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**D9.2 A Collective Case Library about pedagogical models and related practices, v. 2**

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## Executive Summary

This deliverable, D9.2, v.2, has been produced in the context of the Knowledge-Practices Laboratory (KP-Lab) project, which is aimed at facilitating innovative practices of working with knowledge in higher education, teacher training, and professional networks, and the development and integration of technological tools supporting such practices. The deliverable reports the results of ten empirical investigations from the Teacher Training Collective Case Library that were conducted in the M1-M18 period. The Case Library was originally described in M9.1 then in D9.2, v. 1, and its theoretical underpinnings were fully presented in D9.1. In reporting the results of these studies, the priority areas (PAs) identified for KP-Lab's research agenda have been employed in the present deliverable with the aim of building a perspective on knowledge practices in teacher training. In addition, the research cases examine the extent to which the pedagogical interventions underlying each case, which were described in the two previous WP 9 deliverables, can be characterized in terms of the design principles for triological learning. It should be noted that the theoretical and methodological basis of WP 9's research in teacher training was described in D9.1, and that the cases themselves were described in D9.2, v.1 according to their status in M12 (prior to data analysis). Theoretical and methodological aspects discussed here are treated in the present deliverable as complementary to the previous expositions.

Participants of WP 9 in the M1-M18 period included researchers and practitioners in the fields of education, and teacher training specifically, from the Hebrew University of Jerusalem (HUJI), Eotvos Lorand University (ELTE), Utrecht University (UU), University of Neuchâtel (UniNe), Skelleftea Kommun Skeria Utveckling (SKERIA), and University of Oslo (UiO). As a result of reconceptualizing pedagogical research in KP-Lab, which simultaneously served as input to DoW 2, two of the partners have decided to continue their research under WP 8 (UNINE) and WP 10 (UIO) respectively. Nevertheless, their cases are reported in the present deliverable since these represent work carried out in the M1-M18 period.

One of the central goals of the Case Library is to exemplify how triological knowledge practices are instantiated in teacher training. Many of the cases serve as a basis for iterative, longitudinal investigations to be carried out in the M18-M30 period of work, in addition to new cases and activities that are planned for this period, which will be reported in D9.3 (M29), such as the international Teacher Community. On its most general level, by providing a concrete platform for negotiating to take place with the other pedagogical work packages and with the technological work packages, the Case Library contributes to the advancement of KP-Lab theory, tools, and practices. At the same time, it is clear to us that there is sometimes a gap between the cases themselves and the theoretical analysis presented here. Where these discrepancies occur, they should be understood in terms of the evolving understandings about triological learning that have occurred during the actual research, and that did not necessarily precede the empirical work. Juxtaposing the analysis presented in the deliverable with the case descriptions (<http://www.kp-lab.org/publications/public-deliverables/documents-of-the-public-deliverables/KP-Lab-D9-2-Appendix.pdf>) enables us to revise and refine our case research agenda for the upcoming period.

## Contents

Executive Summary.....	3
1. Introduction.....	5
2. Priority Areas .....	7
3. Design Principles.....	10
4. Research Approach and Methods.....	11
5. Case Analyses according to the Priority Areas .....	12
PA 1: Managing collaborative design in teacher education.....	12
PA 2: Retooling boundary crossing between education and work.....	18
PA 4: Creating teacher networks that foster professional transformation .....	25
PA 5: Developing capabilities of transformative learning and knowledge management in work places by reflective tools and practices.....	31
PA7: Developing technology-enhanced practices for scientific writing .....	34
6. General Conclusions.....	38
Research findings and implications for knowledge practices in Teacher Education .....	39
7. References.....	40
8. Appendix: Case Descriptions listed according to the Priority Areas .....	41
PA 1: Managing collaborative design in teacher education	
PA 2: Retooling boundary crossing between education and work	
PA 4: Creating teacher networks that foster professional transformation	
PA 5: Developing capabilities of transformative learning and knowledge management in work places by reflective tools and practices	
PA7: Developing technology-enhanced practices for scientific writing	

**The Appendix** with the case descriptions is available on the KP-Lab web site at:

<http://www.kp-lab.org/publications/public-deliverables/documents-of-the-public-deliverables/KP-Lab-D9-2-Appendix.pdf>

# 1. Introduction

The present deliverable has been prepared within the framework of the Knowledge Practices Laboratory (KP-Lab) project, which seeks to understand learning in terms of how people create their own knowledge and transform their practices by developing and advancing common objects of activity. The term dialogical learning is employed to denote those activities where learners are collaboratively developing shared objects of activity, such as conceptual artefacts, practices, and products in a systematic fashion (Paavola & Hakkarainen, 2005). The main goal of the KP-Lab consortium is to develop theoretical models, pedagogical approaches and methods, and technological tools that elicit the deliberate creation and advancement of knowledge as well as the corresponding transformation of knowledge practices in education and workplaces.

To provide a platform for researchers, developers and end-users to create a shared understanding of current knowledge practices and to envision the integrative design and evaluation of novel technological tools and pedagogical methods, a co-design approach is employed (KP-Lab, 2007). This approach underlies the framework for describing and systematizing the design process. The co-design framework involves a cyclic process wherein theory and research on the one hand and pedagogical and technological development on the other are integrated. This integration is accomplished by dividing both the design and the evaluation practices in the KP-Lab project into four layers: theoretical, practical, technical, and a boundary layer that joins the practical and technical layers.

Work in WP 9 relates primarily to the theoretical and the practical layers, since we are both concerned with developing an understanding of the knowledge practices in teachers' teaching and with learning (including their ongoing learning as they teach) and teacher training contexts. We are doing this through design-based studies investigating the relations between pedagogical interventions and evolving practices based on principles of the perspective of dialogical learning on these practices. (See KP-Lab deliverables D9.1 and D9.2, v.1, where many of these studies included various types of pedagogical interventions, but where some of the studies described there did not yet include interventions but were analyzing current practices, with the view to implementing interventions in the next phase). Accordingly, in D9.1 we presented a theoretical overview of knowledge practices in, and visions for several teacher training contexts. Subsequently, in D9.2, v.1, we used a case-based approach to characterize current as well as envisioned knowledge practices that may take place within the teacher training contexts selected by partners. The sixteen cases comprising D9.2, v1 were described using the theoretical framework explained in D9.1 and were subsequently grouped according to the pedagogical interventions that characterized them, exemplifying the nature of knowledge practices in these teacher training contexts. As such, these cases served as stepping stones in the process of creating an initial shared understanding of how the dialogical perspective on learning could be applied to concrete practices in teacher education. In addition, the cases constituting the original Teacher Training Case Library were central to inform the planning and execution of empirical research into teacher training.

Of the sixteen cases comprising the previous report, ten of the cases represented empirical research carried out in M6-M18 (ELTE – 3 cases, HUJI – 1 case, UNINE – 3 cases, UiO – 1 case, UU – 2 cases). The other six cases represented, either past research that added to our theoretical and empirical understanding of knowledge practices in teacher training settings (SKERIA – 3 cases, UiO – 1 case), or envisioned teacher training contexts for future research (HUJI Cases 2 and 3).

The focus in the present deliverable – D9.2, v. 2 – is on the ten cases in the Case Library that were subject to empirical research. In general, the studies reported in this deliverable aimed at

investigating the extent to which design decisions (i.e., decisions according to which certain interventions were introduced into a particular teacher training context) supported knowledge creation processes and the transformation of knowledge practices in these teacher training contexts. Such analysis has been conducted by each WP 9 partner in relation to their own case(s), and can also be viewed more generally, from a knowledge practices perspective that attempts to describe the practices underlying teacher training and to make a statement about how these can be supported.

In order to report our results in a more generalizable and structured way within KP-Lab (thereby allowing comparisons with work of other pedagogical WPs), we have – in the six months separating the two versions of this deliverable – revisited the concept of "pedagogical interventions" that provided the organizational framework for categorizing cases at the earlier stages of our research when interventions were being designed. We now find that a more coherent characterization of the case research is enabled by viewing the cases from within the framework of design principles as applied to WP 9, and in terms of how these cases advance our work according to the priority areas (PAs) defined in DOW 2. Each of these priority areas incorporates research cases in which similar knowledge practices are enacted that instantiate a particular set of trialogical principles.

The main aim of the present deliverable is therefore to present a coordinated examination, through the conceptual framework provided by the design principles, of the ways in which knowledge practices develop. The analysis relates to the ten empirical cases in the Teacher Training Case Library. Based on these evaluations, new requirements are ultimately suggested on different levels of abstraction for pedagogical methods, technological tools, organizational aspects of teachers' work and their learning, and future research.

The present deliverable reports on the empirical research that was performed up to M18 and which has focused on knowledge practices of in- and pre-service teacher populations (both of whom are at once teachers and learners, applying their ongoing learning into their teaching practice). Taking into account the diversity of these cases, we categorize them in according to a taxonomy consisting of the priority areas mentioned above.

The present deliverable is a logical and chronological continuation of D9.1 and D9.2, v.1 in that it principally reports on the implementation of particular configurations of design principles (i.e., design principles as represented in the different priority areas) in relation to the cases. Most of the cases reflect implementation of pedagogical practices using existing technologies because specific KP-Lab tools were not yet available in the M6-M18 period in which the studies were conducted. However, we expected that these cases would nevertheless reveal important trends about the ways in which knowledge practices may change when any technologies are introduced to the learning and teaching context that are, at least to some extent, new to the users.

In the following sections of this document, we first consider the KP-Lab priority areas and design principles before discussing how particular sets of these principles are instantiated within the cases belonging to the respective priority areas. Subsequently, for each priority area, we report on the results of the first KP-Lab studies in teacher training. Where a priority area includes more than one case, one case is presented in detail and is compared to the others in order to enable understanding of commonalities and differences with the other cases. As some of the case research was already under way prior to the launching of the project – or was begun during the early stages of KP-Lab when many of the theoretical and methodological ideas were being developed, we treat our findings with caution while using them as a frame of reference for our design-based research in the future. Relating our findings to the PAs identified in KP-Lab will help us to re-design our cases accordingly, both in terms of the design principles themselves, and of the tools which we are going to use. Therefore, we

consider the present organization of our cases according to KP-Lab PAs as a benchmark for continued work in the next period (M19-30) Based on the empirical results reported, we conclude by suggesting plans for research in the next implementation cycle and how our efforts inform high-level requirements for KP-Lab tools and pedagogical methods.

## 2. Priority Areas

The cases in WP 9 reflect a variety of knowledge practices since they vary in terms of teachers' pedagogical beliefs and approaches, content areas involved, activities presented to learners, and organizational designs in the related schools, teacher training colleges and university education departments. From the research point of view, this variety results in a diverse array of teacher training cases that differ with respect to: a) the focus of research, b) the type of data collected, c) the granularity of the data selected, d) the characteristics of the courses selected for study, and e) organisational contexts).

In the establishment of a coordinated research direction for KP-Lab, scientific coordinators and pedagogical partners engaged in the creation of a taxonomy that would represent a way in which design principles are instantiated in the respective research cases and which considers the central areas of interest in knowledge practices from the field. As a result, KP-Lab research in all the pedagogical work packages has now been clustered around the following eight priority areas of investigation:

1. *Managing collaborative design in higher education* involving efforts of co-designing of various artefacts by educational and professional communities;
2. *Retooling boundary crossing between education and work* in terms of providing collaborative and mobile tools for students engaged in field work;
3. *'Knotworking' in complex learning environments* by providing tools for systematic reflection and semantic annotation of authentic work situations;
4. *Creating teacher networks that foster professional transformation*;
5. *Developing capabilities of transformative learning and knowledge management in work places* by reflective tools and practices;
6. *Ontology-based collaborative modelling*;
7. *Developing technology-enhanced practices for scientific writing* by providing tools that scaffold collaborative production of knowledge as prototypical dialogical activity;
8. *Contextual investigation of knowledge practices in personal use of students*.

These priority areas coherently depict the ways knowledge practices are actualized within KP-Lab courses and set the stage for determining tailored research questions and corresponding research strategies, methodologies and technologies. In accordance with this, we have grouped and reported the WP 9 research cases in this deliverable employing those priority areas that proved to be relevant. The following table provides an overview of the cases reported in the presented deliverable according to the relevant priority areas.

Partner	Site/case	Time	Participated students / teachers	Tools used	Data collected
<b>PA 1. Managing collaborative design in higher / teacher education</b>					
	Visualization in art and science education	September 06-June 07 (2)	2 university instructors / teacher	Email, forum PowerPoint e-Portfolio software	<i>Process:</i> e-Portfolios by pre-service students

Partner	Site/case	Time	Participated students / teachers	Tools used	Data collected
ELTE		semesters)	trainers 1 software developer 1 researcher 1 PhD student 10 pre- and 47 in-service teachers	MOVELEX VLE: - Task database - Test constructor - Image maker - Animator	Survey on learning processes and course satisfaction by in-service teachers  <i>Product:</i> Knowledge artefacts by pre- and in-service teachers
UNINE	Argumentation in Science Education	October 2005- June06	25 students (pre-service teachers) + 18 students (pre-service teachers)	Digalo	Pre and post-questionnaires, written accounts, Digalo maps, observation
UU	Innovative Knowledge Communities at Secondary School (UniC)	July 2006 – March 2007	4 researchers, 1 school leader, 4 teachers, 1 project coordinator, 1 pedagogical expert; 20 students	E-Mail PowerPoint FLE3 Internet Forums Video editing software Programming software 3D visualization software	<i>Products:</i> knowledge objects (i.e., reports, concept maps, and comments), pre-and post questionnaires and interviews, <i>Process:</i> observations from video recordings obtained during meetings and audio recordings of teachers' pedagogical practices
<b>PA 2. Retooling boundary crossing between education and work</b>					
HUJI	Cross-boundary contexts and practices in EFL	October 2006 - June 2007	18 students (pre-service EFL teachers) 3 college instructors 1 English teacher and her class of 35 pupils	Email PowerPoint HighLearn LMS and discussion forums User-selected synchronous communication tools (ICQ, Skype, etc.)	Interview data and reflections from college instructors, English teacher, pre-service student teachers Sample artefacts developed by student-pupil groups, e.g. PowerPoint presentations Samples of student-pupil virtual interactions through emails
UNINE	"The Russian Dolls" Model in the Teaching and Learning of Music	Still ongoing	Still expanding	Music recorders, electronic platforms (Claroline, Educanet2)	Video and audio recordings (mp3), diaries, online documents
UNINE	Bilingual Education	Still ongoing	~ 200 bachelor students	Claroline, Forum	Online documents, forum data, apprenticeship dossier (of the students)
<b>PA 4. Creating teacher networks that foster professional transformation</b>					
ELTE	Multi-grade Teacher Community	September 06-June 07 (2 semesters)	2 university instructors / teacher trainers 1 PhD student 22 in-service multigrade school	Email, forum PowerPoint  Teachers' manuals  Student work sheets PowerPoint series	<i>Process:</i> School survey (history, present status, relationship with local society,  ICT Skills and Educational Strategies Surveys  Blogs by 12 teachers about innovative programs

Partner	Site/case	Time	Participated students / teachers	Tools used	Data collected
			teachers		<i>Product:</i> Knowledge artefacts by teachers and students  Anthropological photo documentation of 18 schools and their geographical / social environments
ELTE	Teaching Authentic English through Communication-based ICT Tools (EFL)	February 07-June 07 (1 semester)	1 university instructor/ teacher trainer 1 educational researcher and PhD Student 19 pre-service teachers	Collaborative online knowledge building in the LMS Moodle  Blended learning	<i>Process:</i> 2 types of questionnaires to the pre-service teachers: one focusing on ICT competence, the other on participant satisfaction and communication  Log file data analysis Interaction analysis  <i>Product:</i> Course artefacts such as forum discussions of groups, and knowledge artefacts produced by the groups
<b>PA 5. Developing capabilities of transformative learning and knowledge management in work places by reflective tools and practices</b>					
UiO	Wiki in English as Foreign Language (EFL)	February 2006-June 2007	Researcher, 1 teacher and 30 learners	MediaWiki, Xwiki Email, Chat, Search engines, Fronter LMS	Video of interactions Log files Field notes interviews
<b>PA 7. Developing technology-enhanced practices for scientific inquiry and writing</b>					
UU	Characterization of Knowledge Practices during Scientific Writing in Web-based Learning Environments (WebLE)	February - April 2007	2 tutors, 4 bachelor students in educational sciences	E-mail Powerpoint Blackboard Mepa Shared Space COFFEE VCRI DREW DIGALO	<i>Products:</i> pre-questionnaires that were contextualized to this particular course (categories: understanding and expectations of the course's purpose, prior knowledge of the domain, aspects of collaboration, epistemic agency, working on shared object, tool usage), the produced artefacts that were placed on the Blackboard system, <i>Process:</i> video recordings and observations of the interactive lectures provided by the tutors, audio recordings of students' meetings, email correspondences, and semi-structured interviews with students and their tutors

### 3. Design Principles

Design in the KP-Lab project involves the creation and the development of pedagogical methods and technological tools based upon design principles which are grounded mainly in the dialogical perspective on learning. The design principles serve as guide and as generic criteria in the co-design process in the sense that the cases that have been created attempt to situate and contextualize the knowledge practices they prescribe within particular pedagogical contexts. Hence, the cases in this deliverable can be conceptualized as operationalizations and concretizations of the design principles and can accordingly be employed as boundary objects for facilitating communication and development within the project. Nevertheless, design principles are provisional, implying that they reflect the current understanding within KP-Lab and will therefore be subject to continuous review and, if necessary, revision or extension based on empirical results and/or renewed thinking. The design principles that originally formed the basis of the first implementation round of the teacher training cases were the following (from KP-Lab Wiki:

<http://kplab.evtek.fi:8080/wiki/Wiki.jsp?page=DesignPrinciples>):

#### 1. Focus on dialogical activity around shared objects

A central idea of dialogical learning is that work and learning are organized around developing some shared objects of activity. These shared objects can be, for example, conceptual artefacts (emphasized in knowledge building), or social practices (emphasized in activity theory), or products and product plans developed in companies, e.g. as in Nonaka & Takeuchi's (1995) model of organizational knowledge creation. In dialogical learning the interaction happens through developing these shared objects of activity.

#### 2. Interaction between the personal and social levels

One central concept in dialogical learning is the knowledge creation approach on learning. This approach is aimed at transcending the dichotomy between the acquisition approach on learning (which emphasizes individuals) and the participation approach on learning (which emphasizes social participation and practices). The dialogical approach does not concentrate only on what is happening within individuals' minds or how individuals learn, or only on collective processes or social practices as such, but on those processes where people are developing something new and combining individual initiatives and social processes for developing novel objects of activity.

#### 3. Eliciting (individual and collective) agency

Dialogical learning has its basis on epistemic agency of the participants; both agency of individual participants on their own efforts but also on collective agency supporting social processes and collaborative efforts. KP-Lab should provide tools and practices for supporting such forms of agency.

#### 4. Fostering long-term processes of knowledge advancement

Processes of transforming existing knowledge practices and developing something new usually take a lot of time (whether this is in relation to individuals, groups or social institutions). The dialogical approach should provide tools and practices for supporting knowledge practices and collaboration around shared objects, not just here-and-now, but also within long-term processes. In other words, support should be provided for using and building on previous knowledge and practices when creating something new.

#### 5. Development through transformation and reflection

Models and theories belonging to the knowledge creation approach (which is a basis for dialogical learning) emphasize development through interaction between various forms of knowledge (e.g., tacit, explicit, theoretical, practice-bound, procedural) and between knowledge practices and conceptualizations. This means, for example, that interaction and

transformations between tacit knowledge, actual practices, and theoretical concepts are a driving force in processes of knowledge creation.

#### **6. Cross-fertilization of knowledge practices**

Knowledge work in KP-Lab engages people in solving complex, authentic problems and producing objects also for purposes outside the educational institution. In teacher training contexts, support should be provided for cross-fertilization of knowledge practices occurring between educational institutions where teachers are *working*, or engaged, in teaching practice, and *learning* frameworks aimed at developing teachers' professionalism at the pre- or in-service levels.

While design principles are grounded in theory and provide indications of how to achieve the goals of the KP-Lab project, the cases are closely bound to, or situated in, particular teacher training contexts. The cases in this deliverable reflect partners' understanding of how KP-Lab design principles can be operationalized to foster novel ways of working with knowledge within their respective educational contexts.

The broad nature of the KP-Lab design principles allowed for research into a heterogeneous array of cases in which different knowledge domains, activities, target populations, and pedagogical and technological requirements could be addressed. Rather than defining a strict or fixed set of cases to be implemented, KP-Lab design principles inform instructional design for multiple pedagogical contexts. This is in keeping with the view that knowledge practices are highly dependent on the context in which they are enacted (Lave, 1988). The WP9 cases thus reflect the pragmatic instantiations of particular compositions of KP-Lab design principles. The effectiveness of the decisions made in constructing the cases and during their implementation has to be assessed against the assumptions built into these 'artefacts', i.e., the KP-Lab design principles.

#### **7. Flexible tool mediation for triological activity**

The triological approach is based on the idea of mediation, i.e., activities of human beings are seen to be mediated by tools, signs, artefacts, and social practices which people can develop collaboratively and with cultural means. The triological approach has its basis on flexible tools that facilitate those aspects highlighted in other design principles, fostering long-term, cross-fertilized work around shared objects of activity, which involve interaction between personal and social levels, and which help to make transformations between various forms of knowledge.

## **4. Research Approach and Methods**

Research within KP-Lab aims to examine how innovative knowledge communities transform their knowledge practices which revolve around the creation and advancement of knowledge objects. A more holistic and process-oriented approach is therefore needed. Rasmussen and Ludvigsen (submitted) suggest that CHAT (cultural historical activity theory) enables us to understand changes occurring when reforms or interventions are introduced into a system, not only in terms of intentional changes that are seen to have occurred or not, but also in terms of changes that do happen, whether intended or not. The authors contrast this bottom-up approach to research with Larry Cuban's top-down historical analysis and points out that the emphasis should be, not only on what is or is not there (for example after ICTs are introduced into a system) but on how different players use ICTs and on what happens.

The approach proposed by Rasmussen and Ludvigsen involves multi-level analysis and implies that multiple layers of data will be gathered in a variety of ways about a given system. The design-based studies reported here are compatible with this approach and allow identification of patterns in knowledge practices that emerge from the empirical data (e.g., Brown, 1992; Collins, Joseph, & Bielaczyc, 2004) since, from a methodological point of

view, we are not carrying out cause-and-effect studies, but attempting to trace relationship and processes within different teacher training contexts based on some changes introduced into them.

Each of the cases on which this report is based conducted their research using their own data-gathering tools and distinctive methodological variations, but they all attempted to give detailed characterizations of the learning and teaching processes underlying teacher training practices and that mostly combined qualitative and quantitative approaches. In accordance with the approaches characterizing a qualitative research paradigm, multiple sources of data were gathered, such as observations, questionnaires, participant reflections, audio and video recordings, and content analysis of artefacts such as blogs and forum entries. In most cases, triangulation was possible on various levels.

Each case has been followed up in its own right and various cases have been presented as separate research papers in a variety of international and national forums (e.g. Schrire, 2007; Sins, 2007; Sins, Damşa, & Andriessen, 2007; Kárpáti Ed., 2006; Kárpáti, 2006, 2007; Kárpáti, Török & Szirmai, 2006, 2007 and to appear)). Many of the cases are longitudinal studies, and will continue to be followed up in the coming period of the KP-Lab project. The individual case summaries are presented in the Appendix to this deliverable, but in the following section, we present the main research outcomes within the framework of the KP-Lab design principles and according to priority area.

## 5. Case Analyses according to the Priority Areas

In general, our research efforts have been directed at investigating the developments in knowledge practices as a result of the implementation of KP-Lab learning principles and (where possible) technology. Although the first iteration of KP-Lab research cases represents a great deal of diversity, the priority areas described in a previous section encapsulate subsets of these cases which involve the investigation of a particular instantiation of KP-Lab design principles and knowledge practices. In this section, we show how design principles were applied in relation to the priority areas relevant to WP 9.

### ***PA 1: Managing collaborative design in teacher education***

#### *General description and focus*

A central interest in teacher training resides in its potential for teachers to learn from and with one another in ways that support instructional improvement and their professionalism. Resources for teacher development and the improvement of teaching are created in and through interaction with others. This means that teachers are challenged to learn to go beyond their individual efforts and to collaborate within multidisciplinary communities for the advancement of their knowledge practices. A distinctive application that complies with the perspective of dialogical learning concerns communities in which teachers, educators, research and other actors concerned are engaged in the *collaborative design* of curricular *artefacts*, such as instructional modules, assessment rubrics, educational ICT applications, and written educational reports. In the domain of teacher education, the focus in this priority area is on collaborative design practices of pre- and /or in-service teachers (who are also engaged in their own learning or developing professionalism) with their own learners and other professionals in the work place (the school setting) or training environment as they create and advance shared knowledge artefact that are relevant to advancing their knowledge and needs. Collaborative processes between partners from multiple fields of knowledge call for managing of a new kind of interagency supported by collaborative strategizing and

technology, in addition to creating conditions that encourage constant reflection on an individual level.

The priority area *Managing collaborative design in teacher education* consists of the following three cases: ELTE – Visualization in Art and Science Education, UniNE – Argumentation in Science Education and UU – Innovative Knowledge Communities at Secondary School (UniC). The UniC case will be employed as a stepping stone for reporting the main results of the research cases within this PA. Typical research questions in this priority area as applied to teacher training are:

1. How can teachers' participation as learners within collaborative knowledge communities and/or professional development contexts be characterized?
2. How did teachers' pedagogical practices and / or knowledge of the subject develop during the collaborative design work?
3. How did participation in collaborative knowledge communities relate to transformations in teachers' pedagogical practices?

*Description case: Innovative Knowledge Communities at Secondary School (UniC – at UU)*

This research case focuses on examining the developments in teachers' pedagogical practices that relate to their engagement and participation in a multi-disciplinary team consisting of researchers, teachers, students, school leader, and external experts who collaborate on the design, implementation and evaluation of a new learning module. The main goal this community at UniC attempts to achieve is to develop and to advance an instructional module in which students create their own knowledge and develop agency during technology-supported authentic projects in which they work in small groups on shared objects. To accomplish this aim, the design team is intensively engaged in boundary-crossing practices between the traditional roles represented by the various groups.

This case investigates the ways in which pedagogical ideas are transferred from the context of their design to their actualization in teachers' practices in the classroom. Developments in teachers' pedagogical practices are examined while they collaboratively design learning activities and subsequently bring these ideas into practice when providing guidance to their students.

*Overview of results*

### 1. Focus on dialogical activity around shared objects

The project partners shared the intention to create and to advance the design and implementation of a new course module in the context of teachers' professional development, based on theoretical insights gained from the dialogical perspective on learning. The meetings of the project partners served to improve the design of the module based on experiences of teachers and researchers encountered during implementation of the module and based on socio-cultural theoretical insights. All partners were highly involved in the collaborative design work provided that the goal of all participating parties was shared and the object (i.e., course module) afforded discussions and further elaboration and reflections to advance its implementation. This finding was also reflected in both the cases of ELTE and UNINE in that all participants were highly involved and motivated in the design work and commented on the importance of the shared object providing opportunities for discussion, elaboration and reflection.

Teachers' actions corresponded to transforming and reflecting on their pedagogical practices in such a way to foster students' activities according to dialogical principles. Although teachers acknowledged the importance of changing and adapting their pedagogical role and insights according to the particular student group they encountered, their role mainly corresponded to a more directive and coaching role. This was mainly reflected in the finding

that they and their students reported that they did not have sufficient insight into the object progression of the student groups. Thus, teachers were not able to precisely and consistently monitor their students' activities. This may be due to the fact that, in their social cultural context, it was not common practice to interfere with students' content-related activities. However, they closely followed up on individuals, especially the problematic students (on a cognitive or behavioural level), in order to check if they were doing their work and feeling comfortable with the group and its functioning. Actions of the teachers that subsumed under the main design activities focus on the conceptualization and advancement of their pedagogical practices during the implementation of this module.

Similar results concerning the position and use of shared artefacts in collaborative activities have been obtained in the other two cases belonging to this PA. In ELTE's case teachers, teacher trainers and software developers created new functionalities for technological support in science and art classes, which widened the array of pedagogical options for their discipline resulting in developing and advancing epistemic agency. In UNINE's argumentation case the collaborative design, implementation and evaluation of argumentative scenarios in science class, led student teachers to develop new understanding of teaching practices and knowledge on argumentation in general and in science in specific.

## 2. Interaction between the personal and social levels

The activities of the partners participating in the design team at UniC cut across the practices occurring within the following two intersecting levels: a) that of the students engaged in learning activities, and b) that of the community consisting of project partners who collaborate on the (advancement of the) design of the module based on principles of dialogical learning.

The meetings of the project partners served to improve the design of the learning module based on experiences of teachers and researchers encountered during implementation of the module and based on theoretical insights from the dialogical perspective on learning. The experience of the project partners involved in the design and implementation of the learning module could be characterized by a motivated and engaging atmosphere in which the different voices they articulated contributed to the shared understanding of how to configure pedagogical practices. In addition, both teachers and researchers indicated their role in negotiating about the development of their pedagogical practices as very helpful and inspiring. This finding is also reflected in both ELTE's and UNINE's cases since the reflexive position of the actors that were engaged in intensive collaboration proved to be a source of developing effective practices, from the point of view of these participants. In addition, in these cases, the experiences of participating partners reflected a motivated and engaging atmosphere which contributed to the shared understanding of how to configure pedagogical practices.

At UniC, the role of researchers' participation during the project changed as a result of teachers' articulating that they required more directive feedback on their practices, activities that can be related to the community developing and advancing a shared object. In addition, after several meetings between researchers and teachers, the importance of defining the objects and the criteria for completion with the students was discussed and agreed upon.

Teachers acknowledged the importance of monitoring individual and collective students' reasoning and understanding. Still, it seemed that the teachers, although they had a different role from what was formerly adopted, placed themselves outside the collaboration process which was found in their interactions with their students. This may be related to teachers' holding the epistemic stance that their role should be facilitating the process at a distance instead of being part of the knowledge-creation process. In some cases this led to the problem of some students reporting that they sometimes experienced their teachers' support as being

disruptive in the context of their activities. These observations suggest that an effective balance has to be found between what can be interpreted as top-down instruction at one extreme and social distancing at the other, and as such highlight the importance of the social dimension in supporting collaborative learning and work.

### 3. Eliciting individual and collective agency

Traditionally, the teacher community at UniC can be characterized as highly reflective, since teachers observe each others' pedagogical practices and provide intensive constructive feedback based on their enquiries. Additionally, development towards self-reflective professionalism is strongly fostered at UniC, since a great deal of opportunities is offered for participating in in-service teacher courses provided by teacher training institutions.

The design work requires participants to be highly engaged and motivated to persevere in their shared efforts to reach their own set goals. The project partners shared their intentions to create, advance and implement a new course module based on negotiations around a pedagogical model and acted accordingly. Participants were willing to engage in long-term co-development of the course module to be implemented at UniC and to learn from each other. Also, partners expressed the need for transforming practices to guarantee an effective way of working. This was also accomplished since, for instance, researchers changed their role from more observatory participants to actively engaged participants in the reflection on and co-design of teachers' pedagogical practices, which was due to teachers expressing the need to receive more feedback on their activities. In the Visualization in Art and Science Education case the boundary crossing between the world of work (software design) and education (primary and secondary level art and science instruction) was related to participants' developing agency.

The activities of the project partners and of especially the teachers involved indicated a great deal of agency on their part. They showed responsiveness to feedback of the other partners, reflected on their own practices, were prepared to change their practices accordingly, evaluated their own practices and those of other teachers involved and were very engaged in coming up with new ideas based on their own knowledge and experiences and testing them in practice. For instance, during meetings teachers expressed the need to change their practices in order for these to be more in line with the new pedagogical model and to agree on how to organize their pedagogical practices more structurally. Furthermore, teachers came to acknowledge that they should explicitly address and evaluate student responsibilities in meeting the requirements of the assignment, but also that they wanted to be more responsive to each student groups' needs to be able to foster these groups' practices. In UNINE's Argumentation case it was concluded that teachers should invite learners to discuss their perspectives in argumentation and that teachers should emphasize process rather than responses in order to promote the development of critical thinking among their learners.

### 4. Fostering long-term processes of knowledge advancement

The process of the collaborative design of the learning module at UniC will take place longitudinally, spanning several iterative modules. New teachers and educators will be involved in the subsequent phases of the advancement and design of this module and workshops will be organized around the object of creating and developing an understanding and insight into the pedagogical practices that effectively foster practices in student groups. Moreover, in next implementation rounds of the module, the design team will be engaged in practices revolving around the development and testing of an educational scenario. The argumentation scenarios that were developed by the pre-service teachers in UNINE's case are going to be continually developed, implemented and tested in the classroom with school pupils. Both ELTE's and UNINE's cases in this PA are long-term from the research point of view, i.e., also contribute to the knowledge advancement of the KP-Lab research community.

The teachers indicated that they learned more about coaching their students during the project but that they required more feedback on their practices and expressed the need to further develop their teaching style and roles. The project partners acknowledged that the presence of an external client who collaborated with the student groups on advancing their object, is highly effective in motivating them and providing them with a sense of ownership and collective responsibility. Teachers took up this idea in their pedagogical practices.

On the basis of the results from the first pilot at UniC the framework of knowledge creation, which was employed as a basis for the new module, was collaboratively revisited and made more utilizable for teachers by breaking it down into 6 elements, which will be used to train subsequent teachers and which will be further developed in next implementation rounds: collaboration, knowledge objects, complex problems, presence of client, tools & expertise, and use and sharing of existent knowledge. In ELTE's case, the role of visualization in science teaching will constitute an added layer in the future planned iteration, which builds on the findings from the pilot studies, and collaboration around new knowledge objects (a set of digital teaching aids for Physics).

### 5. Development through transformation and reflection

In the UniC case, interaction between different types of knowledge (i.e., tacit, propositional, declarative, procedural, and explicit) occur on both the individual and collective platform of the design team and is reflected in the behaviour of the participants. Tacit knowledge (represented as the network of implicit epistemological beliefs, attitudes and knowledge) was explicated during group meetings of the various teams, and ideas expressed were often taken up by the group and integrated within existent practices, or became the driving force behind the development of relatively new pedagogical practices. In addition, a great deal of informal learning occurred during meetings between participants and during encounters between student groups and their teachers, presenting the possibility of the development of new pedagogical practice (cf. Eraut, 2000). In the argumentation case, which involved mainly pre-service teachers, the participants indicated that they had developed their own knowledge mainly through the elaboration and implementation of the argumentation scenario in the classroom, suggesting a translation of theoretically based knowledge (about both science and pedagogy) to procedural knowledge, to explicit knowledge (about science and pedagogy).

During meetings of the design team an open atmosphere was created to foster the exchange and elaboration on new ideas to organize and foster innovative practices during the new learning module. The ideas that were taken up by the group were processed to incorporating them into existent practices or leading to relatively new pedagogical practices.

In interviews teachers' implicit conceptualizations of teaching came to the fore which may have affected their pedagogical practices during their encounters with their student groups. In addition, teachers' knowledge and practices interacted with those of the student groups when they discussed the students' progression. Teachers' knowledge and practices took place on the boundary of both student activities and activities of the design group institutionalized within practices occurring at UniC. For instance, although teachers tended to fall back to their traditional 'deliverer-of-knowledge' mode, they were aware of this and attempted to resolve this issue in subsequent encounters with their student groups. Also, in ELTE's case, in-service teachers were challenged to revisit their teaching practices while considering new forms of visualizations. These "translation" processes can be seen as occurring at the boundary between forms of knowledge, practices, and pedagogical conceptualizations.

### 6. Cross-fertilization of knowledge practices

The design team at UniC consisted of partners coming from diverse fields of knowledge, such as: educational sciences, practical pedagogy, psychology, and teacher education. The negotiating between the diverse voices originating from these fields served the development

and advancement of the shared object; that is the new course module. Both researchers and teachers indicated that they experienced the collaborative design work as highly rewarding and noted that both groups contributed equally to the iterative conceptualization and operationalization of the way in which pedagogical practices during the learning trajectory at UniC should be organized. This advantage of cross-fertilization practices in communities is also reflected in UNINE's case, where teachers indicated that they mostly developed new knowledge through the elaboration and implementation of the scenario in the classroom (thus through concrete practices), thanks to collaborative work with their colleagues.

In addition, cross-fertilization also occurred at UniC between student groups and teachers' activities. For instance, some teachers also fulfilled the role of client for some student groups, specifying the criteria of the products students had to deliver. The fact that different roles can be played by either one or more teachers led to cross boundary practices. In addition, a teacher contacted an expert so that students could consult him and ask for feedback. In ELTE's visualization case, the synergy of domains was also evident when stakeholders assumed one another's role: for example, teachers co-developed digital learning tools, students of art and design education offered software design hints, and the software developer co-developed surveys with educational researchers.

### 7. Flexible tool mediation for triological activity

At UniC FLE3 system was introduced to teachers and students to support the work that concentrates on creating and developing expressions of knowledge (i.e. knowledge artefacts) and design. Normally at UniC a self-developed tool is used (i.e., EdUniC), which is an asynchronous electronic learning environment functioning as a virtual blackboard: teachers can upload their themes and assignments, teachers can monitor students' learning and personal development, teachers can communicate with their students, and students can consult school-related information and can upload their finished assignments.

During their projects, students in general used FLE3 as an object repository. The electronic environment FLE3 is merely used for storing information and (group) products. Furthermore, computers were used for searching information on the internet. Incidentally, the computer was used for leisure activities (gaming, surfing on the internet, chatting) during the working session time. Communication within the groups took place mainly face-to-face. Teachers themselves did not make use of the electronic learning environment. They had the possibility to use FLE3 for keeping track of students' work development, but they preferred to ask the group about the progress made.

In the other two cases belonging to this PA, the target groups involved made little use of virtual environments for communication and feedback, preferring to have face-to-face discussions, to use email, or to keep track of students' work by asking the group about the progress made. However, the specific software programs that formed the focus of activity in two of the cases (Digalo for synchronous communication in one case, and Movelex in the other) were effectively integrated in the collaborative work of the participants.

### *Conclusions*

In general, the collaborative work involved in developing the instructional module at UniC was an important trigger to the transformation of teachers' knowledge practices. Also for the other two cases belonging to this PA, the work around the shared objects of the different types served to elaborate and refine existing knowledge practices, and develop new ones. This direction towards more triological practices as far as pedagogy is concerned was evident for all the target populations involved in the teacher training contexts. Data obtained in all cases show that all actors recognized how collaborative work around an authentic artefact fosters a knowledge-building process characteristic of innovative communities.

The research observations regarding tool mediation suggest that new technological tools (being developed in KP-Lab) will advance the collaborative design work of the groups in all the cases and provide additional opportunities for reflection and discussion; however, as indicated in the results reported above, integration of these tools in pre- and in-service learning-teaching activities will require extensive technical and pedagogical support.

## ***PA 2: Retooling boundary crossing between education and work***

### *General description and focus*

On their way to becoming professionals in specific subject matter domains, pre-service teachers doing internships or field training engage in activities aimed at the appropriation of practices (pedagogical, technological, and subject-specific) characterizing the domain. Similarly, practicing teachers undergo in-service training to develop their existing conceptualizations and knowledge practices as teachers. Teacher training contexts reflect the special position of the teacher *vis a vis* knowledge since the teacher-in-training is, ideally, either at once both teacher (of her/his pupils) and learner (of new pedagogical approaches and practices, of new theories regarding the content to be taught, new techniques, new insights about him/herself as a teacher, etc.), or constantly switching between these positions. The teacher who is not constantly reflecting on his/her practice and using the "work of teaching" as "material for continuous learning and personal and professional development" is limiting teaching practice to repetitive sequences once learned and never revisited or renewed. The experience of teachers in training, especially of pre-service teachers, has generally been characterized by a theory-practice "divide" impeding the translation of theoretical concepts learned in the academic situation to actual practice, and the interpretation of classroom events in terms of theory. Darling-Hammond (2006) presents a vision for teacher education that emphasizes "curriculum taught in the context of practice" and advocates coherence and integration among the academic courses themselves, and strong collaborations between universities and schools (cf. Burstein et al., 1999).

To set in motion processes that are seen as underlying best practices in teaching, teacher training contexts should enable cross-fertilization between education (the learning context, e.g. a college or university course, or an in-service training unit in the work place) and work (usually the school). To this end, pedagogical and technological tools are required which enhance the translations between theoretical knowledge and conceptualizations, and practical knowledge, beliefs and experiences. Boundary-crossing contexts present challenges for creative uses of technology, such as providing collaborative tools for students engaged in field work, as well as pedagogical support for teachers in pre- or in-service training in cooperating educational institutions such as universities, college education departments, and schools. Moreover these tools allow for ongoing discussions and negotiations on pedagogical and technological issues as well as iterative processes involving repeating and/or varying interventions.

Three cases reflect the research in this PA: HUJI's "Cross-boundary contexts and practices in EFL" case, and UNINE's "Russian Dolls Model in the teaching and learning of Music" and "Bilingual Education" cases. All three cases have in common a number of interacting target populations: pre-service teachers, in-service teachers, the teachers' school pupils, a group of teacher training colleagues in each case, and a main researcher in each case who is also part of the teacher training group. Interaction between the various intersecting activity systems (which teachers are a part of as they switch from being defined within one population or

another) is triggered when crossing of boundaries is embedded within the different settings of the teacher's practice.

Both the design and the changes in teachers' knowledge practices as they cross boundaries from one setting or context to another are the focus of the research in this PA. The HUJI case is used as the example in this section. The description of this case is presented in some detail, and then the case is viewed in relation to how the design principles apply both within it and in comparison to the other two cases in the PA. The purpose of the description that follows is to show how the adoption of the design principles in teacher training contexts helps to change knowledge practices in the relevant inter-connected systems so that learning and teaching become more dialogical.

*Description case: Cross-boundary contexts and practices in EFL (HUJI)*

In an education college training context, pre-service teachers of EFL (education students) develop their knowledge in subject matter (English written proficiency), pedagogy (teaching approaches and methods in EFL) and technology (application of ICT in teaching). The students immediately apply their knowledge in all three areas in a semi-formal virtual exchange with high school pupils. In small groups where inter-personal connections were established, the students taught the pupils what they learned, and what they learned provided input to their teaching. These processes were part of a spiral-like cycle. After writing about specific topics in their written proficiency studies, the college students used these same topics as the basis for communicating in English through email exchanges and online chats with their pupils. They applied a variety of pedagogical techniques to promote writing among the pupils that they tutored, many of which were adaptations of those that they had themselves experienced as students in their related college courses. Each group also prepared digital presentations in English on topics relevant to all group members. Each small-group then worked collaboratively to develop a presentation on a topic relevant to all group members. In this case, close collaboration was envisaged between the college and school frameworks, and between the knowledge practices of the course instructors in relation to the knowledge domains they represented. Boundary-crossing processes, especially in terms of how these are reflected in connections between different forms of knowledge (theoretical, practice-bound, tacit), and pedagogical metaphor underlying the various participants' practices were analyzed.

In keeping with what was described above about best practices in teaching and teacher training and difficulties facing the field, HUJI's EFL case was designed to establish an appropriate setting for both pre- and in-service teachers (the course students on one hand, and course instructors and school English teacher on the other) to make theory-practice connections as well as connections between knowledge in different domains constituting their study program. The case design enabled an understanding of learning and teaching in terms of boundary-crossing processes and learning-teaching metaphors that go beyond credos of mere acquisition.

The principal objectives of the study were: a) to characterize the boundary-crossing network established at the organizational level (between institutions; between disciplines); b) to characterize the cross-fertilization occurring across these two types of boundary zones. These objectives were translated into the first research question): How do the various players involved in the common activity perceive the connections between the systems? Furthermore, since it was expected that a "dialogical" metaphor of learning – one placing at its centre the idea of knowledge building around a shared object – should be the driving force behind such an inter-disciplinary cross-institutional project, the third objective was: c) to characterize the pedagogical credos of the players involved. This objective was translated into the second research question, which involved defining the pedagogical credos of the teacher trainers, the school English teacher, and the pre-service teachers (the students). Answering this question

enabled a comparison between the various players' views of teaching and learning, in order to establish in what ways similar or different pedagogical credos work to activate collaborative endeavour on one hand, or conflict on the other.

Questionnaires, interviews with the various players involved in the activity, as well as reflections by the researcher (who played the additional role of ICT course instructor) provided data for analysis. Categories elicited from the data included indicators of inter-disciplinary and cross-institutional cross-fertilization and a characterization of the cross-boundary context according to the communication setup, the roles of the various players, and the credos of the parties involved. The context, and the interplay between features of the context, helped to characterize the presence or absence of cross-fertilization.

The three most important features of the cross-boundary context emerging from the data analysis were:

- the communication setup within the teacher team, including the communication between the college team and the school team, and the communication setup between the students (the pre-service teachers) and the pupils;
- the ways in which the various players define their own roles and those of the other players involved in the activity, highlighting the importance, both of reaching agreement regarding role definition and differentiation, and regarding fluidity between roles where necessary, with a balance between role differentiation and "role crossing";
- the necessity for discussing conflicts that emerge during the activity in terms of the credos about teaching and learning in general and in relation to the specific disciplines involved.

The interview analysis with the pre-service teachers, as well as the reflections, pinpointed necessary conditions for the implementation of technology in teaching contexts. The email correspondence within the groups fitted well the learning and teaching agenda of all players involved. Technically, all participants were familiar with email, and it encouraged collaborative work within each group. From the pedagogical point of view, the email involved "writing in English," which had face validity for all participants as "a legitimate activity for learning and teaching English." However, the task of small-group development of digital presentations which are commented by each participant and sent back and forth by email, presented obstacles both to the education students and to their pupils. The task was perceived as too difficult, and the use of technology in this setting seemed artificial. With the exception of only two or three groups, both the students and the school pupils did not understand the benefit of this mode of work (compared to preparing presentations together face to face), and did not see it as a translation of knowledge practices from the world of work (collaborative writing and editing) into education settings.

It is possible that all participants would have seen the benefit of the virtual communication if a technological platform had supported this throughout the course. Re-designing the course for the next iteration would call for establishing such a platform and for assessing knowledge practices in this virtual context.

### *Overview of results*

All three cases in this PA focused on how the theory-practice divide can be bridged as traditionally separate systems become integrated and re-form as new networks. In all three cases, the restructured or new network creates possibilities for teachers in training to move seamlessly from one activity system to another: to transfer knowledge from one course to another, to apply theoretical knowledge (from their courses at university or college) to their practice (in the schools, in the classroom), and to re-conceptualize practical experiences (from the classroom) in terms of theory (learned in university or college courses).

As with the HUJI case, the pedagogical setting in the UNINE Music case has four layers that are intertwined, but this occurs through the researcher, since the layers depend on the different roles taken by the researcher: researcher and music teacher of school pupils, researcher and pre-service teacher trainer, researcher and in-service music teachers, researcher and PhD student working with the director of his thesis. In the UNINE Bilingual Education case, the inter-connected populations are students and mentors. In all three cases, not only the student and in-service teachers, but also the "experts" are both teachers and learners, making constant translations between the learning occurring in the work setting (learning from their experiences and revising their conceptions) and their theoretical conceptualizations about their practices.

On a level of aggregation or generalization, all three cases highlight the role of boundary crossing between learning and work in teachers' developing professionalism. Broadly speaking, the EFL case emphasizes how a boundary-crossing setup can be deliberately constructed in a teacher training context; the Music case emphasizes how pedagogical understandings and practices develop as a result of a constant movement between constructing and implementing pedagogical scenarios and reflecting on them; the Bilingual Education case emphasizes the role of technology and of the learner-mentor dialogue in bringing about pedagogical change. Although different in their specificities, the research questions in all three cases examine what kinds of understandings and insights about becoming a professional teacher, or developing professionalism, can be supported pedagogically and technologically. The pedagogical and technological support involved a variety of interventions described in earlier WP 9 deliverables. Viewing these interventions and the design experiments in terms of design principles defined in KP-Lab sets the ground for better coordination of case-based research in the future and allows comparability across cases within WP 9 and with other pedagogical WPs.

### 1. Focus on triological activity around shared objects

In all three cases, triological activity around shared objects was expected to occur within and between the inter-related population groups described above.

In the HUJI case, each of the pre-service teachers worked in a small group with two to four school pupils to negotiate solutions to a series of teenage problems. The shared object was the negotiated solution, a task demanding intensive virtual collaboration over a set period of time. The task preparation was, in turn, the shared object of activity of the pre-service English proficiency course instructor and the school pupils' English teacher. A second task that was centred on the design of a shared object of activity involved each pre-service teacher negotiating the topic of a PowerPoint presentation of common interest with the pupils in the group and collaboratively developing the presentation, through face-to-face meetings and via email. Both these tasks were aimed at helping the student teachers bridge between their theoretically orientated studies at the college and the practical application of their knowledge in their future world of work, i.e., the school context. The task preparation was also meant to be a shared object of activity between the pre-service teachers' ICT instructor (who was also the researcher) and the school pupils' English teacher, and between all the course instructors on the team, but in this iteration of the case, different perceptions of the relative responsibility of each instructor in this part of the project led to a breakdown in the definition of "shared object" and in the quality of the collaboration. This breakdown was paralleled in breakdowns in collaboration between the pre-service teachers and their pupils.

In UNINE's Music case, the triological object of research was the activity of pupils and teachers with tools (music instruments, recording devices, etc.). This activity was planned via didactical sequences during which pupils in triads compose and collectively perform a rhythm. The central object of shared activity in the teacher training context, with the pre-

service teachers, as well as with music teacher training colleagues was the recording and analysis of what happens in teacher-students-tools interactions during the didactical sequences. The teacher was asked each time to make predictions about what would happen during the didactical sequences, to write these down, then video-record what actually happened. Discrepancies between expectations and real outcomes became a focus of continued shared and individual activity.

In both the Music and the EFL cases, the discrepancies between the expected and the actual can be seen as objects of interest. Some consider these discrepancies as “disturbances” within and across the related systems; others view these not as disturbances, but as means to understand the complexity of the reality in which groups can work together creatively and as providing an opportunity for learning. These disturbances become shared objects for reflection and discussion, triggering new plans, new proposed solutions or changes in the approach. These plans, solutions, or adaptations in both cases are boundary crossing in that they affect all the groups comprising the context (e.g., pupils, pre-service teachers, course instructors, researchers, etc.) and all levels of activity (the class in school, the class in the training setting, the group of teacher training colleagues).

## 2. Interaction between the personal and social levels

The social level in all three cases in this PA involves a small group setting rather than a community as such. The small group may be a dyad, such as the expert-novice dyad in UNINE's Bilingual Education case, the doctoral researcher-thesis director in UNINE's Music case, or the college course instructor-school English teacher in HUJI's EFL case. In addition, as would be expected in cases where the PA is characterized by a boundary-crossing setting, in all three cases, the same individuals are parts of additional but also small groups. For example, in the HUJI case, the course coordinators may at a given point, each be working in a dyadic interaction with the school English teacher, but they also constitute a working group among themselves, with their own procedures and practices, which are manifested at different times and places, and they interact with their student teachers as trainers, each in the framework of her own course. Similarly, the pre-service teachers interact among themselves as a class community, but each also works in interaction with the school pupils in his/her small-group set up in the framework of the project. The learning and teaching in the context of shifting, open-ended groups, means that there is constant boundary crossing across the related activity systems.

In the EFL case, there was clear awareness that the collaborative small-group work among the students and pupils was dependent on first establishing a socially based personal interaction. To this end, certain structures were in place in the project: ice-breaker social activities at a first face-to-face meeting at the pupils' school, the encouragement of constant personal emails between the students and the pupils, and additional organized face-to-face meetings between the students and the pupils. Data collected reveals that most of the groups were satisfied with the social and personal relationships that developed. Moreover, good interpersonal relationships were often a driving force behind successful collaborative work, for example, preventing “slumps” in the email exchanges and related activities. It is significant that, in this case, insufficient attention may have been paid to fostering a similar interaction among the course instructors, which may have impeded successful collaborative planning throughout the project. In both the Music and the EFL cases, the interaction between the personal and social levels is mentioned, especially in relation to the work of the school pupils. In the Music case, the teacher relates to the management of the social relationships among the school pupils in their group's organization around the set task where the children are invited to reflect individually and collectively on their activities. The video-recordings give them feedbacks and serve to sustain joint attention to common objects of discourse.

### 3. Eliciting individual and collective agency

In the EFL case, the development of epistemic agency was not explicitly embedded in the design. However, the case analysis on completion of this iteration of the project strongly suggests the important role epistemic agency could play in such a project. A successful process of work in the student-pupil groups was related to the responsibility and initiative each member, especially the student (the pre-service teacher), took on in the group and their feeling of collective responsibility for the group as a whole. A similar conclusion can be drawn regarding the group of instructors, where the breakdowns described above could be seen as related to the absence of collective agency. This was the result of the course instructors perceiving the extent of their involvement in the project differently. At the end of the year's work, there was explicit acknowledgment by the instructors that much greater collective involvement and collaboration were needed.

In the Music case, one of the explicit research questions was how the pedagogical situation for the teaching of music could be designed to help the pupils develop creativity and epistemic agency. The design of the pedagogical situation enabled pupils to develop a critical point of view on their production and better it. It also allowed teachers to be “co-authors” of the didactical sequences that they improve on the basis of their self-monitored observations.

### 4. Fostering long-term processes of knowledge advancement

The two UNINE cases are longitudinal from the research point of view within KP-Lab, and can therefore be seen as contributing to the long-term knowledge advancement of the KP-Lab research community. Not only is the Music case planned to span a number of iterations, but the study and networking is extending to cases in Canada, Argentina and Brazil, so that these will be part of the body of findings and analysis of this case.

In terms of the learning of the pupils, teachers and course instructors, the cases were characterized by constant planning, implementation, reflections, revision, implementation again, and so forth. In other words, the case design embedded within it opportunities for all parties to constantly advance their knowledge about teaching and themselves as teachers..

In the EFL case, knowledge advancement was at the heart of the epistemological view of language teaching underlying the project: as something that is learned in an authentic communicative context, and that is taught holistically. For the pre-service teachers, the project provided a real-world opportunity for enculturation within the teacher community that they would be part of in the future; for the practicing teachers, the project provided opportunities for revising their views and practices of English teaching and learning and general pedagogy.

### 5. Development through transformation and reflection

Interaction between different types of knowledge (e.g., tacit, explicit, propositional, declarative, procedural, or theoretical, observational, propositional, etc.) occurred on both individual and collective levels in all three cases. In the EFL case, the project was designed to enable connections between tacit, theoretical and practice-bound knowledge – in relation to each of the sets of players. In interviews and questionnaires, some students commented on how the project, with its basis both in theory and practice (of pedagogy, writing, and ICT) had contributed to their understanding of what it means to be a practicing teacher. The specific research question underlying the Bilingual Education case relates to the connection between theory and practice in teacher education, as well as to the tacit knowledge of the pre-service teachers and their mentors. In the Music case, the teacher plans the didactic sequence and predicts what will happen (explicating his tacit knowledge and the rationale of the procedures (theoretical basis, past experiences and... prejudices, *a priori*). After recording and observing what actually happens, he reconsiders and revises his earlier assumptions. Then, in the teacher training situations, with the pre-service teachers and with colleagues, the teacher's tacit,

procedural, and declarative forms of knowledge are further explicated and revised or enriched by the trainer.

#### 6. Cross-fertilization of various knowledge practices

Both the EFL and Music cases have clear indications of horizontal and vertical cross-fertilization of knowledge practices from different educational and work contexts. In the Music case, the teacher uses his observations in the school setting as a basis for creating and improving the didactic sequences he presents to his pre-service teachers and for the reflective discussions with the teachers or expert colleagues. The insights gained from the discussions with colleagues and students serve to cross-fertilize his work. The same process arises with students. In the EFL case, there is similar cross-fertilization between knowledge practices in the various inter-related institutions (college, school) since the project was designed as a “cross-boundary setup” between mainly theoretically-based knowledge practices defining the college (learning) context, and practice-bound and tacit knowledge practices defining the school (work) context. Additionally, the EFL project was also designed as a “cross-boundary setup” to establish conditions for cross-fertilization between teaching and learning practices related to a variety of domains: pedagogy and didactics, English proficiency, and ICTs in education. Despite this intended objective, however, some students were unable to perceive the intended inter-disciplinary connections.

#### 7. Providing flexible tool mediation

All three studies were conducted using available tools and, in the present iterations, were not supported by KP-Lab-specific technology. The EFL case was based on the use of commonly available tools such as email, a standard LMS, PowerPoint, and available forms of synchronous communications. The possible ways in which email and PowerPoint could be integrated in EFL teaching were modelled and exemplified to the pre-service teachers – the email both as a means of communication and as the object of a drafting and redrafting process in the teaching of writing in a foreign language. The PowerPoint was also both a tool for teaching paraphrase and summarization as well as an object of shared activity involving collaborative revision and reworking. As mentioned above, some of the students found this task, which was supposed to model how collaborative writing works in the world outside the classroom, and how this can serve as an authentic basis for a learning task in the EFL context, too difficult to carry out. Difficulties were conceptual, linguistic, and technical. However, quite clearly, this study could benefit from a platform for sharing “artefacts-in-process” such as KP-Lab’s Shared Space. In addition, a tool for synchronous virtual communication like Mapit could be valuable in the work of the instruction team, especially for retooling the work across the two sites (the college and the school).

The Bilingual Education case made use of an LMS (Claroline) and forums. The Music case made use of a large variety of available technological tools: LMSs like Moodle and Educenet2 for storing and managing files, and video for recording the lessons, in addition to a variety of discipline-specific technological devices such as beamers, loudspeakers, paper, pencil and musical materials (but also other objects that can be used to produce sounds). This case would benefit from a video annotation tool or a tool enabling direct writing or what pupils do.

#### *Conclusions*

The discussion of the cases in this priority area suggests that knowledge practices of the participant players evolve at the boundary areas between different institutional settings (university and school, college and school, etc.), between different disciplines (music, history of music annotations, psychology of learning, pedagogical expertise, technological domains, etc.), in relation to different populations (e.g., pre-service teacher with instructors and with

pupils; teacher with pupils, with pre-service teachers, and with colleagues), and in different languages. Not only are objects shared in the collaborative work within a given group, but they serve different purposes and transform as they shift from being product in one setting to being part of a process in another (e.g., the didactic sequence or the performance or the video recordings of these in the Music case are at once product and object for reflection, an end and a means to another an end; the email in the EFL case is an end product when it is the final draft containing the solution to the problem presented to the group, and also a means of communicating about another object of activity, the PowerPoint presentation). Reflections, planning and revisions support the needed transformations between different forms of knowledge, and between the practices in the different institutional contexts, especially as relating to enculturation into the teaching profession and/or developing professionalism of practicing teachers. Technological tools in this priority area should be designed to support individual reflection and collaborative discussion and planning, as well as serve as catalyst for subject-specific change and innovation.

#### ***PA 4: Creating teacher networks that foster professional transformation***

##### *General description and focus*

An important phase of preparing for a teaching career is role modelling. Teachers' roles are generally defined by a distinct set of behaviours: knowledge and teaching practices as well as patterns for solving educational problems. Underlying values and attitudes create a motivational base for assuming the role of the erudite professional, the motherly support person or the ambitious coach, to mention only a few generally practiced roles for teachers. Professional "culture shock", the critical situation at the beginning of a teaching career, can be eased by the provision of a set of role models relevant for pre-service teachers' practice. Observation of lessons by master teachers in a laboratory school setting is far from an authentic opportunity for teachers' role modelling. Providing hundreds of students with opportunities for individual encounters with teachers of various professional qualities and inclinations is an impossible organisational task for teacher training institutions. In contrast with the mass-model approach, the model we implement in KP-Lab – training through involvement in shared innovative practice – unites pre-and in-service teachers with mentors and educational researchers in work around a shared object central to both in- and pre-service training efforts. This shared object is the development of new paradigms for education.

Two cases of ELTE, the English Teacher Training Workshop and the Multigrade Teacher Community, address the challenge of providing authentic opportunities for role modelling in innovative teaching-learning contexts. The Multigrade case, which is the focus in this section, has an in-service teacher population, but the approach applies equally to our pre-service case, where future teachers of English are mentored by a team of a practicing teacher, researcher and teacher trainer. In both cases, roles modelled are the teacher as innovator (developer of new teaching methodology and content), researcher (evaluator of student performance, reflective practitioner), and mentor (trainer and coach of peers for deeper understanding and improvement of own practice).

##### *Description case: Multigrade Teacher Community (ELTE)*

Multigrade schools are generally situated in remote villages with very small school-age populations. Multi-age groups are taught simultaneously by one educator who has to manage two or more parallel learning sequences at the same time, in the same classroom space. Research on Multigrade pedagogy was initiated by the Network for Multigrade Schools in

Education (NEMED), a European group of training institutions in five countries where Multigrade schools are perceived both as an educational problem and an asset. The Hungarian KP-Lab team studied these schools in 2005-2006 through educational surveys, socio-ethnographic analyses and school visits. Findings indicate that inferior results of pupils, often leading to the closure of the school (and the resulting desertion and decline of the village), are mainly due to the lack of suitable teaching methodology and teaching-learning infrastructure that would consider specificities of this teaching arrangement. The team decided to employ the mentored innovation model elaborated for a similar pedagogical problem for the Gypsy (Romani) population in Hungary and enrich it with triological design elements. The model involves an in-service training that incorporates a teaching context where mentors and participants of the training course, practicing teachers engage in collaborative innovation.

Multigrade teachers, teacher trainers and researchers agreed on two design principles for Multigrade pedagogy: combination of individualised and collaborative learning, and creation of a unique, ICTs-enriched teaching-learning environment. This case, however, is not about testing cutting edge technology and new applications developed by KP-Lab, but rather, the pedagogical model itself is meant to be cutting edge. The case is aimed at adapting and later adopting triological design principles to construct a pedagogy for this unique educational setting. Thus, technological solutions for novice users were selected that foster collaboration but also enable monitoring individual achievement. The MOVELEX virtual learning environment was employed for learning the basics of computer-supported education and collaboratively developing teaching aids applicable to this special setting.

In-service training, as well as collaboration in peer groups, required a virtual learning environment where knowledge construction, sharing and evaluation could be scaffolded. We chose the Moodle VLE because of its adaptability to social learning: its wiki and group-based forum functions as well as the customisable learning environment available in Hungarian as well as in languages of KP-Lab partners assured expandability of the learning community. As participating teachers had no experiences with virtual learning (two thirds of the first iteration did not even have an email account), the first issue to research was flexibility of learning styles of experienced teachers. Would they be able to become motivated ICTs users as learners – and also as teachers in a later phase? ICT competence surveys with questions about educational applications were conducted at the beginning and end of the project to monitor change.

Multigrade education should be “silent” for most of the time. Pupils learning different disciplines at two to four different levels at the same time need silence for concentration while solving individual tasks. Therefore, short explanations by teachers have to be supported by visualisation tools to deepen understanding and at the same time provide an enjoyable, playful learning atmosphere. Contemporary child culture is highly visual – the value of still and moving images is exploited by television programmes and toy / game designs alike. We employ PowerPoint blended with the format of the old slide show for children with cartoon characters as protagonists as well as still and moving images to demonstrate concepts of arts and science. The research question related to visualisation technology is the role of images in comprehension and creation. As pupils are invited to express their perceptions of the learning content through different visual representations, supporting technology is supposed to develop skills of visual communication.

Teachers keep logs as records of the questions raised and technology decisions made within specific cases. Mentors organise hands-on experiments with new technology solutions for teachers to make them realise their educational potentials. In our future iteration of the case, MapIt will be included as a support tool for decision making about educational methods.

### *Overview of results*

### 1. Activity around shared objects

In the Multigrade case, a new system of pedagogical practices for multi-age, multi-level, multicultural classrooms was the shared object of activity, resulting in the development of teaching and learning processes and artefacts to support these practices. The multi-grade schools worked with a number of objects: a teacher training program, a national competition, and the organization of a national network. Research on own practice constituted the framework for the in-service training course and a working theory about methodological innovations needed was set up, followed by critical evaluation of existing multigrade teaching and learning practices by mentors and teachers. New subordinate questions of study were generated, which are currently being developed into new working theories by researchers, mentors and teachers.

In the English Teaching Workshop, online collaboration where authentic English was used resulted in group forum discussion. The discussions were regarded as both course artefacts and shared knowledge artefacts produced by the participants. Additional knowledge artefacts that can be considered shared objects of activity were conceptual artefacts, collective products (a number of tried and tested course modules) as well as product plans (future course modules). Due to the EFL workshop design (implementing practice-oriented modules in a virtual learning environment) both the pre-service teachers and the two facilitators relied on joint knowledge-creation processes and developed course artefacts collaboratively. In two out of the five groups knowledge-creation processes – visible from the threads of interactions – were of high quality. Through working on shared objects, the pre-service teachers expanded their methodological inventory, and the communication in English in an argumentative form contributed to their language skills.

The community stakeholders in the first iteration experienced dialogical perspectives on educational strategies for the first time.

### 2. Interaction between personal and social levels

For the multi-grade schools, face-to-face meetings and visits to schools were social ice-breakers for sharing locally relevant issues that were embedded into the innovative teaching program. Regular email correspondence was used to foster an interpersonal dynamic in the multi-grade community of educators who often feel professionally isolated in very small schools. Face-to-face meetings of the project team cut across the practices on two intersecting levels: a) teachers engaging in learning activities while teaching; and b) that of the innovative knowledge community consisting of project partners who collaborated on the advancement of two multi-age communication development programs based on principles of dialogical learning. The inclusion of local community stakeholders was optional but proved to be extremely important. Community involvement will extend in the next iteration and also include parent participation in the work around shared objects.

The multi-grade schools reported a motivated and engaging atmosphere in which the different voices they articulated contributed to the shared understanding of how to configure pedagogical practices. The digital communication made the information flow among the different levels and the teacher community smooth and mutually inspiring.

Similarly, in the English Teaching workshop, communicating while collaborating in problem-solving activities related to the teaching and learning processes of EFL contributed to pre-service teachers' professional advancement. For some of these teachers, online communication (in the blended way it was implemented) was easier than contributing during a face-to-face class.

### 3. Eliciting individual and collective agency

The development of collective agency was embedded in the research design of both the cases in this group. Working online collaboratively in small groups around course artefacts, and the use of forums in small groups in the English Teaching Workshop were aimed at supporting ways of creating collaborative agencies. Taking responsibility on a personal and group level became crucial in the problem-solving activities. Despite the permanent encouragement of the facilitators in all groups, for two out of the five groups in the English workshop, this was deemed successful.

The multi-grade teacher community was quickly formed and turned out to be highly reflective. This was evident in how teachers observed each others' pedagogical practices and provided intensive constructive feedback based on their enquiries. Development towards self-reflective professionalism was strongly fostered. The role of researchers' participation during the project changed in the course. In order to foster activities related to the community developing and advancing the shared object of multi-grade pedagogy, researchers became participant observers. They demonstrated innovative teaching methods, took part in the review of students' work and thus modelled the teacher-as-researcher role. This change of professional role turned out to be beneficial for the researchers as they could immediately experience the effects of the multigrade pedagogy they promoted. On the other hand, teachers were able to take a passive stance and observe processes in their own classroom from the viewpoint of a consultant or even supervisor.

In both cases teachers expressed a need to develop pedagogical practices further. New forms of cooperation were initiated: apart from the continuous role shift from teacher to researcher, peer reviews were regularly initiated after each interdisciplinary learning sequence. Thus, teachers could offer their interpretations of practices of colleagues and through this, reveal their (mis) understanding and (mis)belief in Dialogical teaching and learning strategies. This may be seen as a collective agency with a boundary-crossing element. In the second iteration, four schools will intensively co-operate and peer reviews will be followed by peer coaching (pair and group work). Parallel with these collaborative processes, competitions still offer a chance for individual practitioners and their pupils to get feedback on their achievement.

#### 4. Fostering long-term processes of knowledge advancement

Innovative pedagogy requires profound flexibility in teaching style and the development of knowledge practices in the various roles each teacher has to play: as educator, curriculum developer and community member mainly responsible for the preservation of the cultural values of a village. This was evident in the Multigrade case, where flexibility was central to the selection of teaching methodology and adaptable content to meet the needs of different student groups. Multigrade teachers were inexperienced in organizing and managing multi-age, interdisciplinary learning groups in an educational setting that calls for and promotes this approach and new methods were developed together with teacher trainers and researchers for coaching their students during the project and offering feedback on their practices.

Similarly, the English Teaching workshop and its modules were designed to support pre-service teachers in acquiring skills and competencies that they could apply in the teaching and learning of EFL, as professionals. The goal was to encourage the teaching of English in an authentic and integrative communicative context, and to provide a collaborative context for constant improvement of practices. The results of this study show that the pre-service teachers were satisfied with their knowledge advancement regarding the use of the virtual learning environment and the communication forum. Similarly, they expressed satisfaction regarding their professional skills development. The collaborative way of learning was also considered to be an advancement of personal and professional knowledge and problem-solving practices.

From the point of view of the research agenda, both these cases are long-term and undergoing a number of iterations. In this way, long-term processes of knowledge advancement among in- and pre-service teachers in specific settings will be investigated.

#### 5. Emphasizing development through transformation between various forms of knowledge and practices

The Multigrade case brought together multiple groups of stakeholders and teachers and researchers representing different professional groups and emphasizing a variety of disciplines. In the course of the planning, teaching and evaluation process, researchers and mentors often exchanged roles with teachers and suggested certain methodological solutions in the classroom while teachers assessed their interactions with pupils. Virtual communication between teachers and during encounters with researchers and teacher trainers contributed to new pedagogical practices for all parties involved. Email messages and logs showed multigrade teachers' implicit conceptualizations of teaching. In their texts, an emerging set of principles that constitutes the basis of Multigrade pedagogy is evident. Unlike traditional educational theories that are often developed in isolation from what occurs in real contexts, the learning objectives, methods and content were created by the practitioners with the scaffolding of the researchers.

Tacit knowledge of teachers influences their pedagogical practices, and the consolidation of this tacit knowledge into knowledge that is both practice-driven and theory-based was evident in both the cases. Informal learning during the EFL workshop enabled a transformation of theory-based knowledge practices (typical of the university learning contexts) to a more practice-bound knowledge and development of professional skills.

#### 6. Cross-fertilization of various knowledge practices

The multigrade communication development projects in Mathematics and Integrated Arts involved a design team of partners coming from diverse fields of knowledge. The multigrade teacher community that was formed includes teachers of various backgrounds, professional level, epistemological beliefs and expertise. Researchers and trainers became members of the community, with all groups acquiring a sense of shared ownership of project activities and developing views about innovative multigrade practices as an issue that crosses the boundaries of their respective domains of expertise. The different roles played by the teachers led to boundary-crossing practices, and their reflective summaries showed positive effects of continuous peer-to-peer and teacher-researcher interaction. Local community stakeholders were also involved, which intensified cross-fertilization.

Within the English Teaching Workshop, the setting itself, which was comprised of an experienced teacher trainer, a pedagogical researcher who is at the same time a PhD student, and the pre-service teachers allowed for boundary crossing and cross-fertilization. Practices related to domains also promoted cross-fertilization, such as EFL for special purposes, ICT in teacher training, ICT in EFL teaching and learning processes. Two groups out of the five were able to really integrate the virtual communication aspect in the practice of collaborative problem-solving activities and creating course/knowledge artefacts. All groups made use of their previously acquired EFL knowledge and adopted it efficiently in new pedagogical settings such as argumentation regarding methodological issues.

#### 7. Providing flexible tool mediation

At the core of the Multigrade project were the conceptualization and advancement of special pedagogical practices for multigrade schools through the implementation of innovative ICT-based teaching programs. The majority of teachers were inexperienced or beginning ICT users, and the European Pedagogical ICT Licence (EPICT) was used as a training framework

to raise their ICT literacy and prepare them for flexible tool mediation in the second iteration. Most of the schools in the project selected the introductory course on developing digital learning objects through MOVELEX, a simple-to-use, flexible teaching and assessment environment. While working with MOVELEX, teachers described their existing teaching practices and collaborated on software applications that could help them overcome their most important teaching problem: individualised instruction through differentiation. Mentor teachers and researchers, however, identified another, equally important problem with current multigrade practices: unilateral teacher → student communication during learning and lack of multi-age collaboration and peer support within the student community. To enhance the quality of the in-service course, progressive inquiry learning was introduced as a method for self-reflective practice and teachers planned for the following iteration according to these principles.

Communication within the teachers' group and researchers' and trainers' groups took place mainly through email. During the first iteration, the digital literacy of teachers was raised substantially and included elements of free time use, for example, using email and exchange of digital documents and images in a non-formal way for searching information on the Internet. Future iterations of the Multigrade case will include KP-Lab tools, and insights from the reported iterations will be used to inform methods of integrating ICTs into the teaching and learning context.

As to the English Teaching Workshop, in the absence of KP-Lab tools at the time in which the workshop was set up, tools such as Moodle and email were used. The workshop users confirmed the idea that the Moodle virtual learning environment was user-friendly and ideal for problem-solving collaborative activities. All groups managed to get accustomed to using the virtual environment and the communication tools, so that the project had a positive impact on their ICT competence. As mentioned earlier, the forum as a group communication tool contributed to a great extent to knowledge-creation processes of the group members, both on the individual and group level. However, fewer pre-service teachers than expected became aware of the high relevance of integrating ICT tools for their own teaching of English. In this case, too, KP-Lab tools will be introduced in future iterations, using the insights gained in the reported period.

### *Conclusions*

The task of creating networks is generally facing two different sorts of challenges: one is the practical issues in getting the network running, and the other is the topical challenge – how to get participants motivated to be actively engaged in the network. While these two are related (motivation can be lost if technical problems are too overwhelming) and important to investigate on their own, the creation of a knowledge building community and strengthening group cohesion is extremely important. In both ELTE cases, the practical setting (the use of virtual learning environments and email communication) seemed to catalyse group activities and enhance as well as structure communication. Thus, the topical challenge was served by the practical setting and at the same time this setting was studied in the course of community formation and functioning for further improvements.

Given that a network is up and running, the aspect of fostering professional transformation can be further investigated. How is a network configured to encourage professional transformation? One answer from the cases above can be that the network needs participants with different competencies, experiences and backgrounds, to provide the necessary differences for transformation. On the other hand the differences can not be too big, since that may mean that when the gaps are too wide to cross, the participants with a higher level may lose interest. Therefore it seems wise to make sure that every participant can learn from another or from the situation, in some way, for example, in the way that researchers perform

research on contexts in which the participants are involved while contributing to the knowledge building in the community.

A certain degree of guidance or control can also help. While a good network will have a good bottom-up perspective and bring forward issues to discuss, some guidance or some control from administrators or moderators can increase the degree of professional transformation. One example can be how pedagogical models were developed when teacher trainers guided the work. In addition, the results of these cases show that practices revolving around the creation and advancement of a shared object may increase collective responsibility and serve as a focus for ongoing practices.

## ***PA 5: Developing capabilities of transformative learning and knowledge management in work places by reflective tools and practices***

### *General description and focus*

Next-generation approaches to knowledge management appear to be about managing and transforming social communities, their practices and their networks rather than mere creation of repositories of knowledge. This priority area focuses on developing tools and practices that assist participants in collaboratively reflecting on, making visible, and transforming their knowledge practices. Novel forms of work-based learning require improvisational models and platforms for professionals to arrange knowledge and reflections in both a socio-material and discursive sense in order to create new understanding and re-organization of everyday work of their own, and thus build up professional learning.

The single case in this priority area, on the use of Wikis in teachers' professional development, takes advantage of the rapid growth of digitized and networked learning environments by exploiting new opportunities as well as coping with emerging learning contexts and activities. In particular, how teachers commute between the physical, co-located classroom setting and the various online modes has proved to be a major challenge for practitioners as well as researchers. The case discussed in this section illustrates this, but also shows – and perhaps more important – how difficult it is to mediate between the individual and small group level of knowledge creation and the larger, distributed Wiki context. A third aspect that emerges from the analysis of this case is the importance of the task that the teacher sets for learners and how it relates to dialogical tools for knowledge creation. Following the principle of minimal effort, a task that can be accomplished with little or no collaboration will be carried out individually. This case highlights how the task should embed within it a real need for collaboration among the participants.

### *Research questions*

The following research questions characterized the case analyzed here:

1. How can we develop guidelines for working with a wiki application to so that it facilitates teachers' boundary crossing between co-located and virtually distributed activities?
2. How can we develop pedagogical designs that are conducive to orchestrating learners' as well as teachers' efforts towards knowledge advancement?

### *Overview of results*

#### 1. Activity around shared objects

In this case, the shared object was the development of the Wiki product by 11<sup>th</sup> grade Norwegian learners of EFL. Two different tasks were set at different stages of the project, highlighting the challenges posed by collective tasks. Using the MediaWiki, in the first task students had to produce a collective hypertext. *Our USA* – that would reflect teenage Norwegian students' perspectives on that country. The aim was that learners should use what they had learned about the USA during the school semester and add a personal flavour to the product. The intention was that through revisions and interlinking learners' personal flavours would be more collective and representative of a group than the sum of individual contributions. Thus, the task required a combination of encyclopaedic orientation, connectionism, and opinion. However, analysis of the artefacts showed that, although there was effective collaborative activity around sub-topics developed by each small group or pair of learners, there was little real connection among these within the bigger shared object – the class Wiki on the USA. There were too many pages for the students to process, and the teacher found it difficult to keep track of the growing quantity of work. The second task, involving the use of a Wiki to represent *Build a typical British town*, lent itself to the type of negotiation that is needed in collective work around such a shared object and there was noticeable collective interlinking, although even in this task revision of content by peers was done by only a few of the students. In both tasks, revision was restricted mainly to language editing. A comparison of the two tasks suggests the importance of embedding a personal, narrative element in the task, and the need for better tools to support and manage collaborative work.

## 2. Interaction between personal and social levels

This case highlights two important aspects of learning through collective tasks. One aspect is the mode of work during the group activity and the size of the group developing the collective product. In the first project, the more effective work was accomplished by pairs or small groups planning and preparing their input to the collective Wiki. Compared to the work of online revision, use of the wiki required other practices for which we need to develop social as well as technological support. The other aspect emerges from a comparison between the two projects. The personal and narrative element characterizing the work in the second project was more conducive to the collective work on the Wiki and encouraged the development of new practices although, as noted above, such development marks only a beginning since most students did not make use of opportunities for online revision.

The challenges are how to encourage interaction between the personal and social levels so that the social level includes the whole class and not only within small groups constituting the larger collective, and when awareness of social presence of others is through virtual means (in addition to other modes, which are likely to remain). This means that the technological infrastructure should contain features affording opportunities for virtual peer-to-peer interaction and interaction with the teacher.

## 3. Eliciting individual and collective agency

Accomplishment of the tasks described in this case is dependent on the development of individual and collective agency. The study specifies examples of agency that emerged during the projects such as decisions relating to the selection of resources, division of work between the students, constructing of drafts, and coordinating work with that of others. The importance of tools that can help learners and teachers monitor their activities in relation to others is highlighted in the case analysis.

## 4. Fostering long-term processes of knowledge advancement

This case can be seen as advancing knowledge through long-term processes on a number of levels. On the level of the school pupils, although each project was time-bounded, these

learners, in addition to the opportunities provided for use of language through an authentic virtual communicative platform (the Wiki), they also developed skills and strategies for real-world work within the framework of such settings, both face-to-face in the groups they were part of, and virtually by contributing to the collectively developed Wiki. On the level of the teacher's knowledge, the second iteration of the project enabled her to create a task that reflected revision of the earlier one on the basis of insights gained previously. From this point of view, the case illustrates how the pedagogical integration of technology involves long-term processes in teachers' professional development. On a third level, the case contributes to theoretical advancement of ideas shared by the research community.

#### 5. Emphasizing development through transformation between various forms of knowledge and practices

Transformations of knowledge and practices can be seen to have occurred on a number of levels. In both tasks, the school pupils had to translate their prior (mainly theoretical) knowledge of the content topics (USA, Britain) into a concrete digital product that incorporates personal and collective stances on these topics. The activities involved in the creation of such a product thus required a constant movement of translating between theoretical, practice-bound and procedural knowledge. The class teacher and the researcher, too, had to make such constant switches in their examinations and revisions of the projects, for example, translating theoretical conceptualizations into concrete steps for bringing in changes to the project in the second iteration. An additional – and perhaps most important – trigger to development through transformations is the nature of the project itself, which required the teacher to make major changes to her practices as an EFL classroom teacher through a project which contextualizes learning in subject matter requiring integration of multiple resources in a foreign language and presentation of this material via a collective digital product.

#### 6. Cross-fertilization of various knowledge practices

Cross-fertilization of knowledge practices can be seen as occurring at the boundaries between the various forms of knowledge and practices that the learners, teachers, and researchers had to negotiate. In changing the learning object from the more traditional textbook-type texts and activities to a Wiki-like product, the class English teacher, as well as her learners, had to commute between the co-located setting of the classroom and the various virtual modes of work. There they had to integrate knowledge based in diverse domains and move between the global and local application.

#### 7. Providing flexible tool mediation

The world of work and professional development as well as educational systems increasingly makes use of flat structures in and across small or larger groups. Such groups often work on projects of a multifarious nature and that draw on several knowledge domains and by using increasingly sophisticated technologies. The traditional hierarchical structures with clear-cut command lines and delineated tasks are challenged by networked expertise. This situation requires an educational discourse, activities and designs for learning that reflect such networked literacy.

While Learning Management Systems to some extent have taken care of the managerial aspect of such literacy and expertise, wikis seem to hold more potential for the actual learning and for knowledge advancement, for going beyond what we currently know by affording multiple and heterogeneous perspectives to construct an aggregated and perpetually refined learning object. One of the strengths of this case is that it takes as its technological trigger the Wiki, which is an existing platform harbouring within its underlying “philosophy” all that is

meant by Web 2.0. The case therefore affords opportunities for a zoom-in on the knowledge practices of the various participants learning and working with such technologies.

Already at this stage, the researchers point to some of the problems involved with learning and teaching with wiki technology, such as the difficulties that both learners and teachers have in monitoring the massive quantity of material that is produced within a Wiki system, the arbitrariness of hyperlinks put in by students, and resistance to meaningful revision of work done by others. In addition, the case emphasizes the importance of providing awareness functionalities within such systems.

### *Conclusions*

Although the above analysis is based on only one case, we can draw some preliminary conclusions about research in this priority area as it applies to teacher training. First, as far as the teacher is concerned, the case provides a perspective of the teacher as lifelong-learner in the workplace. It also highlights the importance of knowledge management tools for the teacher using technologies that are, so far, associated with the world of work more than with the world of education. At the same time, it suggests that just as workers are being perceived as lifelong learners in the work place, who have to deal with growing quantities and increasingly complex representations of knowledge, teachers will have to be seen as workers in constant professional development, managing transformation in their learning and that of their students. Second, as far as school-age learners are concerned, this case – like those grouped in the other priority areas – shows that at this level too, learners will need to adopt knowledge practices of people in the work place as learning becomes more collaborative and based on the collective creation of new knowledge mediated by technological tools. Thirdly, the technological tools themselves, as Web 2.0 tools, will have to provide solutions for the support of collaborative production and knowledge management. Finally, as far as pedagogy is concerned, this case highlights significant issues that have to be accounted for in teacher training and in supporting the development of teachers' professionalism through the use of ICTs, such as the types of tasks that develop knowledge practices meaningfully integrating Web 2.0 capabilities within them.

## ***PA7: Developing technology-enhanced practices for scientific writing***

### *General description and focus*

This priority area concerns the knowledge practices that revolve around the design, performance and reporting on scientific research within the field of the social sciences. In this approach the focus is on the creation of new knowledge and skills through the construction of shared objects, with this process itself also being an object of reflection. This means that students' knowledge practices and the object of reflection are equivalent: collaborative production of knowledge and skills through the performance and reporting on an empirical study. These activities deepen and elaborate on students' prior knowledge, thinking style, attitudes and skills regarding scientific research. In addition, object mediated collaborative creation of scientific knowledge enables students to accommodate and recreate the authentic practices of scientific communities.

These authentic practices are reflected in the fact that students will follow an iterative cycle of progressive inquiry in which they negotiate and decide on a range of intermediate artefact, such as: a research plan, read relevant scientific literature, design and conduct their study, analyze their data, and write their research report in which all previous elements are

integrated. To advance their practices, students engage in discussions which are fuelled by their growing knowledge of scientific publications relevant for their inquiry topic and use collaborative computer-supported tools considered fit for their purposes.

The processes related to conducting and reporting on an empirical work present students with a rather complex task, which necessitates for an appropriate supportive network of tutors and other professionals from the field of scientific research. In addition, students have to negotiate and create shared responsibility regarding their ongoing practices, to guarantee an effective progression of their main knowledge object, which entails the scientific report on their empirical study.

In this priority area one case is described which involves the investigation of aspects of students' object-related activities and reflective practices during the course Web-based Learning Environments (WebLE) that is part of the curriculum at the department of Educational Sciences of Utrecht University. During this course, students collaboratively generate a report about a small-scale study they have conducted within the domain of collaborative learning supported by computer tools. Students were to produce this research report in groups of three or two, using their understanding of scientific literature, their self-guided research interests and their experiences with collaborative computer-supported tools to design and subsequently perform their study.

The work of this priority area and case has been presented in two conferences (Sins, 2007; Sins, Damşa, & Andriessen, 2007).

#### *Research questions*

- What object-related activities and reflective practices characterized students' research practices?
- How did tutors foster students' research practices?
- What was the role of the computer-based in supporting students' research related knowledge practices?

#### *Overview of results*

##### 1. Focus on dialogical activity around shared objects

In general, students were engaged in intensive discussions, which were fuelled by their growing knowledge of collaborative computer-supported learning as a result of reading and negotiating about scientific publications within the field of CSCL and due to students having experiences with the use of software for the support of collaboration and learning. These discussions were a source of reflection and progress, since they served to create and advance their main knowledge object, i.e., the scientific paper reporting on the results of their empirical study. Moreover, the creation and development of this knowledge object seemed to define the purpose of students' activities.

During the course students created several intermediate artefacts which supplied relevant material for their knowledge object, such as the research proposal, research planning, ideas about research methods and preliminary versions of their research report. The extent to which students invested effort in working on these artefacts depended on how they valued their function in the process of advancing their research report. It has to be noted that all artefacts were dynamic in the sense that their structure and roles continuously changed during the process.

##### 2. Interaction between personal and social levels

Both collaborative and individual learning practices were embedded in the cases in this priority area. In this course the collaboration between the various participants resulted in

transformations in students' practices. For instance, the research question and students' planning were subject to changes as a result of developments in students thinking which was reflected in and affected by the collaborative activities that resolved around these artefacts, such as feedback received from the tutors, discussions within the group, and research tools and methods chosen.

In addition, the tutors encouraged students to search and process more scientific literature that provided the necessary background and substantiation for their research question. In an intensive collaboration, students performed the following learning activities in an iterative fashion: a) reading and processing scientific texts, b) designing materials for their study, c) revising research question(s) or plan, d) conduct their study, e) analyze the data, and f) write preliminary versions of their research report.

Students also exchanged results, materials or methods to reflect upon each others activities. This involved a great deal of elaboration from students, since they had to integrate, to translate and to critically reflect upon their own understanding, scientific understanding, research methods and analyses, and research findings.

### 3. Fostering long-term processes of knowledge advancement

The process of designing and performing scientific research within the field of educational sciences is emphasized in a number of courses in our department at Utrecht university, therefore the activities of the students during this course can be viewed as deepening and elaborating on students' developing knowledge, attitudes and skills regarding scientific research.

Prior activities provided essential material for students to continue creating their research paper, in other words students' evolving knowledge creation practices that was mediated by constructing of artefacts fed into the main activity that is the creation of their knowledge object. This was exemplified by the findings that the artefacts students already created were used as tools used in the process of creation their research paper.

### 4. Development through transformation and reflection

In this course, different forms of knowledge and practices are addressed which resolve around the design, performance and reporting on an empirical study. Tutors encouraged students to reflect on their practices and to adapt them in face of difficulties, disruptions or in case of new insights.

Students indicated that the open nature of the activities they performed led them to acknowledge the idea that they were advancing their own knowledge instead of producing objects in service of course requirements. During the different phases that could be identified in students' object-related activities: Problem statement and domain understanding, Designing and conducting research, and Synthesis: collaborative writing of research report and presentation students created their own contexts by creating and advancing artefacts which followed the evolution of their practices.

### 5. Eliciting (individual and collective) agency

Students' persistence in collaborative designing and performing a small scale empirical study was fostered by offering computer-supported tools, expertise and by creating an authentic inquiry context. Although students changed their research plans pragmatically, they attempted to keep with their initial empirical interests in designing and conducting their research. Tutors fulfilled the role of providing students with feedback, however the artefacts were mainly produced by the students and the strategy and planning of their study was negotiated with the tutors. For instance, students developed the research instrumentation themselves and also

performed the study and analyses of the data themselves, using the feedback of their tutors to advance these artefacts.

Students reported to be highly motivated in following this course, but found the time too short to perform a study of higher quality. In addition, they reported the tutors' lectures to be somewhat too directive and not entirely integrated and relevant for their ongoing activities. Nevertheless, tutors reported that they wanted their students to be highly self-directed and their role as being mainly problematizing students' artefacts and practices, which for some students worked out counterproductive.

Being actively engaged in and responsible for the whole process of conducting and reporting on research within the field of CSCL fostered students understanding and skills involved in the process of scientific inquiry.

#### 6. Cross-fertilization of knowledge practices

The main cross fertilization practices occurred between the students belonging to the group and between the student group and the tutors. Students were also encouraged to consult other experts on the field of educational research for support in their inquiry activities, but this mainly remained to asking tutors for their feedback and processing the scientific literature they found relevant for their research topic.

Tutors asked students to reflect on scientific articles and react to leading questions with the aim of coming up with first ideas for research questions. In addition, tutors presented students with a number of CSCL environments (i.e., VCRI, DREW, FLE3 and KP-Lab shared space). Based on these experiences, students in groups decided upon a research question and delivered a research proposal.

The tutors took an approach of questioning the practices of the students which resulted in some discussions about how to continue or even adapt ongoing activities. As the course progressed, the lectures become more driven and determined by the activities of the students and tutors agreed to spend most of the contact hours to discuss about issues students identified during their inquiry

#### 7. Flexible tool mediation for dialogical activity

In the first stage of the course tutors acquaint students with some of the tools used in CSCL research, such as:

- VCRI: a CSCL multi-tool including an online diagrammer, word-processor, task-planner, chat-facility and discussion-forum
- DREW: a graphical tool, combined with a chat
- DIGALO: concept mapping tool for collaborative argumentation and visualization of running discussions
- Rainbow: an analysis schema for electronic discussion
- MEPA: program for the annotation of, coding of verbal or nonverbal observational data or protocols
- The critical artefacts are textual (electronic discussions, reports for the 4 assignments) and graphical (3 graphs).
- FLE3: Fle3 is designed to support learner and group centred work that concentrates on creating and developing expressions of knowledge (i.e. knowledge artefacts) and design.
- Shared Space: Shared Space is a tool designed in the KP-Lab project which serves to support knowledge creation processes

Students and tutors used mainly the Blackboard (i.e., Studion) to communicate and discuss about the scientific literature and as a platform to send artefacts. However, students used e-mail more often for internal group discussions and exchange of artefacts.

### *Conclusions*

The main object in students' inquiry process served as a motive and goal to feed into their knowledge practices and enabled students and their tutors to monitor and reflect on their progress. The artefacts students created served to direct discussions within their group but moreover with their tutors, and fostered elaboration and explanation about domain knowledge, which can be characterized as processes of knowledge creation. In addition, students indicated that the open nature of the activities they performed led them to acknowledge the idea that they were advancing their own knowledge instead of producing objects in service of course requirements. Being actively engaged in and responsible for the whole process of conducting and reporting on research within the field of CSCL fostered students understanding and skills involved in the process of scientific inquiry.

Nevertheless, tutors indicated that there should be more focus on transformation of students' practices through the reuse of artefacts; in addition more emphasis should be placed in critical reflection on the process by means of which artefacts are created. This involves the idea of cognitive trials to some extent: students have to more explicitly report and reflect on how they achieve new insights, and give other students the chance of discovering the same. In addition, the rather directive approach taken by the tutors in the lectures at the start of the course changed towards a facilitating strategy which was related to the needs expressed by their students. This led to discussions which were guided and focused on the artefacts produced by the students.

Since students during this course gain experience with tools employed in the field of CSCL, which is directed by the research topic they choose and the strategy for creating their central object, WebLE proves to be an excellent platform for testing and evaluating tools developed within the KP-Lab project.

## **6. General Conclusions**

The main aim of the present deliverable was to organize and present the main results that were obtained from the first studies performed within the ten cases of the Teacher Training Case Library. In general, the studies reported here advance our understanding regarding teachers' knowledge creation in pre- and in-service training contexts. Our review here shows that dialogical learning design principles were applied in all 10 cases, albeit not always explicitly embedded, or not always given equal weighting. Our analysis of the 10 chosen cases in our Case Library helped us to understand and highlight the potential of additional emphases on dialogical learning principles for our future case research. The lessons learned from revising these cases will serve as a benchmark for further design of our cases. These understandings will be reported in the next deliverable, D9.3 – the Teacher Training Collective Case Library, v.3 – due in M29.

The work reported in this deliverable applies to both the theoretical and the practical layers of the KP-Lab co-design framework, since we are concerned with developing an understanding of the knowledge practices in teachers' teaching and learning and teacher training contexts. The research cases represented an initial step in creating a shared understanding of how the perspective of dialogical learning applies to concrete practices observed in teacher training contexts. In addition, these cases and results reported are central for informing technological design and for planning and executing future empirical research into teacher training. The rest

of this section is focused on moving from the results obtained from our case studies towards implications for pedagogical and technological design of theory and research practices.

### ***Research findings and implications for knowledge practices in Teacher Education***

The priority areas identified for KP-Lab's pedagogical research agenda were employed to organize the ten research cases within this work package. The following five priority areas appeared to be relevant for research into teachers' knowledge practices: PA1: Managing collaborative design in teacher education, PA2: Retooling boundary crossing between education and work, PA4: Creating teacher networks that foster professional transformation, PA5: Developing capabilities of transformative learning and knowledge management in work places, and PA7: Developing technology-enhanced practices for scientific writing. In reporting the results of these studies, the KP-Lab design principles were used to describe how practices within cases belonging to that priority area were found to be actualized and which conditions fostered teachers' changing their practices.

More specifically, the reported research cases involved examining interrelated aspects of the teaching-learning context, such as: processes of knowledge creation by the in- and pre-service teacher populations and their learners, teachers' engagement in sustained inquiry, especially as regards the constant translations between theoretical and practice-bound knowledge underlying the learning of both in- and pre-service teachers, collaboration strategies and object-related activities found in teacher training communities, the development of epistemic agency in teachers and learners and the strategies and techniques teachers employ for fostering epistemic agency in their learners, boundary-crossing practices between learning and work environments, and the ways in which teachers (learn to) integrate ICT tools in their teaching. Longitudinal research is conducted by following up on individual students, teacher groups, multi-professional teams and/or course formats to be included in the KP-Lab project across four years.

One of the main findings from the studies reported in this deliverable concerns the role of shared objects in the knowledge practices of teachers, their students and other stakeholders. Although objects are not always entirely shared in collaborative work within a given group, they serve different purposes and can be transformed as they shift from being a product in one setting to function as a tool in another process, depending on the appropriation of the group's practices. The fact that teachers could work around the creation and advancement of shared objects, whether these were conceptions, ideas or tangible products, provided them with a motive and goal to achieve; also a condition for fostering teachers' epistemic agency. This enabled them to assess and reflect on their ongoing practices and those of their students. Moreover, teachers indicated that they wanted to follow up the progression of (re-used) objects they or their students developed to monitor their learning processes (i.e., creation of cognitive trails).

Secondly, authentic collaborative work around boundary objects which occurred in multidisciplinary teams, networks or teacher training communities was found to trigger the transformation of knowledge practices. Productive collaboration in these groups served to set conditions for fostering knowledge creation activities. Such collaboration was characterized by mutual dependency between group members, sense of ownership, social motivation, collective responsibility and an integrative context consisting of pedagogical methods and technological tools supporting practices within this context. Nevertheless, the complex task of creating groups in which participants are motivated to be actively engaged and who persevere in the collaboration can be approached by designing contexts that take into account the

different motives, beliefs and knowledge of participating actors and by offering appropriate technological support.

Thirdly, most research cases emphasized the need to prolong the support of teachers' learning and developing professionalism in the long run. To cope with challenges of changing demands of the different institutional contexts in which they are going to participate in, teachers have to be able to transform their learning and that of their students; as such the teacher can be conceptualized as a lifelong-learner in the workplace. It was found that implementation of particular sets of KP-Lab design principles supported teachers to become reflective practitioners within their particular working and learning contexts.

Finally, technological tools seemed to support reflection, collaborative discussion and planning, as well as serve as catalyst for change and innovation of practices. The technological tools themselves may provide solutions for the support of collaborative production and knowledge management. However, it was found that tools have to be designed as such that they serve to support and trigger innovative knowledge creation practices. Therefore, based on their empirical observations, partners of the relevant cases that will be continued from within the frame of WP9 will inform technological design by means of participation in the working knots: 'Project and Content Management', 'Document Centred Collaboration', 'Change Laboratory' and 'Meeting support'.

The present deliverable serves as boundary object between activities performed on the theoretical and practical layers as well as those on the technological layer of the co-design framework. The document should therefore be seen as a springboard for continued understanding of transformations of knowledge practices in teacher training contexts and teacher communities.

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## 8. Appendix

### Case Descriptions listed according to the Priority Areas

Available on the KP-Lab web site at:

<http://www.kp-lab.org/publications/public-deliverables/documents-of-the-public-deliverables/KP-Lab-D9-2-Appendix.pdf>