

Chapter 8

Implementation of an Infrastructure for Networked Learning

Tom Nyvang and Ann Bygholm

Introduction

Information and Communication Technology (ICT)-supported learning, understood as the use of ICT to support and enhance learning practices, has become an integrate part of university education. This is, however, only a small part of the full story. Institutions, departments, and individual members of faculty utilize ICT in quite different ways depending on the kind of ICT and assumptions about which designs for learning are the most productive. Problem-based learning (PBL), computer-supported collaborative learning (CSCL), and networked learning are examples of (overlapping) genres in learning design that offer different ways of thinking about ICT support for learning and many more could be mentioned. PBL stresses the importance of working with authentic real world problems and projects as an integral part of (university) education (Kolmos et al. 2004). PBL has spread in universities since the 1970s which of course is before ICT developed into a significant part of educational processes, but is today often associated with ICT support for collaboration and project management (Dirckinck-Holmfeld 2002; Dirckinck-Holmfeld et al. 2009; Ryberg and Dirckinck-Holmfeld 2010; Haakon Tolsby et al. 2002). PBL has its theoretical roots in the very early constructivists Dewey (1910), Vygotsky (1978), and Piaget (1999). The problem with the PBL genre is that it tend to say little about all the aspects of education that is not problem solving and it has only to a smaller extent been developed in the light of ICT. CSCL is born with the personal computer in the 1980s and stresses the learning outcomes of close collaboration between learners in a computer-supported environment (Koschmann 1996). CSCL has its theoretical roots in the social constructivism and some of the same early works that underpin PBL (Koschmann 1996). Today CSCL has developed its own

T. Nyvang (✉) • A. Bygholm
Department of Communication and Psychology, Aalborg University, Aalborg, Denmark
e-mail: nyvang@hum.aau.dk

theoretical foundation in works by Koschmann, Stahl, and others (Stahl et al. 2006). In the case of CSCL, the focus on close collaboration is its strength and weakness at the same time; we regard it a strength that the genre is very focused, but a weakness that it cannot be applied above the microlevel since no or very limited perspectives on the relation between close collaboration in the organization is offered (although Jones et al. (2006) suggested more work on meso-level design in CSCL and networked learning). Networked learning has a broader definition:

Learning in which information and communication technology (ICT) is used to promote connections: between one learner and other learners; between learners and tutors; between a learning community and its learning resources.

(Goodyear et al. 2004, p. 1)

The concept networked learning has developed over the past 10 years along with the increased use of networked personal computers for learning support in universities and other educational institutions. Networked learning draws on the early constructivists (Dewey 1910; Piaget 1999; Vygotsky 1978) just as PBL and CSCL. Networked learning has similarities with the views on networks presented by Castells (2000) and Siemens (2005) and they have to some extent influenced the development of networked learning (Bell 2010; Jones and Dirckinck-Holmfeld 2009; Jones et al. 2008). Castells do not focus specifically on learning, but on the network society and the concept of networked individualism describing the interdependence between individual and network (Castells 2001). Siemens (2005) does, however, focus on learning and argues that ICT is a core driver for learning by supporting connection of nodes and sense making.

With networked learning ICT support for learning has developed from being an isolated and uncoordinated endeavor of individual technology interested teachers to being an institutional commitment. If there is no institutional or managerial commitment the network for learning is not likely to have many nodes or stretch across an institution. With few nodes it is also not likely to foster the kind of connections needed for networked learning to take place. If the network stretches beyond the class of the individual teacher it is, however, also evident that the network of learners becomes quite complex. Actors (teachers, students, managers, others) will have to develop their own contributions and yet make sure they fit into the network of other actors and resources.

Jones et al. (2006) suggest that for CSCL and networked learning to be developed further research and practice should focus on the meso-level of collaborative learning:

On how to design for collaborative learning at the institutional level, in organizations, school settings, and in networked learning environments,
 On what the basic conditions are that allow for collaborative learning in these settings,
 On how the technology and infrastructure affords, and mediates the learning taking place.

(Jones et al. 2006, p. 37)

The meso-level is in other words the level that lies between the overall societal or institutional macrolevel in large institutions and the very local microlevel teaching and learning practices.

With this chapter we aim to uncover the meso-level conditions under which institutional actors decide upon ICT strategies for networked learning purposes. We chose to do so because we suspect that the meso-level is where networked learning is made possible, but also where different rationales, priorities, and values may clash in an unproductive manner and hinder the implementation of a networked learning environment that helps the learner to learn something useful to her. We know from earlier research that decisions are often made in an ecology of multiple actors, tools, and intentions (Bygholm and Nyvang 2009). To develop leadership and change strategies in and around networked learning we thus experience a need to develop insights that are qualitative in nature.

In the following sections, we present our case study methodology, our analysis, and discuss our findings.

Human Centered Informatics: Case Study Design

The case study focuses on implementation of ICT in the program Human Centered Informatics, a program within the humanities at Aalborg University. The program offers bachelor and master level educations and has approximately 700 students distributed across two campuses, one in Aalborg and another in Ballerup (in the Copenhagen area). The program combines studies in communication, organization, esthetics, learning, and ICT.

This case study is a follow-up to another case study committed 4–8 years ago when Human Centered Informatics went through a development process ending with the implementation of Lotus Quickplace (later renamed Lotus Quickr), an information and communication system to be used by administration, students, and teachers. According to Nyvang (2008), the early stages of the project aimed to uncover the existing ICT-related practice in the organization. The project also aimed to identify the goals to be pursued by using ICT in the organization. In the end, the goals were transparency, coherence, flexibility, and quality in teaching and learning – these were however also at a high level and open for interpretation. At a more concrete level, the new ICT were supposed to support PBL approaches to teaching and learning (Nyvang and Tolsby 2004; Tolsby et al. 2002). The latter had a significant influence on the choice of Lotus Quickplace because it supported group collaboration. Lotus Quickplace was, however, also chosen for its flexibility as a content management system which meant that it could be rearranged to manage course-related communication too. The case study conducted 4–8 years ago also focused very much on the implementation process – on the change from a myriad of different systems and ways of communicating to one common system and way of communicating across the organization (Bygholm and Nyvang 2009; Nyvang 2006; Nyvang and Poulsen 2007): What were the needs of the different members of the organization? How were ICT adopted and adapted? What were the main influences on the many decisions made on different levels and by different actors in the organization? The main influences were ICT already used in the organization, ICT known from other contexts, culture and pedagogical model, and the existing division of labor between teachers, students, and

administration (Nyvang 2008). Members of the organization discussed whether one common tool for all students, teachers, and administrators would be the most productive way to proceed. Those discussions never came to any concrete conclusion. Lotus Quickplace was chosen as a common framework, but many teachers and students chose other ways to communicate and collaborate, and discussions and negotiations kept bringing the technology to the forefront of attention in the organization.

This case study investigates under which conditions actors in institutions decide upon which ICT to use for networked learning purposes? The occasion is when Human Centered Informatics has decided to discard Lotus Quickplace and implement a suite of tools with Moodle at the center instead. From an overall perspective, it seems unclear what the organization has learned about networked learning so far and how it affects the decision to implement Moodle and the day-to-day decisions on how to use Moodle. With the research behind this chapter we aim to uncover the so far invisible or unspoken rationales developed and used by different actors in the decision and implementation process. Our working hypothesis is that the tools, infrastructures, and technologies we use will never permanently step into the background. From time to time, they will require attention for one reason or another and it is when they spring into attention we have a special opportunity to gain a deeper insight in the practices and challenges of networked learning in the organization. Tyre and Orlikowski (1994) support the hypothesis that times of change are relatively short when new systems are implemented in organizations and that the windows of opportunity for studying change are equally small. Research by Flores et al. (1988) supports the hypothesis from a different perspective – namely, by suggesting that the situations when tools or practices fail and thus come to the forefront of attention offer access to information that is usually invisible or resembles silent knowledge.

The case study methodology and analysis used in the Human Centered Informatics case is rooted in the theoretical frame of activity theory. Activity theory derives from Russian psychology where psychologist like Vygotsky (1978) and Leont'ev (1978) developed a cultural historical social psychology during the twentieth century. Over the past 20–25 years activity theory has been subject to growing attention in the Western Europe and in the USA and across a diverse set of research and practice fields. Yrjö Engeström (1987), a major contemporary contributor to activity theory and others have developed the use of activity theory in education and learning. Kari Kuuti has also taken part in the development of activity theory for use in human computer interaction and defines it as:

a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, with both individual and social levels interlinked at the same time.

(Kuutti 1996, p. 41)

Vygotsky originally founded activity theory based on a criticism of the behaviorist stimulus–response (S–R) model of human behavior – a theoretical model that explained human response to stimuli with prior positive or negative experience of a similar stimulus and response (Vygotsky 1978, pp. 39–40). He found the S–R model too simple to explain human reasoning in a socio-cultural context and argued that

human action internally (in the mind) and externally (in the world) is mediated by some sort of mediator. Language is one such mediator that shapes the way we think. Tools are another kind of mediator – a hammer in hand mediates the way we think about and approach a task. Vygotsky also stressed that human action is goal-oriented. Leontjev moved on to add that human goal-directed action is subordinate to a motive and takes place under certain contextual conditions. Engeström (1987) took activity theory a step further by developing the understanding of the relation between individual and collective.

Early works by Vygotsky (1978) used case studies to develop activity theory, but from these works, we cannot learn much about the methodology. One of the major contributors to activity theory-based methodology, Engeström (1987, 2009) did, however, take his developmental research a step further by claiming that research based on activity theory should involve the researcher in action research like developmental cycles to fully uncover the nature of development. Kaptelinin et al. (1999) went on to suggest an activity check-list aimed at studies of human computer interaction – not specifically calling it case studies, but from their description of the check-list they were obviously a tool for organizing studies of cases of human computer interaction. Later on, Kaptelinin and Nardi (2006) and Spinuzzi (2003) have developed more comprehensive methods for organizing analysis and design processes aimed at different instances of human computer interaction. These methods thus fall into the expansive developmental research tradition of Engeström, but they also contribute to the body of methodological knowledge by developing tools with a specific domain in mind – and by developing tools aimed at both practitioners and researchers.

For the research reported in this chapter, we draw on the analytical tools provided by Kaptelinin et al. (1999). Our choice is based on the simple and yet knowledge generating nature of the methodology. This means that we have the following foci when designing data collection and analysis:

- **Means/ends:** Deals with the hierarchical nature of an activity – conditions, goals, and motives for activities in the organization.
- **Environment:** Deals with the objects in the context of an activity – tools and technologies used in the organization and by its members.
- **Learning/cognition/articulation:** Deals with the exchange between internal mental processes and external processes – ways of thinking and how they interact with technological potential for representation in the world.
- **Development:** Factors influencing change in the organization – the history of core activities and how they shape present changes.

In our data collection, we have focused on all of the four major issues of the activity check-list when asking questions in interviews, reading documents, and examining ICT that are in use in the organization. For data collection, we have conducted qualitative interviews with key members of staff. In our search for key members of staff we look for what von Hippel (1986) defines as lead users. Lead users are users with the special quality that they can identify the needs of a larger population before the rest of the population does so. In our search for lead users we have also focused on finding the influential members of staff. We ended up with a teacher who is a

networked learning expert, two from the division responsible for the design and support of networked learning systems, and the head of the study program Human Centered Informatics. We have also met 80 third semester students in a workshop-like situation where the students were asked questions, discussed these, and returned short answers in writing. Finally, we have studied existing documents (research mentioned earlier in this section) and the primary system used so far: Lotus Quickplace.

We have chosen not to focus on the interaction with higher levels in the organization and stick to actors very close to the technological infrastructure even though our interest in meso-level design might suggest a broader scope. We have done so because the head of studies and the study board behind him at the time of the data collection had the resources and power to make this kind of decisions without involving higher levels in the organization. It is, however, important that higher levels in the organizations allowed this kind of local decisions and that it was possible to buy technical support for it in the organization. We thus plan to broaden to scope further in future research.

Analysis

The activity of interest is networked learning at Human Centered Informatics at Aalborg University and the aim of the analysis is to reveal practices and problems with the existing system, and also ideas and positions to the new system. The data analysis has been organized in two steps – first we identified different groups involved in realizing networked learning at Human Centered Informatics and then we read and coded our data with the activity checklist in mind. The major groups identified were management, support, and key users, i.e., students and teachers. They are all important but of course they engage very differently and play different roles in realizing networked learning. In our report of the analysis, we go through the groups with focus on means and ends – the hierarchical structure of the activity. The hierarchical structure, that is the distinction between conditions, goals, and motives, opens for an understanding of different aspect of the use of technology, i.e., physical/technical interactions, conceptual interactions, and contextual interactions (Kuutti and Bannon 1993). Focus on means and ends imply furthermore that you start with identifying the goals of the various actions and then extend the scope of analysis both “up” to activity level and “down” to operations (Kaptelinin et al. 1999).

Management

The first theme, management, was informed by all interviews and by the students, but primarily by the interview with the manager of the program. This excerpt from the interview transcription (our translation) gives an impression of the statements of the head of program:

My only opinion is that we need to have a system that is super useful and super efficient for the students [...] but we also need a system that matches the ambitions we have [...] we need something that match these and I am told and can see myself that Moodle perhaps meets this requirement better than Quickplace. And also it may be argued that Moodle, which we agreed on relatively fast, is more scalable and easy to handle in terms of implementing supplementary systems as ELG or Mahara [...] which we also have ambitions to do.

(Head of programme)

The motives directly or implicitly expressed by the head of program stress branding by use of state-of-the-art systems for networked learning. Since state-of-the-art shifts, he implicitly expresses a positive attitude toward change and implementation of a new technology. The head of program also emphasizes the students whom we interpret as his major concerns in the excerpt and in the interview in general. Emphasis on students is perhaps not surprising, but he could, however, also have chosen a more indirect approach to the students by bringing the working conditions of his administrative or teaching staff to the forefront of attention.

Lower in the hierarchical structure, we find the more concrete activity and goals of the management. He admits that he has only used the existing platform very little. He has, however, experienced some of the problems with the platform reported by others: Often response times are rather slow (and worse if you use the wrong browsers and operating systems) and from an esthetic point of view he regards the platform as a disaster. In relation to the change of infrastructure for networked learning he has put together an expert group of researchers and support staff to help him choose a new platform for networked learning. What the head of program wants from the new platform in terms of actual use is, however, unclear and, based on the interview, it is our impression that he likes it that way. He wants the experts to tell him and the teachers how to proceed.

When managing Human Centered Informatics, the research done by the teachers in the program is a prominent condition. It is so in more ways; firstly a relatively large research center in the department researches networked e-learning; secondly another research center in the department researches media and esthetics, and thirdly, research-based programs have to develop content (and form) as time goes by and research develops new insights. These conditions altogether pose a context that influences the management toward choosing state-of-the-art networked learning environments – and perhaps also to put more emphasis on the esthetics of the networked learning environments. Other prominent conditions are the pedagogical culture and the organizational readiness to implement new systems. These conditions are further discussed in the following sections.

Operation and Support

The operation and support of the learning platform are divided into two different tasks, the operation of the server and the support of users, that is students, teachers,

and administrative staff, using the platform. The support task is taken care of by a special section and the following is primarily informed by our interview with two people from this section. The people working in the section have the overall responsibility for organizing the support task and they use a group of (hired) students to take care of much of the actual support. The following excerpt from the interview transcription (our translation) gives an impression on the issues that are emphasized by the support section.

Our role has been to organize the support. What kind of support and how should we deliver it? Who is going to do what? And so on. We have a group of student employees, how do we divide tasks, coordinate the duty roster, etc. [...] we use mail lists and similar to communicate internally [...] part of the support is to document procedures, we have produced a manual on how to handle support, shift in semesters and so on, on e.g. Human Centered Informatics.

(ICT supporters)

The original design/appropriation of Lotus Quickplace was based on a questionnaire to students which revealed a wish for a flat structure with relatively immediate access to the particular places in the platform. Principles of immediate access and relevant overview have also guided the further appropriation of the platform, thus a major reorganization gave the users from Human Centered Informatics their own Lotus Quickplace with a common notice board and a room for each semester, recently a SMS service has been added in order to provide users with relevant information.

The ongoing support “peaks” every time a new semester is beginning and a major task for the support section is to make sure that all the semester forums/rooms on Lotus Quickplace are allocated with the right students, teachers, and courses. In the interview, the support people mention that they often hear students complain about the very different ways in which the system is used by the teachers. In other words, there are huge differences in the way the courses are organized, several teachers do not use it at all, etc., and that the students would like the teachers to follow a more uniform pattern of use. The support section have tried to accommodate these needs by developing a course forum template indicating the basic demands for content and offering support to teachers in setting up the courses. Without much success though as the teachers have shown no interest.

Much effort in the support section has been done to systematize and standardize the support task. Thus, a help list has been implemented to take care of the day-to-day support, FAQ-lists, list of general rules for use, formulas for requesting rooms for project groups, and a task-divisions list for internal use in the support section. Also, documentation of the various practices has been developed.

The target actions of the support section are the ongoing day-to-day support of the users and also an appropriation of the system. The main concern is on the day-to-day support and they try to organize this as effectively as possible. The overall goal or motive is to deliver effective, useful, and prompt support and, in order to do so; they have developed tools and procedures to follow both for the users and for themselves. Questions concerning how to use the systems, e.g., the dissatisfactions

expressed by students about the teachers' use of the system and the teachers' lack of interest are of less concern.

Teachers and Students

The third theme, teachers and students, was informed by all interviews, by input from the students and by our reading of the Lotus Quickplace platform. The primary insights did, however, emerge from the teacher interview and from the inputs from the students. This excerpt from the interview transcription (our translation) gives an impression of the statements of the teacher:

I would have liked to have more dialogue in Quickplace – I believed that I would have been able to make the students more active and thus I had planned to make a café [...] for informal talks [...]. My experience from other settings is that if you add some fun elements it may motivate students to log in just from curiosity to see what is going on [...]. Some of them did not want to blog, just out of principle because they were forced to do so [...]. But as the course was about basic ICT we have also used other tools [...].

(Teacher).

The motives directly or implicitly expressed by the teacher points toward the pedagogical model of the program (PBL) as a core motivation. She stresses the importance of student involvement and active participation in the learning processes. The motive of the teacher is, however, challenged by students that repeatedly argue for more standardized teacher-generated input – e.g., lectures and readings. We interpret this as the students strive for a reduction of the uncertainty and stress that may follow when teachers hand over the responsibility for tasks and problem solving to the students.

At the activity and goal-oriented level of the activity, much attention from both teachers and students seemed to be given to day-to-day planning and accomplishment of teaching and learning activities. The teacher structured activities and published information to students. Sometimes she also searched for information about the content of other courses, but was often unsuccessful. The students spent time on finding out which activities they were expected to take part in and on preparing for the activities by reading or meeting with other students to work on tasks or projects. The busy lives on both the teacher side as well as on the student side might lead to a contradiction founded in the division of labor: The teacher pushed tasks to the students and the students pushed tasks to teachers and administration. The input from students and from the interview with the support staff told us that a lot of students used the virtual group rooms in Lotus Quickplace to support collaboration in the project group work. Apparently, this practice was invisible to the management since a new facility for group collaboration was given less priority in the Moodle implementation (in spite of the emphasis on collaborative PBL) than the course management.

The conditions for teaching and learning practices indeed include the official pedagogical model of the organization: PBL in different shapes and forms is very difficult to avoid. The platform for networked learning offered is another important condition – today, it is Lotus Quickplace and, in the future, it will be Moodle.

Platforms of different kinds that teachers and students use in other contexts also influence the way they interpret the needs of Human Centered Informatics. The teacher we interviewed know the platform First class from another program and likes the way it supports dialogue – and the students point toward Facebook for a well-functioning platform for communication and collaboration.

Discussion

It appears from the analysis that a multitude of issues, practices, and opinions forms the experience of the system in use and the decision to implement a new one. Different kinds of dissatisfaction have been expressed. A prevalent issue echoed in almost all interviews is that the existing system is inflexible meaning that there are too many levels to go through in order to get the desired information in, e.g., a specific course room. Also in general, the users find the system slow in use, response time being too long and, too many operations are required in order to perform relatively simple actions as posting a piece of information. This experience forms a contrast to the intention of support staff to ease the user's access and overview. This point to the fact that overview is highly sensitive to the actual context, but perhaps also that reproducing the structure from the physical context, e.g., semesters and courses, might not be the best solution. Another issue of dissatisfaction is expressed in the students' request for a more consistent and homogeneous use of the system on the teachers' part. Differences in use span from rather sparsely information, like a link to another system or perhaps a course plan to comprehensive use from some teachers with lots of material, interactions, and dialogue opportunities distributed in several subrooms. Hence, there is a contradiction between the students' needs for uniformity and a clear line of direction in where to find what is expected on the one hand, and, on the other hand, the teachers' need for doing things in their own way. This contradiction, that exists on the organizational level will of course not be solved by implementing a new system. Instead, it points to a basic discussion of what kind of role the "official" system should have. Different systems and different use practices in educational activities are tolerated, which on the one hand gives the opportunity to experiment, to innovate or to do next to nothing, on the other hand this also means that the students have to tolerate a wide variety of systems and use practices. Although the meso-level design and use of networked learning are mature in the sense that they are integrated, supported and have the attention of management, it is not at all clear how networked learning more specifically is supposed to be practiced.

If Tyre and Orlikowski (1994) are right, then Human Centered Informatics only have a small window of opportunity in which the existing unsatisfactory practices can be changed. This case study compared to earlier case studies in the same organization also suggests that Tyre and Orlikowski are right – very few changes have actually happened since the early days of the implementation of Lotus Quickplace. This suggests a need to work systematically with the development of new practices around the implementation of Moodle. What a suitable approach to development of

practices looks like depends on which perspective on change the organization adopts. De Freitas and Oliver (2005) list five different perspectives represented by five models: the fordist model, the evolutionary model, the ecological model, the community of practice model, and the discourse-oriented model. The fordist model implies a strong management and emphasis on division of labor, whereas the evolutionary, ecological, community of practice, and discourse models imply a focus on learning (e.g., through a series of smaller developmental steps over time) and the importance of communication in the organization. In this case, one could argue that the evolutionary learning-oriented model has failed so far since the predominantly bottom-up approach to development by means of Lotus Quickplace has failed. This is, however, not to argue that the fordist model would be a better approach to change management in the organization. The evolutionary learning-oriented models still have something to offer, but management and other parties involved need to accept that the evolutionary models also call for active participation, intervention, evaluation, and dissemination in the organization for the learning to take place and inform future practice. This implies that some sort of management intervention is desirable if the organization is to secure an implementation of Moodle that helps to develop teaching and learning practice in Human Centered Informatics. Drawing on the inspiration from Stein et al. (2011), it seems reasonable to aim for a process model that integrates different kinds of support for teachers (and students) with different attitudes and approaches to ICT. Drawing on the inspiration from the activity checklist (Kaptelinin et al. 1999) and keeping in mind the critique expressed by management, teacher(s), and students regarding the lack of shared visions for the use of networked learning, it becomes increasingly evident that Human Centered Informatics needs to work on both the why (why networked learning?) and the how (how are we going to use networked learning?).

Conclusion

We set out to uncover the meso-level conditions under which institutional actors decide upon ICT strategies for networked learning purposes. Moreover, we have drawn on a definition stating that networked learning is learning in which ICT is used to promote connections between actors in the learning ecology. Just as we suspected actors in the organization have quite different reasons for suggesting strategies for change that are also quite different in nature. Based on our literature study, case study, and discussion there is no reason to conclude that one strategy is better or for that matter more correct than another. Each strategy and its associated goals suggested that change should focus on issues that are important to different kinds of actors. Instead of searching for *one* correct strategy, we suggest that organizations aim for a multitude of interacting change strategies. A multitude of strategies that interact would build on the multitude of perspectives we have observed in our case and be in concurrence with the idea that nodes in the network are different

Table 8.1 Dilemmas in implementation of networked learning

	Goals certain	Goals uncertain
Technology certain	(a) A well-known situation: technology as well as goals are certain	(b) Need for negation: technologies are known but goals are uncertain
Technology uncertain	(c) Need for experiments: overall goals are certain but how goals are best pursued is uncertain	(d) Need for inspiration: goals and technologies are both uncertain

and connects differently. There will, however, still be a need to balance common overall development goals and local private goals of individual teachers.

In Table 8.1, we generalize these findings in a Matrix inspired by Thompson and Tuden (1959). The purpose of the table is not to identify the situation as one of the four prototypical situations mentioned. On the contrary, it is an attempt to display the complexity in working with ICT strategies for networked learning purposes. In the case of Human Centered Informatics some actors and tasks are in one situation, whereas other actors and task are in another situation, and at the same time. There is also no indication that the organization should aim for a situation with complete agreement on goals and technology since it would hinder the dynamics of the developing learning network. On the contrary, the infrastructure should support both the ordinary services defined by agreement of goal and technology and leave room for trying out new ideas. And the point is that in order to develop networked learning practices in the organization there should also be incentives to experiment with different technologies (how) and to take part in discussion on the reasons for and values of networked learning (why).

References

- Bell, F. (2010). Network theories for technology-enabled learning and social change: Connectivism and actor network theory. In *Proceedings of the Seventh International Conference on Networked Learning 2010*. Networked Learning 2010. Aalborg.
- Bygholm, A., & Nyvang, T. (2009). An infrastructural perspective on implementing new educational technology. In L. Dirckinck-Holmfeld, C. Jones, & B. Lindström (Eds.), *Analysing networked learning practices in higher education and continuing professional development*. Rotterdam/Boston/Taipei: Sense Publishers.
- Castells, M. (2000). *The rise of the network society* (IIth ed.). Malden, Oxford, Carlton: Blackwell Publishing.
- Castells, M. (2001). *The internet galaxy: Reflections on the internet, business, and society*. Oxford: Oxford University Press.
- de Freitas, S., & Oliver, M. (2005). Does E-learning policy drive change in higher education? A case study relating models of organisational change to e-learning implementation. *Journal of Higher Education Policy & Management*, 27(1), 81.

- Dewey, J. (1910). *How we think*. Boston, New York, Chicago: D.C. Heath & Co.
- Dirckinck-Holmfeld, L., Nielsen, J., Fibiger, B., Danielsen, O., Riis, M., & Sorensen, K. E. (2002). Designing virtual learning environments based problem oriented project pedagogy. In L. Dirckinck-Holmfeld & B. Fibiger (Eds.), *Learning in virtual environments*. Fredriksberg: Samfundslitteratur.
- Dirckinck-Holmfeld, L., et al. (2009). Problem and project based networked learning: The MIL case. In L. Dirckinck-Holmfeld, C. Jones, & B. Lindström (Eds.), *Analysing networked learning practices in higher education and continuing professional development* (pp. 155–175). Rotterdam: Sense Publishers.
- Engeström, Y. (1987). *Learning by expanding*. Helsinki: Orienta.
- Engeström, Y. (2009). The future of activity theory: A rough draft. In A. Sannino, H. Daniels, & K. D. Gutiérrez (Eds.), *Learning and expanding with activity theory*. Cambridge: Cambridge University Press.
- Flores, F., Graves, M., Hartfield, B., & Winograd, T. (1988). Computer systems and the design of organizational interaction. *ACM Transactions on Office Information Systems*, 6(2), 153–172.
- Goodyear, P., Banks, S., Hodgson, V., & Mcconnell, D. (2004). Research on networked learning: an overview. In P. Goodyear et al. (Eds.), *Advances in research on networked learning*. Massachusetts: Kluwer Academic Publishers.
- Jones, C., & Dirckinck-Holmfeld, L. (2009). Analysing networked learning practices. In L. Dirckinck-Holmfeld, C. Jones, & B. Lindström (Eds.), *Analysing networked learning practices in higher education and continuing professional development*. Rotterdam: Sense Publishers.
- Jones, C., Dirckinck-Holmfeld, L., & Lindström, B. (2006). A relational, indirect, meso-level approach to CSCL design in the next decade. *International Journal of Computer-Supported Collaborative Learning*, 1(1), 35–56.
- Jones, C. R., Ferreday, D., & Hodgson, V. (2008). Networked learning a relational approach: Weak and strong ties. *Journal of Computer Assisted Learning*, 24(2), 90–102.
- Kaptelinin, V., & Nardi, B. (2006). *Activity theory and interaction design*. London, England: MIT Press.
- Kaptelinin, V., Nardi, B., & Macaulay, C. (1999). Methods & tools: The activity checklist: A tool for representing the “space” of context. *Interactions*, 6(4), 27–39.
- Kolmos, A., Fink, F., & Krogh, L. (2004). *The Aalborg PBL model – progress, diversity and challenges*. Aalborg: Aalborg University Press.
- Koschmann, T. (1996). *CSCL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Kuutti, K. (1996). Activity theory as a potential framework for human-computer interaction research. In B. Nardi (Ed.), *Context and consciousness: Activity theory and human-computer interaction* (pp. 17–44). Cambridge, MA: The MIT Press.
- Kuutti, K., & Bannon, L. (1993). Searching for unity among diversity: Exploring the “interface” concept (Using the approach of activity theory). In *Proceedings of INTERCHI '93*. INTERCHI '93. Amsterdam: IOS Press.
- Leont'ev, A. (1978). *Activity, consciousness, and personality*. Englewood Cliffs: Prentice-Hall.
- Nyvang, T. (2006). Implementation of ICT in Higher Education. Proceedings of the Fifth International Conference on Networked Learning 2006. Lancaster: Lancaster. <http://www.lancs.ac.uk/fss/organisations/netlc/past/nlc2006/abstracts/nyvang.htm> University. Accessed September 24th, 2011.
- Nyvang, T. (2008). *Ibrugtagning af ikt i universitetsuddannelse (implementation of ICT in higher education)*. Aalborg: Aalborg University, Institut for Kommunikation.
- Nyvang, T., & Tolsby, H. (2004). Students Designing ICT Support for Collaborative Learning in Practice. Proceedings of the Networked Learning Conference 2004. Lancaster: Lancaster University. Accessed 24th September, 2011.
- Nyvang, T. & Poulsen, C. R. (2007). Implementation of ICT in Government Organizations - User Driven or Management Driven? In A. M. Kanstrup, T. Nyvang, & E. M. Sørensen (Red.), *Perspectives on e-Government: Technology & Infrastructure, Politics & Organization, and Interaction & Communication*. Aalborg: Aalborg University Press.

- Piaget, J. (1999). *The construction of reality in the child*. London: Routledge.
- Ryberg, T., & Dirckinck-Holmfeld, L. (2010). Analysing digital literacy in action: A case study of a problem-oriented learning process. In R. Sharpe, H. Beetham, & S. De Freitas (Eds.), *Rethinking learning for a digital age* (pp. 170–183). New York: Routledge.
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(10), 3–10.
- Spinuzzi, C. (2003). Tracing genres through organizations: A sociocultural approach to information design. In B. Nardi, V. Kaptelinin, & K. Foot (Eds.), *Acting with technology*. Cambridge, Massachusetts: The MIT Press.
- Stahl, G., Koschmann, T., & Suthers, D. D. (2006). Computer-supported collaborative learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences*. New York: Cambridge University Press.
- Stein, S. J., Shephard, K., & Harris, I. (2011). Conceptions of e-learning and professional development for e-learning held by tertiary educators in New Zealand. *British Journal of Educational Technology*, 42(1), 145–165.
- Thompson, J. D., & Tuden, A. (1959). Strategies, structures and processes of organizational decision. In J. D. Thompson et al. (Eds.), *Comparative studies in administration*. Pittsburgh: University of Pittsburgh Press.
- Tolsby, H., Nyvang, T., & Dirckinck-Holmfeld, L. (2002). A survey of technologies supporting virtual project based learning. In S. Banks (Ed.), *The third international conference on networked learning* (pp. 572–581). Sheffield, England: University of Sheffield.
- Tyre, M., & Orlikowski, W. (1994). Windows of opportunity: Temporal patterns of technological adaptation in organizations. *Organization Science*, 5(198–118).
- von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science*, 32(7), 791–805.
- Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.