverable3.3), moving beyond existing pedagogical approaches on collaborative learning, e.g., knowledge building, problem-based learning, progressive inquiry learning. It expands our understanding of the use digital technologies for learning, usually labeled as CSCL studies and studies in the learning science, along the following dimensions:

* Through the semantic layer we can trace the history of the students/participants work activities with version of the knowledge objects
* The knowledge objects represent the learning in the knowledge domains that is investigated in the project
* Given that the knowledge objects can be revised by individual participants and as part of collaboration the objects become the collective outcome of the activities.
* The KP-Lab cases are based on designed field trial in naturalistic settings over a period of time which makes it possible to test out both the trialogical inquiry model, tools, and infrastructure in realistic settings

The four cases will contribute for further specification of the trialogical learning perspective (see Table 2). Together these aspects makes new contributions to the technology-enhanced learning (TEL) research since it adds temporality (days and weeks), new tools and the continuous work and revision of knowledge objects, and makes it possible to trace both individual and collective contributions in knowledge creation in different knowledge domains. A review of the CSCL field shows that a combination of these aspects represents a new approach to TEL research.

**Table 2.** Cases’ contributions to trialogical theory, and tools/functionalities used

| **CASE** | **Trialogical theory contribution** | **Tools / functionalities** | **Arguments for using these tools/ functionalities** |
| --- | --- | --- | --- |
| 1.  UU/  UiO | Elaborating on the influence of the collaborative development of knowledge objects on teaching and learning practices | Content view (spatial organization); Process views (revision of plans); Versioning (of files, Google-docs /Wiki); Object-bound chat; Object-bound commenting; Semantic tagging; Timeline View; Visual Analyzer | This integrated set of tools supports teachers and students to review and analyze their collaborative development of knowledge objects and organization of content based on self-defined semantics.  The functionalities enable teachers and students to trace changes in their knowledge objects, inciting them to evaluate and subsequently improve their collaborative activities |
| Examining the relationship between transformations of teachers coaching practices and students’ collaborative creation and use of knowledge objects | Data Export, Timeline View, Visual Analyzer  Content view (spatial organization)  Versioning (of files, Google-docs /Wiki) | These tools support the monitoring of changes in both teacher’s and students’ activities in KPE. This allows to link these two levels of activities, relating how and when teachers’ intervention resulted in new object-bound activities by students |
| Explicating the relation between productive interactions in students’ collaboration and collaborative creation and use of knowledge objects | Object-bound chat and Versioning (of files, Google-docs /Wiki)  Content view (spatial organization)  Object-bound commenting  Data Export, Timeline View, Visual Analyzer | The object-bound chat enhances students’ object-related discussions (productive interactions), which means that it allows students to focus more epistemic communication enhancing their understanding of their knowledge creation process.  The tools supporting collaborative editing allow students to build up on each other’s contributions, and monitor them through the versioning process. |
| Developing and testing indicators of trialogical activities | Versioning (of files, Google-docs /Wiki); Object-bound chat; Object-bound commenting; Content view (spatial organization); Process views (revision of plans); Semantic tagging; Timeline View | The tools enable teachers and students to: (a) collaboratively develop and exchange knowledge objects flexibly, (b) conduct discussions focused on their objects and (c) trace the advancement of their objects. Semantic services enables them to organize and tag their knowledge objects with semantics, which stimulates them to reflect on the nature of knowledge objects . |
| 2.  UH/Metropolia | Explicating tool support needed by students and students for monitoring and coordinating trialogical processes | Tagging,  Process viewsGoogle-calendar  To-do-list | Affordances, and scaffolds are needed to support users’ pragmatic and epistemic aspects of practices within the trialogical approach |
| Explicating tool support needed by students and teachers for reflecting on their own practices . | Timeline view,  VALS,  Data Export tool | Affordances, and scaffolds are needed to support users’ reflective activities on their own practices in order to transform their practices |
| Novel knowledge practices emerging from tools supporting multimediation (combining epistemic work with pragmatic, social, and reflective aspects) | Integrated use of functionalities of Content view; Process views; and Community view | Testing the use of KPE functionalities affording several types of mediation in an integrated way to support complex, authentic tasks, and if/how different forms of multimediation are really used in the courses |
| Developing and testing indicators of trialogical activities | Versioning (of Google-docs /Wiki, note editor, files); Object-bound chat; Object-bound commenting; Linking; Content view (spatial organization); Process views (revision of plans) | The tools and functionalities enable users to collaboratively develop knowledge artefacts flexibly and keep track of the advancement of artefacts |
| Explicate the relationship between epistemic advancement (e.g., problematizing and conceptualizing) and organization of project activities (multidisciplinary project work) | Integrated use of Content and process views and Alternative process view | Collaborative work with knowledge artefacts and project work must be supplemented with aspects of inquiry learning and knowledge building to ensure the epistemic quality of outcomes  Using Alternative process view for modelling trialogical inquiry practices (TI model) |
| Research-based guidelines and design principles for organizing educational practices supporting trialogical theory | KPE (integrated use of it) | To collect best practices of KPE use in knowledge creation practices |
| 3.  FHOÖ/ KI | Explicating the relationship between collaborative design strategies and knowledge creation. | Data Export in combination with integrated use of KPE | To provide a comprehensive account of technology mediated collaboration, which will be supplemented with data from project diaries. |
| Explicating different roles of artefacts for knowledge creation in design | Content View (Versioning of Content Items), Visual Model Editor, Timeline View and Data Export | The possibility to keep track of changes and revert to previous versions of content items and visual models supports the exploratory creation and use of artefacts. |
| Explicating characteristics of effective scaffolds for open-ended inquiry in design | Visual Model Language Editor, semantic tagging | The Visual Model Language Editor and Semantic Tagging provide multiple forms of scaffolding easily accessible to the students and teacher. Semantic tagging also provides for easy change of the scaffold in runtime. |
| Identification of novel knowledge practices emerging from tool use (in particular different types of mediation) | Visual Model Language Editor | The Visual Model Language Editor can be used in support of different types of mediation (in particular epistemic and pragmatic mediation) |
| Developing and testing indicators of trialogical activities | KPE and VME (integrated use), Data Export | The tools and functionalities enable users to collaboratively develop knowledge artefacts flexibly and keep track of the advancement of artefacts |
| 4.  UH/ Pöyry /KI | Explicating the object centered activities around shared objects | Content View: Versioning of Content Items; versioning with wiki; Object-bound commenting; Object-bound chat; | The tools and functionalities enable users to collaboratively develop knowledge artefacts flexibly and keep track of the advancement of artefacts |
|  | Explicating the use of semantic and analytic tools in object centred collaboration | semantic tagging; Timeline View; Open search; Linking; | Semantic services support participants to organize, monitor and search the knowledge objects with semantic entities |
|  | Explicating the support for the interaction between personal and social levels | use of community view functionalities Awareness tools of social presence: Awareness tools of individual activities. | Tools are needed to link the individual efforts with collaborative activity. Tracking and awareness tools support the collaborative construction of knowledge objects |
|  | Explicating the tool support for individual and collaborative management of the learning process | Integrated use of Content and process views; Use of tasks and subtasks and linked items | Scaffolds are needed to support participants’ pragmatic organization of practices which are linked to epistemic activities |

The point in time that the KPE tools and functionalities are introduced to the participants in the cases is summarized in Table 3.

Table 3. Introduction of KPE tools and functionalities in cases

| **Tool or functionality** | **Time of intro-duction in cases** | **Use in iterations in cases** |
| --- | --- | --- |
| Main features Content View, Process View, Community View | M 44  M 45  M49  M 50 | Iteration 1 of cases 1,2,4  Iteration 1 of case 3  Iteration 2 of cases 1,2,4  Iteration 2 of case 3 |
| Context bound tools: Context bound chat and commenting | M44  M 45  M49  M 50 | Iteration 1 of cases 1,2,4  Iteration 1 of case 3  Iteration 2 of cases 1,2,4  Iteration 2 of case 3 |
| Collaborative work: Wiki, Google calendar, Commenting, recent changes | M 45  M 45  M 49  M 50 | Iteration 1 of cases 1,2,4  Iteration 1 of case 3  Iteration 2 cases 1,2,4  Iteration 2 of case 3 |
| Tagging, tag filtering, use of tag cloud | M 46  M 45  M 49  M 50 | Iteration 1 of cases 2,4  Iteration 1 of case 3  Iteration 2 of cases 2,4  Iteration 2 of case 3 |
| Monitoring: versioning of uploadable content items, personalization i.e., assigning personal notifications of changes etc. | M 49  M 50 | Iteration 2 of cases 1,2,4  Iteration 2 of case 3 |
| Copying and saving faceted searches, Alternative Process View | M 49 | Iteration 2 of case 2 |
| Visual drafting: Sketch pad | M 50 | Iteration 2 of case 3 |
| Visual Model Editor | M 45  M50 | Iteration 1 of case 3  Iteration 2 of case 3 |
| Visual Modeling Language Editor | M50 | Iteration 2 of case 3 |
| Data Export | M44  M45  M49  M50 | Iteration 1 of cases 1,2,4  Iteration 1 of case 3  Iteration 2 of cases 1,2,4  Iteration 2 of case 3 |
| Timeline View, Visual Analyzer | M45 | Iteration 1 (pilot) teachers, professionals, and researchers as users in all cases |
| Timeline View, Visual Analyzer 2nd release | M49  M50 | Iteration 2 of cases 1,2,4 students, teachers, professionals and researchers as users  Iteration 2 of case 3 |

*Design principles* for the trialogical approach have been a main way of focusing the research emphases in the KP-Lab project (see e.g. Deliverable3.1; Ilomäki & Paavola 2008)[[1]](#footnote-1). The important steps from the development of the design principles will be further elaborated in pedagogical models and substantiated by findings from the re-engineered research cases. Design principles, defined at the early stage of the KP-Lab project provided key characteristics of the trialogical approach to be supported by KP-Lab technology and pedagogy. However, one shortcoming with the design principles was that they were more oriented to give basic characteristics of the trialogical pedagogy, but they were not in themselves sufficient to direct technology development. There are many features of technology needed to support collaborative work and learning in general that were not explicated by the design principles. Hence, technology development was structured as co-design processes, around various user tasks allowing “types of mediation[[2]](#footnote-2)” of trialogical processes in different ways. A common denominator of all these types of mediation supported by the KPE and in relation to the trialogical approach is that they focus on organizing the work on shared objects (knowledge artefacts and practices) and supporting multimediation (that is, flexible ways of integrating other types of mediation mentioned above).

Design principles are still valid as ways to focus areas of interest for the research informing the trialogical approach, but they will be written anew and updated on the basis of the KP-Lab research and tool development. What was missing in the original version of design principles is especially the pragmatic and processual support for trialogical activities and practices. The difference between knowledge building (Bereiter 2002) and the trialogical approach is that instead of just emphasizing idea-centered knowledge advancement (à la knowledge building), the focus is more broadly on collaborative work with knowledge artefacts and practices (see Deliverable3.3). But it means (which was not enough taken into account in the original design principles) that processes supporting trialogical activities must be elaborated in more detail at the theoretical and pedagogical levels. These concern activities organizing the process (pragmatic mediation), dialogical interactions supporting trialogical work (like object-bound commenting, object-bound negotiations), and pedagogical models supporting the trialogical approach. It is also important to differentiate students’ and teachers’ perspective on these processes.

# Methological perspectives on trialogical approach

The investigations in the four cases aim to tap into complex and quite heterogeneous processes of artefact production, knowledge creation and practice transformations. To describe tool-mediated knowledge creation processes and outcomes requires data and analysis at different levels of abstraction and at different timescales. For the last 18 months of the project the research cases will focus on interventions with the KPE involving the use of the semantic services. The interventions are mostly on a ‘meso’ level, but include studies of productive interactions using micro-level data, and also at macro-level. Collecting and differentiating between micro, meso and macro level data, allows for exploration and analysis of the different levels of data and timescales that are present in the studies. The data will include and contribute to exploit what are the collaborative production processes and transformation taking place at each level and timescale. In addition types of outcomes that are achieved will be specified, e.g. collaboratively constructed artefacts such as reports, design products, disciplinary concept development, models, work flow/organizational development, and accumulation of knowledge in tools. This methodological approach will expand on the analytic activities started by D8.4, Research Reports year 1-3. Hence, the focus for analysis will be drawing on

1. *‘micro level’* data for analysis on productive interactions and patterns, and shared object(s) as scaffolds in collaborative working environment, focusing on the substantive content evolution in the production processes of trialogical learning. We consider productive interactions to be the mechanisms that bring about the creation and advancement of the shared objects, and at the same time, are characteristic for productive leaning since they express also advancement in participants’ understanding of the matter. A productive interaction is a collaborative action, dialogic turn, move, or activity which leads to a contribution to the ‘shared object’, or in a direction which advances the shared object with respect to knowledge creation. The productiveness of interactions is assessed in relation to how the interactions contribute to the collective motive of the collaborative activity and to the specific of each activity, i.e. how is a graphical software product improved after an idea was brought in by a project group member, elaborated by the group and applied in the product. The goal of these micro-level analyses is to suggest ‘mechanisms’ which identify particularly interesting interactions. These are described in a specific pattern structure way, which can make them interpretable and usable across contexts. Micro level data are data on short timescale. The sources for micro level data will be combination of field observations and data from the KPE, in particular how the content of the knowledge objects in KPE evolves.
2. *‘meso level’* data will support analyzing activities over intermediate timescales, like a course, to elaborate the evolving development of agency in ability to change and stabilize (observed as interplay of individual, delegated (agency of things), collective, epistemic, disciplinary, institutional agency), and the role of the shared object(s) in terms of a) evolution of content, b) regulative structure, e.g., affordances / action possibilities, and c) transformational potential, e.g., types of mediation (pragmatic, reflective, epistemic, social mediation) in processes and practices under investigation in one course, or comparing different courses. “Indicators” of trialogical activities will be developed, that is, concrete things typical for trialogical activities (like the amount of versioning, object-bound commenting and negotiations, planning and revising tasks, etc), and will be used for analyzing trialogical elements in the courses. These indicators can point to what can be expected to happen if activities are organized successfully from the trialogical perspective. A special focus will be on tracking the evolution of the knowledge artefacts produced collaboratively.
3. *‘macro level’* data will tap into longer-term trajectories of change in pedagogical practices and settings, and point to seeds of transforming practices and institutional challenges in relation to the trialogical approach. To do so, we will draw on results from precious KP-Lab studies (D8,4, D8.4, D9.3 and D10.4) and data-material from the proposed cases.

Even though the idea of multi-level analysis has been proposed for the field of social sciences, it’s very few studies if any that has reported this approach in the CSCL and TEL field. The schema for multi-level analysis in the KP-lab project makes it possible to make interpretation of data that works across these three levels taking temporal and spatial dimensions into account. The analytic schemes combining ‘machine generated’ data and data collections strategies like interviews, observation, and video-recording creates very rich, heterogeneous data sets enabling us to trace knowledge objects over time and to understand how and what students learn over longer periods of time.

The KP-Lab Reference Model will serve to further develop the elaborations and abstractions (generalizations) across the instances of rich and heterogeneous knowledge creation processes. The Reference Model will support the utilization of semantics services for the empirical analysis to elaborate instantiations of generic concepts (e.g. Thing, Activities and Actors) and their properties (e.g., ‘consists of’, ‘continued in’). The Reference Model will be further expanded to accommodate efficient analysis where micro-meso-macro level data of processes on different time-scales to capture the dynamics of trialogical knowledge creation processes.

# Analytic tools to support trialogical processes

Facing the criticism presented in the review report (May 2009), the consortium has clearly reframed the scope of development of the analytic tools. The primary users envisioned for the analytic tools (in Dow4.1) are the end-users of KP-lab technology, that is, all the students, teachers, and professionals. They are expected to use the functionalities of the tools to analyze, visualize, and reflect on their own practices. For example, the Timeline view will support tracing activities around development of artefact(s) and the Visual analyzer will enable query into and visualization of activities the participants have been involved in. For any researcher in knowledge creation practices, these are also interesting functionalities. We foresee researchers as secondary users, and plan targeted methodological development in the comparison of large and seemingly dissimilar and heterogeneous processes by their underlying data representation. The comparison across cases can yield new insights about the activities in knowledge practices by identifying patterned events.

The analytic tools will be based on semantic services, and the underlying data model will be the KP-Lab reference model (please see description of envisaged analytic tools in WPII and the underlying middleware services described in WPIII, see accompanying DoW4).

Two main categories of analytic facilities have been identified:

**1) Facilities supporting automatic data collection for their analysis in third party tools**: *Data Export* tool is about the process of gathering data about activities taking place in the KPE (through the Awareness repository), the users (Users’ database) and the artefacts produced (through the Knowledge repository). This is to provide users with the means to organize and analyze the data collected in its raw form, using a tabular structure that can be exported to third party specialized analysis tools.

**2) Facilities supporting integrated reflection on knowledge creation processes and their analysis**, which means in particular:

***a. Timeline-based analysis*** of knowledge creation processes (by commenting and annotating of visualized events and identifying patterned events for comparisons). The system will also allow users to insert information about external events that took place outside the system to enrich the data with extra information (*Timeline view* – see also Appendix 2 of deliverable D5.6 resubmitted in September 2009).

***b. Visual analysis*** of a selected subset of activities logged in awareness repository (*Visual Analyzer* – see also Appendix 1 of deliverable D5.6 resubmitted in September 2009). The Visual Analyzer provides (a) summarized information about performed users' activities based on user defined conditions and (b) suitable visualizations of the summarized information in a form selected by the user (bar chart, pie chart, etc.). Here, by “summarized information” we mean various aggregations of available data about some objects of interest.

*Detail how the Visual Analyzer and the Knowledge Evolution Analysis tools are expected to exploit the underlying semantic layer.* For all of the three analytic tools described above the necessary middleware services have been designed and are being continuously implemented (all those, which will be needed for M44 release of analytic tools, are available already). The design of the semantic middleware services has been extensively described in D5.6 (in DoW3 referred as Analytical and Knowledge Mining Services, in DoW4.1 more appropriate name has been selected, namely Knowledge Analysis Services – KAS). KAS are inherently semantic services, providing results in two alternative semantic representations, namely Trialogical Learning Ontology (e.g. eventAggregation service) and Reference model (e.g. activityAggregation service). Moreover, KAS will enable to comment and semantically annotate events and patterns representing knowledge practices identified by users via visualization on the Timeline view. These semantic descriptions will be used e.g. also in pattern matching mechanism when searching for similar patterns as those defined by the user.

Research in related areas has produced several existing approaches to analysis of processes that are briefly described below; but to our knowledge there is no particular approach focused on knowledge creation processes, trying to analyze the employed knowledge practices, which we see as major advancement with respect to the state-of-the-art processes analysis tools.

Process mining provides functionalities for extraction of potentially useful information from event logs. Logs of events are results of monitored activities over the performed processes, especially business processes, but we believe that it has potential to cover different types of processes as well. Processes in this case are represented as workflows. The process analysis consists of several phases: creation of planned process model; monitoring of performed events; creation of actual process model based on logged events; analyses of acquired model as identification of deviations in process structure; description of causal dependencies between process elements; particular activities represented by events, performance statistics, etc. The work in ProM (Alves de Medeiros et al. 2008) represents a generic open-source framework for implementing process mining tools in a standard environment. The ProM framework receives as input logs in the Mining XML format (MXML). Currently, this framework has plug-ins for process mining, analysis, monitoring and conversion. As our experiments (we took process data from KP-Lab extracted by History-Participation Awareness services) proved that the ProM approach is not suitable for analysis of loosely structured processes which are typical in knowledge creation. We wanted to focus on the main essence in knowledge creation processes trying to offer users such a tools that make them able to identify and extract interesting knowledge practices. The result is the idea of Timeline View as the major supporting analytic tool for such kind of analysis. Building on suitable form of visualization and presentation of extracted (semantic) information from the processes appropriate to the users’ navigation in the Timeline, we will provide means to comment, semantically annotate activities, adding also external activities (which have been performed outside KP-Lab system), group them into patterns and look for similar patterns in other processes. This set of features together provides, as far as we know, original approach to analysis of this specific type of processes.

The IST EU project called Super[[3]](#footnote-3) (Semantics Utilized for Process management within and between Enterprises) (Celino et al. 2007) provides features for semantic business analysis based on utilization of semantic information such as ontologies and semantic annotation. They are focusing on generic framework for the definition and computation of business metrics (Pedrinaci & Domingue, 2009) (not only for operational level, but also for the strategic level, Pedrinaci et al. 2009) in an automated manner. Ontologies provide a framework that comprises the relevant concepts for event description, which is similar idea that we had in KP-Lab. An important distinction between Super and KP-Lab approach is that SUPER is focusing on typical business processes, whereas in KP-Lab deal we with completely different processes (i.e. object-oriented, open-ended inquiry), resulting in different requirements and expectations from analytic tools.

An interesting approach to analyze interactive processes in collaborative environments is represented by a methodology based on Social Network Analyses (Nurmela et al. 1999). The logs describe events in a web-based system oriented toward collaborative processes with shared documents. It is possible to identify social structures, knowledge building processes and interesting relations or interactions. In KP-Lab we are addressing the social network analysis approach to analyze data, providing effective and user-friendly way of exporting the part of data suited for such kind of analysis via Data Export tool, leaving the analysis itself on the third party tools, available in several applications on the market.

A framework for analyses and visualizations of collaborative processes was designed within the Kaleidoscope project[[4]](#footnote-4). This framework, called CAViCoLA (Computer-based Analysis and Visualization of Collaborative Learning Activities) provides functionalities to identify existing complex interactions within examined processes (Dimitriadis 2007). The analysis results are visualized in an appropriate graphical format that enables users to make their own interpretations and allows them to reflect on their previous activities. Interaction analysis is not a major target of the KPE analytic tools, although we partially support this kind of analysis via external tools for which Data Export tool is able to prepare suitable subset of data from the KP-Lab system.

The analysis of knowledge creation processes is mainly represented by social or cognitive methods. This means that participants in such processes analyze performed activities based on their experiences and knowledge background with utilization of suitable applications. Our approaches, described above, are focused on analysis of particular types of processes that lead to creation, identification or acquisition of new knowledge (such as collaborative creation of scientific articles or productive inquiry way of teaching a special courses etc.).

## Impact of the KP-Lab research and dissemination

The review report maintained that KP-Lab “continues to make strong contributions to the Learning Sciences, to CSCL in particular, and to a lesser extent to teacher education and to research on Higher Education”. We still think that it is a strength of the KP-lab to have strong impact within CSCL because it is one natural home for disseminating KP-Lab research and technology. Besides the four new research cases, there is research which have been done previously within the project. Some of it is already on its way to be published; some of it will be published as a part of the dissemination activities. Further, as suggested by the review report from July 2009, work is being carried out to plan, coordinate, and execute an analysis of all cases conducted in the KP-Lab project. This work will address, in particular, (a) the development and refinement of pedagogical models and (b) the development and refinement of the KP-Lab technology. This report (part of DIV.6) will contain a report of all cases that have been carried out during the first three years of the project, including the exploratory ones. Cases will be reported in different formats according to their scientific status. Some have been published in journals, in case of which we report the journal article; others will be briefly reported in one or two pages. Each case report focuses on the relevance and impact on the project in terms of objectives, design principles, or practical guidelines. Cases are grouped under three man headings (Higher Education, Professional Practice, Teacher Training), and by each year. After each grouping has been presented, guiding texts conclude the section resuming the main results and implications of that section. The table of contents and the guidelines for the papers are available by September 30. First drafts are expected by October 27th. Second drafts and connecting comments are due by November 20, at which point they are available for review.

In the future the KP-Lab research will focus on providing new ideas and models on collaborative learning and on knowledge practices important in higher education and modern knowledge work, but also on educational technology, organizational studies, teacher education, and technology design (see KP-Lab research on these themes at: http://www.kp-lab.org/publications - Publications). Apart from providing valuable research data, the cases will also serve simultaneously as pilots and demonstrations for the methods and tools developed by the project. Thus, it would be expected that the cases would provide:

* Examples of specific usage scenarios, to which the KP LAB methods and tools can be applied, and practice examples of the implementation of the same methods and tools
* Experiences in the training of knowledge students & workers in the use of these methods and tools
* Cases of good practice in the use of the tools and methods at addressing specific problems

The documentation of such processes will feed into the compilation of these examples and experiences as tools for training and dissemination that are being coordinated by the various work-packages. Processes suitable for further use in dissemination and training will be identified in terms of:

* Relevance of the usage scenarios to other contexts, particularly those experienced by the main target groups of the project
* Transferability of the techniques used (whether teaching techniques, or those used for knowledge transformation)
* Likelihood of adoption of the methods (taking into account applicability in different areas, complexity, ease of adoption etc)

The identification and documentation of these packages for use by the identified target groups of the project, will thus form an implicit part of the research strategy, and will help increase the already existing academic value of the work by enhancing its impact and scope of appeal.

Another important outcome of the KP-lab R&D is a ‘white paper’ for policymaker in Europe. In the white paper we discriminate between how the trialogical approach could be used in professional fields (e.g. teacher education) and in more general programs. The aggregated results of the KP-lab cases and specification of tools to support evolving approaches to learning will provide rationale and guidelines for pedagogical models combined with different types of technologies to transform higher education courses and programs.

An additional evidence of the potential impact of the KP-Lab research in various fields besides CSCL and learning sciences is the use of the knowledge creation metaphor and the trialogical approach in various contexts, for example, in relation to models of E-learning at work (Tynjälä & Häkkinen 2005), collaborative online learning environments (Roberts 2007), Web 2.0 applications (McLoughlin & Lee 2008), knowledge building courses in higher education (Greenhow & Belbas 2007), and Wikiversity (Leinonen et al 2007).

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# An Appendix.

**Table 4**. Priorities of development of new tools and functionalities used in the research cases.

|  |  |  |  |
| --- | --- | --- | --- |
| **DOW4.0 Titles** | **Description** | **Priority for research cases (incl. both usability and functional set impact)** | **Used in research cases** |
| Content View (M44 release) | Consolidation of the tool functionality and usability improvements to the general consistency of the GUI, to the in-place editing, and to the info tab and versioning of uploadable content items using the updated CIS service | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Content View (M48 release) | Similar items functionality for the Item info tab. | average | UH/Metropolia, UU/UiO |
| Process view | Consolidation and usability improvements | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Process view (alternative) | New functionality to provide alternative visualization of the process. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Tailored View | Consolidation of the tool functionality and usability improvements. Improving the technical integration with the VM(L)E tools. | average | UU/UiO |
| Shared Space Network View (M42 release) | The list view of shared spaces. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Shared Space Network View (M48 release) | New functionality for adding a shared space by creating a full or limited copy of an existing shared space. Consolidation and usability improvements. | average | UH/Metropolia, UU/UiO |
| Community View (M44 release) | Finalizing the functionality for group formation and user profile editing, and for defining and changing users’ role in groups | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Chat | Usability improvements and technical integration tasks. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Semantic tagging (M44 release) | Consolidation of the tool functionality and usability improvements. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Semantic tagging (M48 release) | Development of new functionality for providing suggestions for new tags. Semantic services used: Comprehension. | average | UU/UiO |
| Sketch pad | Integration of the tool in the KPE and improving the usability. | average | UH/Metropolia |
| Semantic wiki | Finalization the GUI for semantic tagging and the interface with the KPE. | high | UH/Metropolia,  UU/UiO |
| Awareness (iteration 1) | Common client synchronization for all tools as part of the Real Time Data Access Services. Consolidation and usability improvements. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Help (iteration 1) | Help Forum and context sensitive display of help documents and help video material. | average | UU/UiO |
| Search (iteration 2) | Saving searches (including search criteria and search results), smarter formatting of search results, and searching similar objects. Consolidation and usability improvements. Semantic services used: Comprehension. | average | UH/Metropolia, UU/UiO |
| User Management, Settings and Preferences (iteration 4) | Extensions for defining personal settings of the KPE, such as selecting object notifications, the way of receiving notifications, or selecting the tools to be available in a shared space. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| User Management, Settings and Preferences (iteration 5) | Consolidation and usability improvements. | high | UH/Metropolia, UU/UiO |
| RT Collaborative Document Editing (iteration 2) | Consolidation and usability improvements. | average | UH/Metropolia, UU/UiO |
| Google Calendar |  | average | UH/Metropolia |
| Visual Model Editor (iteration 1) | Versioning of the visual models, logging of actions performed on a visual model and export functionality for visual models, internal consistency check for visual models, Usability improvements (incl. GUI optimization). | high | FH OÖ / KI |
| Visual Model Editor (iteration 2) | Upgrading a visual model to a newer version of the corresponding visual language while resolving the possible inconsistencies; analytical capabilities for exploration of the visual models evolution. | high | FH OÖ / KI (needed for data-analysis) |
| Visual Modelling Language Editor (iteration 1) | Basic VMLE functions - browsing available visual modelling languages (VMLs), creating, copying, commenting and editing VMLs. Adding, editing, commenting and deleting concepts and relations. Stateful web service.  Advanced VMLE functions (comparing visual modelling languages, updating a visual model according to changes in the VML), versioning of the visual languages, analytical capabilities for exploration of the evolution of visual languages. | high |  |
| Data Export (iteration 1) | This release provides extended functionality, according to the users’ requirements and the tests done on the M38 release, improvements of GUIs design and it will add graphical views to the “Social Networks Analysis” function. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Data Export (iteration 2) | The tool will be further maintained and improved in order to fulfil the requirements of exporting additional data. Export of data compatible with Reference model. | average | FH OÖ / KI (needed for data-analysis), UU/UiO |
| Timeline based analysis of knowledge processes (iteration 1) | Timeline view provides visualization of performed activities related to selected artefact (or set of artefacts) or for a particular user (or group) from awareness repository on a timeline. It will include visualisation of all the actions performed on selected object (created, opened, modified, uploaded new version, replaced item, added tag, added comment, using chat). Possibility to comment and semantically annotate events on the timeline as well as add external events relevant to analyzed process on the timeline. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Timeline based analysis of knowledge processes (iteration 2) | Support for description and storing of users’ defined patterns. Identification of similar patterns and/or comparison of different patterns in various knowledge creation processes. | high | FH OÖ / KI (needed for data-analysis),  UH/Metropolia,  UU/UiO |
| Visual Analyzer (iteration 1) | Basic functionalities for analyzing user or group activities within a shared space using graph visualisations produced by this tool. | high | FH OÖ / KI, UH/Metropolia, UU/UiO |
| Visual Analyzer (iteration 2) | Further maintainence and improvement with respect to usability tests and experiences of teachers and students in pilot cases. | high | UH/Metropolia, UU/UiO |

1. The following design principles were formulated at the beginning of the project: 1) Organizing activities around shared “objects”, 2) Supporting interaction between personal and social levels, 3) Eliciting individual and collective agency, 4) Fostering long-term processes of knowledge advancement, 5) Emphasizing development through transformation and reflection between various forms of knowledge and practices, 6) Cross fertilization of various knowledge practices across communities and institutions, 7) Providing flexible tool mediation. [↑](#footnote-ref-1)
2. E*pistemic mediation* relates to creating and working with epistemic artifacts, *pragmatic mediation* relates to organizing knowledge-creation projects and processes, *collaborative mediation* concerns building and managing networked communities required for knowledge-advancement efforts, and *reflective mediation* making visible, reflecting on, and transforming knowledge practices (see in more detail: Deliverable3.3). [↑](#footnote-ref-2)
3. http://www.ip-super.org/ [↑](#footnote-ref-3)
4. http://www.noe-kaleidoscope.org/pub/ [↑](#footnote-ref-4)