SOCIOMATERIALITY AND DESIGN – HOW DO WE UNPACK TECHNOLOGY FOR KNOWING IN PRACTICE?

Research in Progress/Workshop

Hattinger, Monika, University West, Trollhättan, Sweden, monika.hattinger@hv.se

Abstract

Blended e-learning permeates flexibility and school is no longer the only place for learning, rather through e-learning courses new ways of building competences throughout life and integrated in the workplace can be accomplished. Technological artifacts, the material itself do not create learning, rather, social and pedagogical aspects from a participatory perspective in e-learning courses is needed to balance the impact of technology. Challenges to reach balance between material and social is in this paper illustrated as a sociomaterial learning practice through a work-integrated e-learning (e-WIL) project between a university and collaborating manufacturing industries. This learning practice comprise design of e-learning courses, target industry knowledge needs to reach for being a competent employee. Teachers' and course participants' activities show various challenges of work-integrated e-learning. Early results from focus group sessions and observations are categorized as knowing-how to design and use digital learning technology, knowing-what knowledge to be learnt for work practice and knowing-when to use new knowledge in work practice.

Keywords: Sociomateriality, Work-Integrated e-Learning, learning technologies, engineering competences.

1 Introduction

"I think this web meeting system is fairly good for lectures, but when there are discussions it is still noisy. But as I had to leave the office I switched to the iPhone, and it worked perfectly!"

"We could have practiced more in this web meeting system. Hard to do discussions and also to use private chat functions in the platform, when we negotiate on-line. This is not the case in a real work situation."

These two quotes represent two engineers at work, taking part in a blended e-learning course in collaboration with a university. The participants work at a manufacturing company in Sweden and are joining a course together with participants from other companies. They use a web meeting system for discussions of topics related to the course content within engineering. As we can see, one participant easily switched over to other mobile technologies, when moving out of the office. He found it convenient to use multiple systems for continuing the communication and was eager to learn more. The other participant in the same meeting realised it was harder to do on-line negotiations, and would have preferred a physical meeting instead. These two situations deal with technological artifacts, the material, and also social aspects of the learning situation, and as so, they are intertwined in what can be considered as a *socialmaterial learning practice* (Leonardi et al., 2012; Leonardi and Rodriguez-Lluesma, 2012; Orlikowski, 2000; 2007; 2010).

Learning technologies in on-line (i.e. e-learning) courses has become tradition for university education targeting both students at campus as well as learners in public and private organizations (Govindasamy, 2002; Olson et al., 2011). Efforts towards technological innovation and new pedagogical approaches, reaching for an efficient digital learning environment and to achieve a high learning outcome, have in many cases been the streamline among educational designers and scholars (Johri, 2011). But with the lens of effectiveness at hand, the solution to solve educational problems is often related to

increasing the efficacy of the technological artifact itself, e.g. an application that needs to be improved, and do not always account for the whole learning situation. Such a position could be reflected as technological determinism and is often common when the objective is to effectively deliver courses instead of stimulating learning (Johri, 2011). It bears a strong materialistic stance, where focus is rather on the effectiveness of the technological artifact itself and not on social relations and activities among practitioners, stimulating learning and knowing. Instead, if we again look on the quotations above, we see that there is at least a double intention with the on-line learning situation that needs to be understood; both the technological materialistic features that ought to bring in an easy functionality (private chats were hard), and also how social negotiations of the learning content, the knowledge material is discussed among peers, here viewed from a socio-cultural historical approach (Engeström, 2001).

In contrast to technological determinism (Smith et al., 1994), other streamline of research as organisational studies rather centre social aspects of activities and routines and tend to black-box technology. A problem with such a sociological deterministic account is that when problems within the material is confronted, it will not be illuminated in particular (Leonardi et al., 2012; Leonardi and Rodriguez-Lluesma, 2012). As an answer to either of these two traditions, the emergence of the term sociomateriality, is manifested as a symbol for a *"relationship between the social and the material, in the context of our increasingly digital society"* (Cecez-Kecmanovic et al., 2014, p. 809). This approach underlines an alternative to understand relationships between the social and the technical, and can be considered an ontological view of intertwining between *"the social and the material as inherently inseparable"* (Orlikowski and Scott, 2008, p. 456). It seems that sociomateriality offers a balanced concept that enforces our understanding through a fresh theoretical perspective, leaving traditional dualism of human actors versus material things, to be replaced by mutually constitutive duality between the social and the material (Pickering, 1995; Orlikowski, 2007).

Given that technologies, people and organizations are seen as mutually constituted in an *imbrication* (Leonardi et al., 2011) or in an *entanglement* (Orlikowski 2007, 2010; Orlikowski and Scott, 2008) sounds from the outside as they are ontologically equal, but Kautz and Jensen (2012) argue that they are ontologically different. Accordingly, Leonardi and his colleges tend to build their work from a technological design background, meanwhile Orlikowski´s work are based on social studies of technologies' in use (Orlikowski, 1992) and their relational qualities. Given this background, on entanglement (Orlikowski and Scott, 2001; 2008; Orlikowski, 2007; 2010) and imbrication (Leonardi et al., 2012; Leonardi and Rodriguez-Lluesma, 2012), it is interesting to see if the these concepts are valuable to view knowledge and knowing in practice through e-learning initiatives. The aim in this paper is to illustrate a *sociomaterial learning practice* through a work-integrated e-learning (e-WIL) project between a university and manufacturing industries by giving examples of activities in a learning practice. I will use social and material agencies as interrelated to each through entanglement and/or imbrication in an ongoing design process for competence development of engineers in the industry. (Leonardi et al., 2012; Corradi et al., 2010; Orlikowski, 2002; 2007; Johri, 2011). *How do workers and teachers learn and act competent in a sociomaterial learning practice?*

Further on, a theoretical discussion on sociomateriality follows. I will not try to suggest another term, like many other researchers have, e.g. disentanglement (Bratteteig and Vern, 2012), bounding (Björn, 2012) agential cuts (Kautz and Jensen, 2012) or sociomaterial bricolage (Johri, 2011). Rather, I will search for "being practically relevant" and seek to explore the co-constitution of the social and the material related to the research project and what competences that are sprung out of such approach. In the following a short case description is followed by a sociomateriality discussion exemplified by the case. Thereafter some short implications, an early result, is described.

2 Competence development through work-integrated e-learning

The overall objective in a longitudinal action design project, performed as a collaboration between one university in Sweden and about 15 manufacturing industries (started in 2013 and is still ongoing), is to design and implement blended e-learning courses on advanced academic level. These courses are not regular campus courses, neither in form nor in knowledge content, but target manufacturing knowledge aiming to support industry experts' competence development to foster a productive manufacturing plant. In general, the design work, mostly governed by the university, is to accomplish new learning and new knowledge through short blended e-learning courses of 2.5 ECTS. The engineering practice and the university theoretical knowledge, is intertwined as pedagogical discourse during the courses which is described as a work-integrated learning (WIL) approach. University teachers together with support personnel are designing the courses with a blend of learning technologies. Digital learning content, the material, is designed as instructional videos, power points, you-tube clips, and virtual labs etc. Learning content is shared on a LMS in combination with social media chats, and web meeting systems, Skype and/or Adobe Connect. Every course run for five weeks with maximum of three physical meetings including examination. The didactical discourse aims at communication and interaction. The complexity of designing blended e-learning courses in engineering as a materialistic and problem oriented university subject, besides the complexity of handle the learning technologies itself, form the basis for the data collection activities. Data collection for this paper are mainly performed as qualitative teacher interviews (7 teachers) and focus group sessions (15 courses during 2014-2015) with involved stakeholders (course participants – employed engineers and teachers – researchers in manufacturing), through an action-oriented design approach (Sein et al., 2011).

3 From sociotechnical traditions into sociomaterial practices

From a historical point of view technological artifacts, design and practice in organizations have been described by IS researchers within e.g. socio-technical approaches (Ehn, 1988; Mumford, 2006), by the community of Computer supported cooperative work-CSCW (Schmidt and Bannon, 1992) and also by organizational theorists' keen interest in technology studies (Orlikowski, 1992; 2000; Orlikowski and Iacano, 2001). Orlikowski and Iacano (2001) argued for a deeper engagement of technology, to theorize the IT artifact itself, and to reopen technology, often treated as a black box, within organizational studies, because technology where often seen as a stable structure and taken for granted, a kind of a continuum and tended to vanish in the light of issues around social construction (Latour, 1987). Already then, they proposed differentiated technological conceptualizations, by meta categories; *the tool view*, *the proxy view*, *the ensemble view*, and *the nominal view*. The case in this paper would here be labelled as an ensemble view building on Kling/Latours theoretical split of first a *development* phase and then a *use* phase (cited in Orlikowski and Iacono, 2001, p. 126).

Also, IT artifacts were described as they are *not* neutral, universal or given, because they are designed, constructed and used by people with various interest. IT artifacts are embedded in time, in place and in different communities. Meaning that technology is flexible and strongly bounded contextually: *"As such, their materiality is bound up with the historical and cultural aspects of their ongoing development and use, and these conditions, both material and cultural, cannot be ignored, abstracted, or assumed away."* (Orlikowski and Iacano, 2001, p. 131). An early progress into the concept of sociomateriality, were taken. *Sociomateriality*, the umbrella concept, echoes an entire stream of new research related to relational ontology which is different to the substantialist ontology dominating IS and management research (Cecez-Kecmanovic et al., 2014). A substantialist ontology accept social and material existence as separate entities, meanwhile relational ontology assumes that social and material are inseparable (Orlikowski and Scott, 2008). In Leonardi´s chapter (Leonardi et al., 2012) he thoroughly describes how sociomateriality progressed through researchers' view on technology, e.g. through Latour´s actor-network theory (sociology) and Orlikowski´s structuration theory (organization) among others studies. Orlikowski´s earlier and recent work have inspired the sociomaterial de-

velopment and also Leonardi´s own work. In one of her recent papers (2010) she raises the importance of *"practice is the space in which the social and the material become constitutively entangled."* Though, according to Leonardi´s interpretation of entanglement and entangling, this is not enough, because entangling will not consider all relations and the world as it is (a whole), because some parts need to be dismantled in order to be worked on (Leonardi and Rodriguez-Lluesma, 2012). Instead Leonardi proposes that *"sociomaterial practice is understood as the space in which social and material agencies are imbricated."* (Leonardi et al., 2012, p. 38). Imbrications refer to time and is path-dependent through the repetitive interlocking of social and material agencies (ibid.). Furthermore, he means that it is difficult to take into consideration inseparability when we redesigning systems. So, what he means is that imbrications can be undone and remade. To really understand this line of argument, and to find it useful in design-work in spaces of social and material practices, we need to know what materiality really means.

3.1 Materiality

The material aspects are in many senses hard to describe when it comes to information technology. Technological artifacts, tend to be considered as the physical material of a technology, e.g. the computer, the cell phone, the iPad etc. As technological devices emerge into new "forms" and becomes embedded in practice, in social and organizational settings, it will be shaped into something new. Something that is either material and/or social. For instance, how can a software program be technological material? Rather, *"material properties of artifacts are precisely those tangible resources that provide people with the ability to do old things in new ways and to do things they could not do before"* (Leonardi and Barley, 2008:161, cited in Leonardi et al., 2012, p. 5). The material can be tangible but also intangible through paths that material is mediated and interfered with human concerns. So material in this meaning are no longer physical, as the former, and very often used term artifact. Nevertheless, we cannot say that technology and material are the same thing, and we need to describe technologies material properties as well, when we study such use, design and practices. So relationships between material and technology is not easy to define or even to understand clearly in every occasion, because it is in many senses constituted in social and practical contexts as well in peoples' mind. Another aspect is that materiality, meaning the artifacts physical and/or digital materials particular forms *endure* across differences in time and space (Leonardi et al., 2012, p. 42). Orlikowski (2000), though claim that a *"stabilized-for-know status… to our technological artifacts… because technologies continue to evolve, are tinkered with (by users, designers, regulators, and hackers*)" (p. 411-12).

3.2 Agency

When we know that social and material are intertwined, and occurs in the space of practice, then we need to consider *how* such social and material become entangled (Leonardi et al., 2012). Human agency is defined by the ability to form and realize one´s goals (Giddens, 1984, referred by Leonardi et al., 2012). People perform their human agency in relation to technology´s material agency. Material agency is the capacity for nonhuman objects to act absent sustained human intervention. It means that material agency, like technological artifacts can perform things without human interaction and control. Human and material agency differ in their intentionality. According to Pickering (2001, referred by Leonardi et al., 2012) social agency is a group´s coordinated exercise of forming and realizing its goals, meanwhile material agency has none of its own goals (intentions). From this argumentation, Leonardi's concept of imbrication is progressing. Materiality refers to properties of an object, and material agency refers to the way the object acts when humans provoke it. Almost as a function. In this logical description, Leonardi means that materiality is consistent over time, and is independent of people, meanwhile material agency, is a construction that depends, partly on materiality, and on the perceptions of what functions an artifact affords. Given this, Leonardi's (2012) definition of imbrication follows as; *"Social and material agencies are distinct from one another, and it is only once they be-*

come imbricated in particular ways that they can then reconfigure technology´s materiality and organizations´ communication patterns." (p. 38). In this meaning material agency differs from Orlikowski's relational ontology.

3.3 Knowing in practice

Practice, as a theoretical concept, takes place in space, in a socially shaped arena, in which social and material agencies are entangled and imbricated. Practice is something that is shared within a community (Lave and Wenger, 1988) and is a collective action upon structural conditions and its production is built on experiences, cultures and actions. Orlikowski´s (2000) practice lens deals with how people interact with technology in everyday work as a process to understand the social practices in the ongoing everyday use. This view applies well to the case of e-learning among practitioners in this paper. One need to learn, both informal a formal, to be and act competent (Orlikowski, 2000). Instead of a focus on knowledge, she argues for knowing as a practical experience-based concept. Know-that, know-what, know-how and know-when are variants tightly related to abilities and "doings" of knowledge. Knowing also refers to knowledgeability of people and organizations.

4 Sociomaterial agency in an e-WIL practice

The following situations illustrate social and material agencies on entanglements and imbrications in the space of a work-integrated e-learning (e-WIL) practice. The quotes are interpretations of different perspectives on knowledge and knowing through as a process of learning into acting competent, related to both competences of learning technology design and use (both teachers and participants) and also to be competent engineers at work.

Competence mapping between university and industry. When talking of mapping industry competence needs against the university expertise, one engineer says: *"We should have more relations and develop courses together."* This refers to a strategic relation between the university – industry collaboration and how to increase their communication in order to further co-produce knowledge content. The relations are social but the learning content needed to be defined and con-constructed, is a sociomaterial situation, because it relates to the space between diverse participants and is therefore also entangled. Here both organizations are interested in knowledge sharing across boundaries to reach for higher competences of new knowledge fields, reflecting on each other expertise, but also on digital competences needed to use learning material. This short phrase, thus, entails huge efforts for both organizations.

Designing e-learning courses. Teachers describe their pedagogical work, their thoughts of current practice and how they develop these activities that are strongly bound to hands-on actions and therefore becomes hard to transform into on-line environments: *"My course is a mixture of lectures, hands-on exercises, and I also try FAQ:s or perform small seminars where we discuss different topics… I suggest four different issues to follow up and then the students can pick up one of those to go further with."* This refers to everyday practice for teachers in their profession. It is not enough to be a competent expert teacher in the "engineering way of thinking". Rather, the teacher also need to develop design skills as a new type of digital competence and also to be able to act as a competent teacher.

Diverse competences are needed; a digital *know-how* to design and use learning technologies, *knowing-what* knowledge to be learnt for work practice (adjustment to the learning material content) and *knowing-when* to use new knowledge in work practice. So what is social and what is material? The sociomaterial agencies are hard to separate, for instance how do a teacher delegate the design of digital learning content within an expert field, to others without taking part in such development? But, when considering a teacher with very low ICT skills, to some extent this has to be done in practical design work. Engineering knowledge are not enough, for entering into digitalisation of learning content and to be a competent teacher on-line. ICT skills required for e-learning production is something else. In

this view, everyday e-learning practice is configured and reconfigured by the multiple meanings and materialities that are fused together in the engineering teachers work in relations to practitioners' skills for taking part in such sociomaterial learning practice.

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