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Computer-Supported Collaborative Learning at Work: CSCL@Work goes TEL@Work

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Abstract. We propose the topic of "CSCL at Work" which we advanced through workshops at ACM Group 2010, ACM Group 2012 and CSCL 2013. The resulting book raises an important set of issues and potential topics for research and practice but, like any agenda setting work, does not solve thorny or controversial issues. CSCL@Work provides one possible viewpoint for bridging informal learning and work. The purpose of our proposal is to share innovative approaches discovered to date, and gain input focused on solutions aimed for understanding, studying and designing **Technology-enhanced learning at work.** From 13 case studies, three main theses can be derived that characterize how and when learning at work takes places, A) Learning occurs in unexpected and unusual online learning places, including Social Media. B) Learning activities incorporate feedback from diverse sources, which are not available within traditional organizational boundaries. C) learning takes place across established boundaries. Theses issues inform the design of collaborative technologies, technology-enhanced learning (TEL) and sociotechnical learning practices. To make learning visible, we argue that individual and collaborative learning design must support the alignment of pedagogical, social and technological design. This alignment will increase the likelihood of both surface and deep learning at the workplace.

1 Introduction and related works

Any person who is part of a traditional or virtual organization must learn new skills routinely. Goggins, Jahnke, & Wulf (2013) demonstrate that much of what a person will try to learn for herself or for the purpose to fulfill the job in the modern workplace cannot be found in a book or on the Internet. Information and knowledge are jumbled together with social connection and experience. Often a person at the workplace will need to acquire the acumen to apply skills, tools and approaches that were invented very recently, and for which there is little if any documentation. In such cases, a learner at the workplace will likely get in contact with a group of people – formally or informally – and its quite likely the people who help the learner most will not work in the same organization that the learner does. Research in the field of Organizational Learning emerged in 1978 (Argyris & Schön, 1978), and gathered in-

creased attention beginning in the 1990's when the questions were focused on how to create a culture and practices for sharing existing knowledge within a firm. In addition to managing existing knowledge sharing, managing the creation of new knowledge is important for firms today. But are they able to create new knowledge when the answer to a problem is not available? What cultures of learning exist to support this? Contemporary answers to these questions must recognize that learning is an implicit, often invisible component of work. To build a bridge between learning *what is known* and learning *that creates new knowledge* is of crucial importance for both the computer supported collaborative learning community and the computer supported collaborative work community (dePaula & Fischer, 2005). Such a "culture of participation" (Fischer 2011) is needed for researchers, consultants and designers of Learning@Work concepts.

CSCL typically focuses on learning as a primary activity. By contrast, Learning@Work is not the primary activity in an organization – reaching the objectives of that organization are the goal. We suggest, however, that we must consider how learning is affected by the needs of employees for timely access to information needed to conduct everyday work. More significantly, the development of practice knowledge and information not contained within the firm raises new challenges. Learning in these cases is a secondary activity and work is the primary activity (Mørch & Skaanes, 2010), while both aims at performance improvement.

We distinguish Learning@Work from prior research in CSCL, TEL, (e)CSCW and knowledge management. Prior work in CSCL investigates the application of computer support for learning in the context of traditional educational institutions. This CSCL inquiry inspired new, more broadly applicable theories about how knowledge is constructed by groups (Stahl, 2006), how groups and individuals reflect their work experiences (Knipfer, Kump, Wessel & Cress, in press), and how teachers contribute to collaborative learning. Furthermore, the application of socio-technical scripts is emerging from workplace studies (Bødker & Christiansen, 2006; Crabtree et al., 2006, Turner et al. 2006). There are gaps in some of this past work that we seen to fill through our discussion around CSCL@Work.

Specifically, in order to **frame different problems** that support the development of technologies for Learning@Work, main design issues and research questions are

1) How do firms make learning practices in work processes visible and how to recognize such learning and establish a culture of learning at the workplace?
2) How to bridge formal, non-formal and informal learning activities?
3) How to design learning at work? (when work is the primary activity and learning is the secondary activity)
4) How to design learning activities when an answer does exist (e.g., routines) and when the answer is not known in the organization, or does not exist at all?

Related Work. Prior work related to CSCL@Work includes empirical research on collaborative work practices (Davenport, 2005; Lave & Wenger, 1991), the sharing of information at work (Brown & Duguid, 2000), and the development of communities of practice in workplace settings (Wenger, 1998). Other prior work examines the munificent variation of information and communication technology use in the work place, including studies of informal social networks, formal information distribution

and other socio-technical combinations found in work settings (Hinds & Weisband, 2003). Prior, well-known findings like these rely on the premise that knowledge within an organization's walls can be actively diffused across the organization (Gibson & Cohen, 2003). These studies then proceed to describe various models explaining how that occurs. Such knowledge management approaches are premised on a certain degree of environmental stability inside a company; such premises no longer hold in many contexts.

CSCL and CSCW research each make distinct and important contributions to the construction of collaborative workplace learning, first identified by Billet (2002). One research thread focused on this boundary-spanning field is developed by Yrjö Engeström, who introduced "activity theory – expanding learning" – as a conceptual frame for analyzing and redesigning work (Engeström, Miettinen, & Punamäki, 1999). In his more recent books, Engeström and his team illustrate the connections among learning and work, e.g., "Between School and Work: New Perspectives on Transfer and Boundary Crossing" (Tuomi-Gröhn & Engeström, 2003; see also the works by Mørch & Skaanes, 2010, "learning across sites"). Their case studies reflect new concepts salient for a) new pedagogical practices and b) new work practices, such as "mirror therapy". New pedagogical practices include his use of a cultural laboratory, methods he describes as horizontal working and the notion of "boundary zone activities". Boundary zone activities could be conceptualized as related to the work of Lee (2007) who described boundary-negotiating artifacts.

2 Context, methods and findings

Our work to date includes facilitation, discussion leadership and intellectual guidance for 3 workshops and an edited book focused on CSCL@Work. Our workshops were at ACM Group 2010, ACM Group 2012 and CSCL 2013. Our thinking grew from 8 original case studies in 2010 up to 13 case studies in 2012. These cases and our synthesis of thinking across the cases, is presented in Goggins, Jahnke, Wulf (2013). How learning at the workplace takes place is summarized in 3 key theses:

a) Learning at work occurs in unexpected, unusual online learning places using Social Media
b) Learning activities at work incorporate feedback and 'feedforward' from diverse sources to support individual and collaborative reflections, which are not available within traditional organizational boundaries
c) Learning at work takes place across established boundaries

The theses we present inform the design of collaborative technologies and sociotechnical learning practices in our ongoing work. To make learning visible, to support and recognize it, we argue that the design of individual and collaborative learning (co-construction of knowledge) can be supported through a social, pedagogical and technological design.

2.1. TEL@Work - quality of learning?

We understand learning as "an active process of constructing rather than acquiring knowledge, and instruction as a process of supporting that construction rather than communicating knowledge" (Duffy & Cunningham, 1996). Instructions are not re-

stricted to teaching. It encompasses scaffolding and enabling possibilities for learning. Following this, learning is defined as co-/construction of knowledge and competence development where different people get the opportunity for creative thinking, introducing new ideas and taking creative actions. Learning outcomes are newly developed skills that learners use to solve a specific problem, to create new ideas together with other people, or to create new actions (Anderson & Krathwohl, 2001).

We argue that the design of learning at the workplace needs to support both individual and group learning. Learning underlies a range of different forms of quality. Learning can take place on the "surface level" like remembering facts and understanding information to "deeper learning" which includes a critical thinking and a conceptual change (Kember, 1997). A deeper learning level leads to a member within an organization who does not only know the routines and becomes a 'good' member of a society but also can create new practices and innovations. For example, s/he questions the given understanding of routines.

This learning approach presents new insights about workplace learning, and also new challenges. Operationalizing this view of learning inspires a new set of questions about the behaviors, culture and infrastructure needed to support building a framework for TEL@Work:

- What is the underlying concept of learning within organizations and does it relate to individual, collaborative and organizational learning?
- What kinds of possibilities to enable learning in the workplace are available in the firm?
- Do sociotechnical designers, researchers and workplace learners need to focus on a new balance of formal and informal learning? To what extent?

2.2. A candidate design model for learning at work

When designing learning at work the overall research question is how to design (develop, introduce, evaluate) it *successfully* and what elements can be designed (general model). But the central problem is what does "successful" mean, to what extent is a *design* successful or not? Jahnke, et al. (2010) describes one possible model. In her study of designing remote-controlled laboratories in mechanical engineering, they demonstrate a design model with three elements, which provide a set of opening factors for CSCL@Work inquiry. The model includes three basic elements and its interconnections (*key factors*), read figure 1.

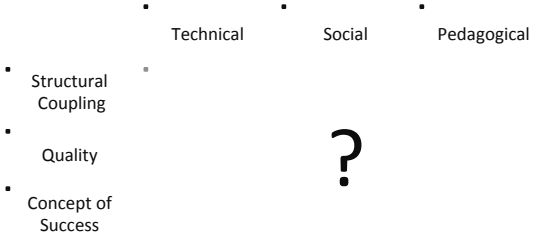

Figure 1. General design model for CSCL@Work (Goggins & Jahnke, 2013)

Summary. The presented framework contributes to a foundation for discussing a design focused TEL@Work research agenda. It is a starting point. Future Learning@Work studies can use it in order to design learning at the workplace in manner

that reflects both changing societal needs and emerging information and communication technologies for learning.

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