Publication 2

Employees' choices in learning how to use information and communication technology systems at work: strategies and approaches

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The purpose of this paper is to promote the understanding of how employees learn to use information and communication technology (ICT) systems at work. The elements of a learning activity in the context of ICT use are identified from the literature. In particular, approaches to learning, learning strategies and problem-solving strategies are reviewed. The empirical part of the study examines how employees choose to start learning how to use ICT systems, and how they choose to learn while solving problems related to system use. The data were collected using qualitative semi-structured interviews with 39 employees in three organizations. The interviewees usually preferred to learn how to use ICT quickly and without investing too much effort. The interviewees preferred informal learning and problem-solving strategies. The most commonly used strategies were to try things out alone or together with peers, or to ask for help from peers. The main conclusions of the study are that the users' learning intentions affect the kind of learning support they need and that ICT learning is best approached as a learning activity strongly rooted in collaboration and the social context.

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Introduction

Information and communication technology (ICT) offers new opportunities to increase the effectiveness of interaction, work performance and workplace learning (e.g. Andriessen, 2003). However, the adoption of a new ICT system may require considerable effort from its users, who need to learn how to use systems technically and also learn new ways of working (West *et al.*, 2007), communicating, and training and studying (see Andriessen, 2003) with the help of the system. Users' skills and fluency in using ICT systems have a critical impact on whether the desired goals of the adoption of the system can be achieved (Committee on Information Technology Literacy, 1999).

Using any ICT system requires learning to take place. Such learning involves various individual and organizational factors. Learning is traditionally perceived as the process or experience through which an individual gains knowledge, skills or attitudes. Learning can be defined as 'coming to understand things and developing increased capacities to do what one wants or needs to do' (Schoenfeld, 1999, p. 6). Learning is also perceived as a social and situated process (Lave & Wenger, 1991), which takes place in direct or indirect interaction between people (Illeris, 2004). Despite extensive interest in learning in general, learning approaches and strategies applied in work contexts have received relatively little attention from researchers (Berings *et al.*, 2005; Warr & Allan, 1998).

The aim of this paper is to promote the understanding of the ways in which employees prefer to learn how to use ICT systems. We formulated the following research question: what kinds of approaches to learning and what kinds of learning strategies and problem-solving strategies do employees choose when learning how to use ICT systems in work settings? To access these learning and problem-solving strategies and learning approaches, we identify the elements that play a part in ICT learning activity. The research also provides some insights into the objects and outcomes of learning.

We describe learning how to use an ICT system as an activity (Engeström, 1987) involving the learner, the object of the work and the ICT system with which the work is to be carried out and which, in its turn, is the object of learning. We also situate the learning in its social and organizational contexts. Most important, the paper explores both the learning approaches and the learning and problem-solving strategies that employees choose when they have to learn how to use an ICT system to carry out their work. In the empirical part of the paper, we explore the initial learning of ICT system use, or how employees become familiar with systems and start to learn about the technical functions and new ways of working (cf. Spitler, 2005). We also describe the learning that is taking place during the ongoing use of the system as people spontaneously solve system-related problems. The empirical data were collected in three organizations in which a new ICT system was put into use a few years before the data collection and in which the system users had opportunities to choose how they went about learning how to use the system.

The research provides some insights into how organizations may support and guide ICT users so that they learn to do their work as competently and easily as possible with the help of the ICT system. These insights can be beneficial for managers, HR personnel, and both ICT system designers and support staff. For instance, HR personnel plan and organize the user training, while designers 'accelerate the process of acceptance and use of these tools' (Bullen & Bennett, 1990, p. 300).

The paper is organized as follows. In the theory section, we identify the elements that make up the ICT system learning activity. We also propose how learning and problem-solving strategies can be conceptualized in terms of their organizational and social contexts. Subsequently, the empirical explorations of employees' choices of approaches to learning and of learning and problem-solving strategies related to ICT system learning follow. Finally, the results are discussed and conclusions are drawn.

Learning how to use ICT systems at work

In the literature, the actors and elements of a learning activity have been recognized (see e.g. Berings *et al.*, 2005; Engeström, 1987; Ramsden, 1988). We build on these

Learning situation

Context of learning Organizational context Social context	**Object of learning** The ICT system and its use	**Learner** Individual choices

Learning approach - - - - - **Learning and problem-solving strategies**

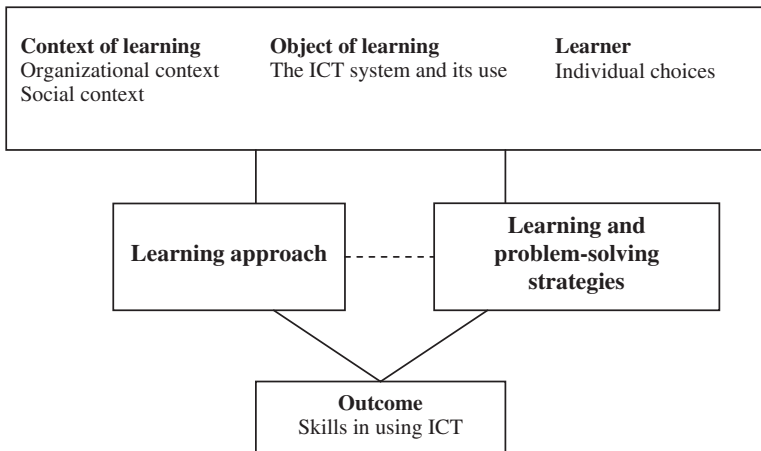**Outcome**
Skills in using ICT

Figure 1: The elements of a learning activity in the context of information and communication technology (ICT) systems at work (inspired by Ramsden, 1988; see also Berings et al., 2005; Engeström, 1987).

studies to discuss how the learner encounters the object of learning (the ICT system and its use) in a work context characterized by both organizational and social factors. A learning situation emerges from these elements, and the learner formulates an overall approach to learning to suit it (e.g. a deep, surface or strategic approach; see below). The specific learning situation also leads the learner to engage in various learning and problem-solving strategies. The skills needed to use the system emerge as the outcome of learning. On the basis of literature (e.g. Marton, 1988; Ramsden, 1988), it can be argued that the learners' approaches to learning and the actualized learning and problem-solving strategies are connected to what and how they learn.

We examine a learning situation with the help of Engeström's (1987) depiction of a work system as an activity system [the same elements can be discerned in the approaches of Ramsden (1988) and Berings *et al.* (2005)]: the learning situation is created by the interaction between the context of learning, the object of learning and the learner (see Figure 1). Additionally, learning approaches, learning strategies and problem-solving strategies can be seen as the tools with which the learner accesses the object of learning and achieves learning outcomes, i.e. the skills needed to use ICT systems (Engeström, 1987).

Context of learning

The context of workplace learning can be approached from two perspectives:

1. the organizational context of learning describing the degree of organizationally induced formality or informality present in learning (see e.g. Hager, 1998; Malcolm *et al.*, 2003);
2. the social context of learning addressing whether the learning is a solitary effort on the part of the learner, or whether it takes place by learning from others or together with others (see e.g. Doornbos *et al.*, 2004).

Organizational context: formal and informal
The dualistic division into formal and informal learning is not clear-cut. Malcolm *et al.* (2003) argue that these concepts are inextricably interrelated because informal learning situations have elements of formal learning and formal learning situations have

elements of informality. However, for analytical purposes, it is possible to recognize learning contexts that are primarily characterized by either formality or informality.

Therefore, we define formal and informal learning as follows: formal learning refers to structured training organized and guided by a trainer or teacher. The trainer or teacher makes all the relevant decisions, such as the learning goals and the measurement of learning outcomes (Doornbos *et al.*, 2004; Hager, 1998). Thus, the level of learner control is low. Informal learning, on the other hand, is guided by the goals of the work, circumstances, personal motives, the ideas of colleagues, discoveries and experiments (e.g. Eraut *et al.*, 1998; Gerber *et al.*, 1995), and is more guided by the learners themselves. Informal learning can take place, for instance, when people work and interact with each other (Marsick & Watkins, 1992) and learn while doing so.

In the event of the arrival of a new ICT system, organizations tend to provide employees with formal user training (e.g. Brown & Duguid, 1991), which can be pre-planned, structured and non-self-directed. Such training methods are often criticized for their one-sided focus on technical, individualized and context-free (Bostrom *et al.*, 1990) ways of learning. Nevertheless, formal user training can be seen as being important as a starting point for conveying basic information on the system, but generally it is viewed only as one way to organize learning (Spitler, 2005). Indeed, research shows that people start to apply an ICT system actively only when they are trained to use the system to perform their specific work tasks (Bullen & Bennett, 1990; see also Orlikowski, 1992). More to the point, researchers (e.g. Carroll & Mack, 1984; Spitler, 2005; Twidale, 2005) have argued that on-the-job learning is crucial for the use of ICT systems. Users can learn how to use the system while working according to their actual needs in performing their tasks (Twidale, 2005) in an informal, self-directed and spontaneous manner.

Social context: alone, from others and with others
Doornbos *et al.* (2004) distinguish three types of learning activities according to the social context of learning, i.e. learning alone, learning from others and learning with others. When learning alone, no direct social interaction contributes to learning, but employees reflect individually on work situations and learn from them. Learning is embedded in social interaction only via the media and other cultural artefacts. Learning from others relates to learning situations in which employees learn through interaction or when collaborating with other people without necessarily contributing to the development of those others. This kind of learning occurs when, for example, an employee asks for help from a peer (see also Twidale, 2005). Finally, when learning with others, employees engage in joint learning and contribute mutually to each other's learning; this kind of learning can also be called collective learning (Garavan & McCarthy, 2008) or learning within teams (Cheetham & Chivers, 2001; Eraut *et al.*, 1998).

Empirical research shows that interaction with peers, and especially with peers who have a better knowledge or aptitude for ICT system use, is an important way to learn how to use an ICT system (Bullen & Bennett, 1990; Lee, 1986; Spitler, 2005; see also a review by Orlikowski *et al.* 1995). It is convenient and comfortable to ask for help from a peer at a moment of need when much contextual information is available (Spitler, 2005) and the social distance between the people involved is small.

ICT system as the learning object

Activity theory (Engeström, 1987) offers a helpful framework to understand the relationships between the employee, the ICT system and the work task. According to activity theory, the employee (subject) focuses on the work task (object) and the ICT system is one tool used in carrying out the task. Activity theory therefore emphasizes how people function in an object-oriented manner, while a tool is simply a mediator between the employee and work object (see Bødger, 1989; Engeström, 1987; Kaptelinin & Nardi, 1997). For example, when people work, they focus on the work task and the ICT system is the mediating tool. However, when employees learn how to use an ICT system or when they encounter problems in it, they temporarily place the main focus

on the system itself and it becomes the object of their learning activity. Therefore, one challenge in learning how to use ICT systems is that employees usually focus on the work task, and their motivation for mastering the system may only be secondary.

Learner's individual choices

The learner is an actor in a learning situation. Many dispositional and personal factors naturally affect the learning process. For instance, a considerable amount of literature focuses on learning styles (see e.g. Berings *et al.*, 2005; Cassidy, 2004; Coffield *et al.*, 2004; Desmedt & Valcke, 2004) or on a learner's tendency to take in and process information in a certain way (Weinstein & Mayer, 1983). Other learner-focused topics in the context of ICT system use are user resistance (see e.g. Adams *et al.*, 2004; Jiang *et al.*, 2000; Klaus *et al.*, 2007; Lorenzi & Riley, 1995; Markus, 1983; Orlikowski, 1992) and technology acceptance (see e.g. Bagozzi *et al.*, 1992; Davis *et al.*, 1989; Hashim, 2008; Jeyaraj *et al.*, 2006; Venkatesh *et al.*, 2003). However, in this paper, we are interested in employees' actual choices and behaviours while learning – how they, in general, approach the learning activity and what strategies they choose for learning and problem solving. These are addressed next.

Approaches to learning

The learners can be seen as active agents in learning; on the basis of their personal preferences, the social and organizational contexts present and available, and the ICT system itself, the learners choose a general approach to learning and also learning and problem-solving strategies. Approaches to learning refer to a set of motives and strategies which learners choose and use to achieve desired learning outcomes (Biggs, 1988; Marton & Säljö, 1976). Learning and problem-solving strategies, in their turn, refer to activities through which learning is achieved or problems solved, respectively.

People may choose qualitatively different approaches to learning, namely surface, deep (Biggs, 1988; Entwistle, 1998; Marton & Säljö, 1976) and strategic (Entwistle & Ramsden, 1983; for a corresponding categorization in the context of ICT adoption, see Orlikowski, 2000). Entwistle (1998) especially has elaborated these approaches: the surface approach to learning refers to learning where the intention is to complete task requirements. The motivation is often extrinsic. The learner focuses on the task and discrete pieces of information and associates facts and concepts unreflectively. According to Entwistle, the outcome is a superficial level of understanding. A deep approach refers to learning where the intention is to understand the object of learning. The motivation is often intrinsic and comes from interest in the subject matter and perceived relevance. The learner organizes the content into a coherent whole, and the outcome is a deep level of understanding and grasping the meaning of the object of learning (Entwistle, 1998). The third category, the strategic approach, which has been recognized as a study approach, combines deep and surface approaches in order to achieve high grades by using effective study methods and time management (Entwistle & Ramsden, 1983). An approach to learning is not a characteristic of the learner, but it is a representation of what a specific learning task is for the learner in a specific context (Marton, 1988), making every learner capable of using all three approaches (Ramsden, 1992).

All these approaches have their benefits and limitations in the context of ICT learning. Employees who apply a deep approach are valuable to organizations as they are motivated and committed users, and their example may encourage others to use the system (cf. Bansler & Havn, 2006; Karsten, 1999). However, in specific cases it may be advantageous to adopt a strategic or even surface approach to learning (Kirby *et al.*, 2003). For example, organizations may have many ICT systems for various work tasks, and not all of them are essential for work efficiency. Adopting a strategic or nonchalant approach to learning may thus reduce the stress originating from the requirement to master a multitude of ICT systems.

	Social context		
Organizational context	Alone	From others	With others
Formal	Takes a self-study course guiding ICT use	Participates in a user training session	Carries out a training exercise with colleagues in a user training session
Informal	Tries out things, reads manuals	Asks for help from other people	Tries out things with others, and they assist each other while working

Figure 2: Examples of learning strategies in a simplified matrix to classify and analyse learning strategies according to two different learning contexts.

Learning strategies

When engaging in learning, a learner needs to choose one or several learning strategies or general ways of going about the learning. Learning strategies refer to practices that learners use to aid the acquisition and development of new knowledge (e.g. Kardash & Amlund, 1991; Weinstein & Mayer, 1983). Warr and Allan (1998) distinguish both cognitive and behavioural learning strategies; the three cognitive strategies are rehearsal (repeating to oneself the material being learned), organization (identifying key issues and creating mental structures) and elaboration (examining the implications of the new material for existing knowledge and making connections between the two). The three behavioural strategies are seeking interpersonal help (obtaining assistance from other people), seeking help from written material (obtaining information from written documents, manuals, etc.) and practical application (increasing knowledge by trying things out in practice) (see also Holman & Epitropaki, 2001).

The definitions of learning strategies thus usually focus on how learners behave and think (Kardash & Amlund, 1991; Weinstein, 1988; Weinstein & Mayer, 1983). In addition, to make the social character of learning visible as well, learning strategies can be classified according to their organizational context (i.e. the inherent degree of formality or informality) and their social context (whether they focus on learning alone, from others or with others). For instance, a learner may learn by thinking about the ICT system when cycling to work (informal, alone) or by carrying out a training exercise with colleagues in a training session (formal, with others). It has to be noted that every learning strategy may combine, in various ways, these learning contexts; the classification is suggestive. The degree of formality and informality of the learning strategy is particularly in need of a precise definition in each case. For example, the learning strategies of seeking interpersonal help may take place both formally (e.g. participating in formal training) and informally (e.g. asking for help from peers). Figure 2 is a simplified matrix to classify and analyse learning strategies according to the two learning contexts. In other words, each learning strategy is characterized by its degree of formality or informality (the organizational context) and by whether it focuses on learning alone, from others or with others (the social context). Some examples of learning strategies are shown in Figure 2.

Problem-solving strategies in daily workplace practices

Problem solving is viewed as one special process of learning (Gagné, 1977). It is considered a powerful way of learning in work settings because learning takes place in a concrete manner while learners are engaged in problem solving in daily workplace practices (Bereiter & Scardamalia, 1993; Ellström, 2001; Lohman, 2002; Schön, 1987). In this paper, problem solving is examined from a very trivial and mundane angle in relation to the smooth flow of everyday work practices. When employees work with the help of ICT systems, they also encounter problems related to their use. They have

to solve these problems in order to continue working and, as they solve problems, they learn more about the system and its use. In line with Chi and Glaser (1985), we therefore understand a problem as referring to a situation where an individual has a goal (although the goal may not be clear, but vague and continuously changing; Ellström, 2001), and must find some means to reach the goal; in other words, these means are not automatically available and a non-routine situation emerges (see Marsick & Watkins, 1992). In a problem situation with an ICT system, the normal flow of work is interrupted or prevented because the employee is unable to use the functions of the system.

A problem-solving strategy refers to a behavioural or cognitive method (see Warr & Allan, 1998) that guides the solver during the problem-solving process (Mayer, 1983). Cognitive and behavioural problem-solving strategies, just like learning strategies, are characterized by their degree of formality (the organizational context) and whether the problem is tackled alone, with others or with others' help (the social context).

Learning outcomes

In the context of our paper, the purpose of learning is to gain or enhance the skills needed to use ICT systems at work. The desired learning outcome in ICT system adoption is often an increase in competence, or in the ability to do one's work with the help of the system. However, assessment of these kinds of learning outcomes is difficult because learning mostly occurs in informal settings (Skule, 2004), making learning often unintentional and implicit, with no prescribed learning outcomes (Hager, 1998). Feedback is considered necessary for learning to occur because it gives information on the results of actions (Ellström, 2001; Frese & Altmann, 1989). In general, because of the informal character of ICT learning, the outcomes are often assessed only by the learners themselves, and yet the learners may also gain feedback from other persons in the workplace (Cheetham & Chivers, 2001; Järvinen & Poikela, 2001).

Methodology

Our research can be classified as a basic qualitative study (Merriam, 2009), which has elements taken from the phenomenological and case study designs. Phenomenological research focuses on individuals' experiences concerning a phenomenon (e.g. learning how to use an ICT system in work settings) and on their interpretations of their experiences (Creswell, 1998; Moustakas, 1994). Learning how to use ICT systems at work is approached according to how it is seen by the employees themselves (cf. Collin, 2004; Marsick, 1999; Spitler, 2005). Semi-structured interviews were conducted with 32 ordinary employees and 7 support persons in three organizations. The data were analysed thematically (e.g. Braun & Clarke, 2006). In addition, the work context in which the data were collected functioned as a significant part of the phenomenon being studied. This brought case study elements into the study (Stake, 1994; Yin, 2003; see also Creswell & Maietta, 2002 on the structural experience). For example, data about the work context and the ICT tools were collected from multiple sources; in addition to the interviewees' experiences, attention was also paid to ICT systems in their organizational context.

Organizations and ICT systems studied

To provide data on ICT learning experiences in various work contexts, employees from three organizations were chosen for the study. The organizations were chosen because they had introduced the ICT systems that were being studied within a few years before the study, and they were interested in participating in the study in order to receive information about their ICT system adoption and user support processes. The findings from the different organizations were not compared with each other, but rather used to formulate a richer picture based on analytical generalizations (Creswell, 1998; Herriot

& Firestone, 1983; Yin, 2003). The organizations' members had used various ICT systems at work for many years. In each organization, we focused on an ICT system generally considered essential for employees' work and on employees' individual learning activities. In each organization, employees were also given the opportunity to choose the ways in which they learned how to use the systems.

In the first organization, the University of Helsinki (with 7700 employees, and called the University from here on), the focus was on an Intranet service tailored to the needs of the organization. The Intranet had been in use since 2004, and it provided a joint working and communication tool, offering an asynchronous internal communication channel. The Intranet was used mainly to search for or publish information. Other IT systems were also integrated into the Intranet, for example, the travel expense report system.

In the second organization, the Finnish Defence Forces (with 15,000 employees, and called the Defence Forces in the paper), the focal system was an educational website, also tailored to the needs of the organization and put into use in 2003. The educational website was used for continuing education, which was carried out as a combination of distance education and local classes. The educational website was used mainly for delivering training material and information during the education. The education was aimed at officers who had been in the Defence Forces for 10 years, and it lasted one year, was full-time and had the objective of equipping the officers with the skills needed to work at headquarters during peacetime and wartime.

The third organization was a global company (with 25,000 employees, and called the Company from here on) producing machinery and process technology on a large scale. An Internet-based meeting system was the focus of our study. The system was purchased from an external provider, and some functions had been tailored for the purposes of the Company during its use. The system was similar to another system named Centra Symposium (http://www.ivci.com/web_conferencing_centra_symposium.html). The system made it possible to arrange live Internet sessions for meetings or training, and it combined voice and video conferencing. Users participated in sessions by means of a personal computer connected to the Internet. They wore headsets to listen and speak to each other. Among other things, the system supported file sharing, and it was also possible to record and edit sessions. This study focused on one business area in Finland, where most of the work carried out was office work. The system was examined when it was used in internal product and sales training. The system was introduced in the entire company in 2005, but it has been used by executive and internal project management teams for their meetings since 2002.

Data collection and participants

The data were collected through qualitative interviews focusing on how interviewees initially learnt how to use the systems, what usage problems they had during the ongoing use and how they solved these problems, what support functions they had utilized, how they used the systems, and their evaluations of their skills in using the systems. The interview protocol is presented in Appendix 1. The interviews were semi-structured: the order, form and extent of the questions varied from one interview to another (Miller & Crabtree, 1992). This data collection method was selected because it gave freedom to the interviewees to talk about and describe their experiences, and, at the same time, the loosely set themes in the interview protocol assured the handling of all the selected issues. The interviews were personal interviews and lasted from 15 to 90 min. Participation in an interview was voluntary. The interviews were carried out by the first author during the spring and summer of 2007.

In total, 39 qualitative interviews were conducted. The focus was on the 32 users' interviews, while seven support persons' interviews gave background information. Table 1 lists the employees and support persons interviewed in each organization. The interviewees were selected on the basis of certain criteria (Creswell, 1998; Miles & Huberman, 1994). Most interviewees were ordinary system users, but a few support

Table 1: Participants in the study

Organization	Employees	Support persons	Total
University	9	3	12
Defence Forces	13	2	15
Company	10	2	12
Total	32	7	39

persons were interviewed in order to gather background information on the introduction and adoption processes of the systems. The system users were chosen in such a way that one-third were favourable towards the system, one-third were unfavourable and one-third had a neutral attitude. The aim was also to include both experienced and inexperienced users, so that employees on various skill levels in the use of the systems were involved. For practical reasons, the contact persons in the organizations chose the interviewees according to these criteria. The interviewees' levels of expertise in using the ICT systems under study can be seen in Appendix 2.

At the University, nine office workers were interviewed. They were from different faculties and professions. Two were male, and the others were female, aged from 25 to 56 years; the mean age was 36 years. Three support persons were also interviewed. In the Defence Forces, 13 employees were interviewed. Nine were trainees and four were trainers aged from 32 to 53 years; the mean age was 39 years. Two support persons were also interviewed. All the interviewees were men. In the Company, 12 users were interviewed. Six were trainees and four were trainers, aged from 32 to 60 years; the mean age was 45 years. Most of the interviewees worked in Finland, but one interviewee was from Sweden and one was from Austria. Additionally, two coordinators were interviewed; they worked as support persons during the training sessions. The coordinators and one salesperson were female, and the rest were male.

In addition to the interviews, the first author participated in the organizations' user training sessions and seminars as well as in training sessions conducted via the Internet-based meeting system. She also collected organizational documents (such as manuals and user instructions, reports on user studies, statistics on the use of the ICT system, and historical reports about the acquisition and implementation of the ICT systems), and examined the use of each ICT system. These multiple sources of data were used to gain an overall picture of the phenomena in their contexts (Creswell & Maietta, 2002; Yin, 2003). Both researchers were independent of the organizations, and the only contact was to conduct the research in question.

Data analysis

The interviews were conducted and analysed by the first author. The interviews were recorded and then professionally transcribed. The analysis strategy was a deductive thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006; Joffe & Yardley, 2004). The unit of analysis was an individual learner's experiences (Creswell, 1998) of the phenomenon being studied.

In practice, the analysis process was conducted in three phases with a pre-existing coding frame (Braun & Clarke, 2006). First, all the 39 interviews were read through to get an overall view of the interviewees' experiences of learning how to use ICT systems and how to use them in their work Second, the data were coded deductively into five main themes: approaches to learning, initial learning strategies, problem-solving strategies in ongoing use, learning and problem-solving strategies which interviewees did not choose, and factors that depicted the interviewees' levels of expertise in using that particular ICT system. Third, within each theme a further deductive thematic analysis was carried out. For example, learning and problem-solving strategies were organized according to Warr and Allan's (1998) six cognitive and behavioural strategies, and then

further organized into organizational contexts and social contexts. The problem-solving strategies were analysed in the same way as other learning strategies because of the everyday learning-oriented nature of problem-solving activities in the context of ICT systems (see the theory section). Additionally, each interviewee's approach to learning was organized into deep, surface or strategic approaches. Interviewees' approaches to learning were identified from the interviewees' descriptions of their experiences, skills and attitudes while using and learning how to use the systems.

Quality of the research

To ensure the quality of this qualitative research, we paid special attention to three quality criteria: communicative validity, pragmatic validity and reliability. Communicative validity refers to an understanding between the researcher and research participants about what both parties are doing (Apel, 1972). Communicative validity was ensured in three ways in this study: (1) the interviews were conducted in the form of a dialogue; the interview questions were elaborated with follow-up questions, such as 'Can you give me an example?', and it was explained to the interviewees at the beginning of the interview that the researcher was interested in the interviewee's personal experiences; (2) the researcher observed and participated in various events in the organizations, such as online and face-to-face training sessions and seminars, and also met and spoke with other employees besides the interviewees; and (3) in the analysis, the aim was to strive for coherent interpretations, meaning that the parts of the phenomenon being studied must fit the whole and the whole must fit the parts (Creswell, 1998; Sandberg, 2005; Silverman, 2006). Pragmatic validity refers to testing knowledge produced in action (Kvale, 1989). In this study pragmatic validity was ensured by asking follow-up questions in the interviews, which constantly embedded the statements in actual situations.

Reliability concerns the procedure for achieving truthfulness in interpretations. Reliability was secured in four ways: (1) the research and analyses processes were described carefully, and the theoretical stance upon which the interpretation of the results is based was expressed clearly (Silverman, 2006); (2) the interviews were recorded and transcribed word for word (Seale, 1999); (3) the research findings were discussed with other researchers in the research group. The other researchers challenged and asked for justification on the emerging categories in the analysis until the categorization was final (Miles & Huberman, 1994); and (4) the researchers were in contact with the case organizations and checked the findings with the key informants (Miles & Huberman, 1994).

Results

The results are organized as follows: first, a brief overview of the interviewees' objects of learning and learning outcomes is provided; second, the learning approaches chosen by the interviewees are described; third, the interviewees' learning strategies are presented; and fourth, the problems the interviewees experienced and their problem-solving strategies are reviewed. The main results are depicted in two matrices, and some citations illustrate the results (Patton, 1990).

According to the interviewees, they set a very practical main goal for their learning: to be able to perform work tasks with the help of the ICT systems. Employees at the University had to learn to search for information (e.g. administrative issues), publish announcements and use group work forums via the Intranet. Trainers in the Defence Forces had to learn to plan, arrange and conduct training with the help of the educational website. Trainees had to learn to log on to the Internet sites of the courses, search for information, use chat forums and return their study exercises via the system. The minimum that the employees in the Company had to learn was how to log on and participate in online training or meeting sessions.

The interviewees were not interested in the use of the system as such because they only experienced the system as a tool to do their work. However, trainers in the

Defence Forces had more specific purposes: they aspired to enhance their teaching skills via the system and to understand new ways of teaching and learning. In the Defence Forces and at the University, learning purposes had some degree of compulsion because the systems were the only means to perform specific work or training tasks. The trainers interviewed in the Defence Forces said that there was an order from the top management to conduct training via the system. In this sense, they received an order to learn how to use the system. The Intranet at the University was the only way to communicate specific information to the personnel. The upcoming audit process at the University also forced employees to learn how to use the system. Employees in the Company were freer to decide whether to use the system or not, and their need to use it depended on their need to participate in online training or internal meetings.

The interviewees were requested to assess their learning during the interviews. Most said that they had learned how to use the systems in order to perform necessary work tasks with the system. But many also said that they could not use the systems as fluently as they wished, because they did not have enough skills. However, many interviewees also longed for better skills in using the systems. Only a few evaluated themselves as being able to use the systems fluently (see Table A2.1 in Appendix 2; most of the interviewees were novice users).

Approaches to learning

In the interviews, all the learning approaches distinguished in the theory section were present. The choice of the learning approach was related to whether the employee was an occasional user or had to use the system often to perform work, the learning object (whether the interviewee experienced the system as being necessary and important in carrying out work, or the employee was interested in ICT systems in general) and employees' earlier experiences with ICT system use. The ICT systems were chosen for this study because they were considered essential, by the organizations' management, for employees' work performance, but the interviewees made their own interpretations as to whether a system was essential for them or not.

Eight users' approach to learning ICT could be described as deep (one at the University, five in the Defence Forces, two in the Company). These users considered the system as a significant part of their work, and had a high level of motivation to use the system. They were interested in benefitting from the support that the system could offer to their work, and tried to manage and understand its use as an integrated part of their work. A citation illustrates a deep approach:

> I have been using these tools for years. I would claim that I know this tool, and I know what it is able to do, and also what is not worth doing with it. (Trainer, internet-based meeting system, Company)

An interesting finding was that the users with a deep approach often applied collective learning strategies; that is, they assisted and supported each other while learning how to use the system together.

Four users applied a surface approach (one at the University, two at the Defence Forces, one in the Company). They were not interested in the system or motivated to use it, but did the work task at hand because it was compulsory and could not be done in any other way. In interviews, these persons exhibited some degree of resistance towards the ICT system. An interviewee with a surface approach stated,

> There are so many [user training] courses and other rubbish that I can't be bothered to do an extra thing. I haven't left a single task uncompleted, so why would I bother. [. . .]. I don't need the extra information, and I am not interested. I am only interested in being able to do my tasks; I just want to find the information and complete my tasks. That is all I need the system for. (Trainee, educational website, Defence Forces)

Most of the users, 20 in total, chose a strategic learning approach. They tried to learn how to use the system quickly and easily, therefore the approach could be described as strategic and practical: the system was only one tool among many other tools and the target was mostly to be able to perform their work tasks with the help of the system. They had moderate levels of motivation to use the system. These interviewees hoped

that the organization would develop the use of the system, but they did not express interest in actively developing their own use of the system. Their strategic approach to learning was closer to a surface approach than a deep approach.

Learning strategies

The interviewees were free to choose their learning strategies in their initial use of the systems, but, in each case organization, they were also offered learning support; for example, user training, manuals, Help Desk services and deskside support were available. The learning strategies the interviewees chose are summarized and classified according to the learning contexts in Figure 3. Figure 3 shows how informal learning strategies and learning alone or from others (rather than *with* others) dominated the initial ICT learning. Employees learned how to use it mostly alone by using practical learning strategies, such as trying things out by trial and error, exploring different functions, and learning by doing. However, most employees sought help from others before or at the same time as they started to explore and experiment; for example, they asked for advice from a peer or a local expert. It seemed important that the adviser was familiar to them and therefore easy to contact. Some employees participated in user training sessions arranged by the organizations' support persons. Interviewees who had participated in user training considered it a good starting point for learning about the ICT systems. Formal user training sometimes also had elements of informality, which were highly appreciated by the interviewees. For example, at the University, employees could take their own work tasks with them to the training session, and do

	Social context			
Organizational context	Alone	From others	With others	Total
Formal		**Seeking interpersonal help** by participating in user training sessions (13)		13 (21%)
Informal	**Practical application** (27), e.g. tries out things by trial and error, learning on the job, exploring, curiosity-driven trial, learning by doing. **Seeking help from written material**, e.g. reads manuals (2), or email information from organization's ICT support department (2).	**Seeking interpersonal help**, e.g. asks for help from deskside support, local expert or peer (10), or observes while other people use the system (1)	**Collective practical application**, i.e. tries out things together with peers, and they assist each other while working (6)	48 (79%)
Total	31 (51%)	24 (39%)	6 (10%)	61 (100%)

Figure 3: Interviewees' learning strategies while initially learning how to use information and communication technology (ICT) systems classified according to learning contexts (references from the interviews).

them under the guidance of the trainer. Only two of the interviewees read manuals in order to start learning how to use the ICT systems.

Only a few interviewees said that they had begun to learn to use the ICT collectively with peers while working with and assisting each other. However, when the employees had learned with others, they also expressed strong satisfaction with this way of learning. We call this learning strategy 'collective practical application' (see Figure 3) and thus propose a new learning strategy to be added to the classification of Warr and Allan (1998): a learning strategy that captures collective learning emerging when learners try things out jointly and assist each other and, eventually, create new knowledge and practice together. A quotation from one trainer in the Defence Forces illustrates the satisfaction with such collective practical application.

> One learns by doing. You don't learn otherwise. We found it while we worked on the course of complementary education. When we did it together with the boys [other trainers], that's when it really sank in. Each prepared his own share of the work [teaching material], we submitted the material to the system together, and things fell into place very easily. (Trainer, educational website, Defence Forces)

As the employees had the freedom to choose their learning strategies, it is interesting to consider how they did *not* want to learn (see Appendix 3). Thirteen interviewees said that they did not want to participate in user training. The main perceived weakness of the training was that the goals of the training did not meet the learners' immediate needs, especially if they could not practise in an authentic situation. The learners also said that training is unnecessary or they did not have time to participate in training. Two interviewees did not want to take a self-study course guiding the use of the ICT system because they did not have any motivation for it. Twelve interviewees said that they did not use manuals at all. They said that they did not understand the instructions in the manuals, the manuals did not 'work', or the manuals were too detailed and therefore laborious to use. Eleven users did not want to contact the Help Desk or computer support service because they did not want to disturb people they did not know, Help Desk staff did not have the necessary knowledge, or it took too long to get help.

Problem-solving strategies

The interviewees identified technical problems and difficulties in the usability of the systems, and they also experienced a lack of the skills needed to use the systems (see Appendix 4). They described technical problems, such as a lack of system capacity, the system crashing and poor voice connections. Usability problems often related to navigation or to finding the information needed. The troublesome and difficult nature of the systems' functions was also mentioned. The employees stated rather often that they had problems because they did not have enough skills and knowledge to use the system technically or to integrate the use of the system into their work. These problems usually set problem-solving processes in motion and contributed to users' learning about the systems.

The interviewees' problem-solving strategies are summarized and classified according to the learning contexts in Figure 4. The problem-solving strategies had many similar elements to the initial learning; problems were practically always solved in informal situations. Problem solving was context-bound, and the need to solve the problem was urgent. The problem situation could vanish as fast as it appeared: employees needed the solution right away, or the situation might already be over. The most common problem-solving strategy was interpersonal help-seeking; interviewees asked for help from peers, local experts and the Help Desk. Again, familiarity with the adviser was essential. The second most common strategy was to experiment with the solution alone. Interviewees described the process of just trying to find out the best solution by scanning and exploring or by trial and error. The users at the University in particular tried to find the information they were looking for because they did not know who might know the location of the knowledge they needed on the Intranet.

	Social context			
Organizational context	Alone	From others	With others	Total
Formal		**Seeking interpersonal help** by participating in user training sessions (1)		1 (1%)
Informal	**Practical application** by experimenting (20), or changing the tool (7). **Elaboration**, e.g. transfers knowledge from previous experiences (2) or formal education (1) **Seeking help from written material**, e.g. reads manuals (6) *Other*: Moves the work task into the future or does nothing (7) Accepts the discomfort caused by small technical problems (5)	**Seeking interpersonal help**, e.g. asks for help from a peer (23) or local expert (22); contacts Help Desk (19); contacts a source of information (5); asks a peer to carry out the task (1)	**Collective practical application**, i.e. solves problems together with other employees while working (15)	132 (99%)
Total	48 (36%)	70 (53%)	15 (11%)	133 (100%)

Figure 4: Interviewees' problem-solving strategies while further learning how to use information and communication technology systems (references from the interviews).

Collective problem-solving was also used; learning with others was slightly more prevalent than in the initial learning phase. The trainees in the Defence Forces even generated proactive problem-solving, which meant that if one trainee solved a problem (for example, found an announcement which the trainer had added to the system's pages), he immediately shared the information with the other trainees, thus initiating collective learning. Employees in the Company said that they tried to solve problems together during a meeting via the Internet-based meeting system. Some employees also read manuals in order to solve problems, but often it was 'the last resort'.

When encountering problems with the ICT systems, the interviewees also sometimes abandoned the system altogether and found an alternative way to proceed (cf. Ciborra, 1996). The original problem with the ICT system remained unsolved. The interviewees, for example, changed the tool or did not do the work task at all. For example, trainers in the Defence Forces delivered the course material with CD-ROMs or by mail if they had problems in using the educational website. Some interviewees were passive when solving problems with the use of the system. The employees at the University in particular postponed the task or did not try to solve the problem at all. They usually said that the work task at hand was not very important, and they had many things to do, so it was possible either to do the work task with the system later or neglect the work task totally. One of the interviewees at the University stated that if employees resisted the use of the Intranet, they asked their peers to do the work task for them, for

example, to publish an announcement on the Intranet pages. Additionally, the employees in the Company mentioned small and unimportant problems that they did not solve at all. However, the users in the Defence Forces did not describe such strategies of avoidance, but they were ready to accept small technical difficulties because 'they are a part of everyday life'. Nevertheless, in all cases the interviewees became frustrated very quickly if the problem was not solved in a short period of time. They were not particularly prepared to struggle for a solution.

Discussion

This study examined employees in three organizations using three different kinds of ICT systems for different purposes. However, the overall organizational approach to ICT learning was similar in all three organizations: they all gave their employees the freedom to choose the ways in which to learn how to use a new ICT system. Therefore, most of the initial learning about the ICT system and solving use-related problems was grounded in individual choice and decision making. The nature of the learning activity was personalized, and individual employees were also in control of their learning.

Within such a context, the interviewees usually preferred to learn how to use the ICT quickly and without too much effort, but not necessarily by using support functions offered by the organization, such as user training or manuals. Additionally, learning was not tool-centred, but the work task was the primary target. Such findings indicate that ICT systems should be easy to use and their technology should move quickly into the background, to the role of a tool.

The interviewees obviously preferred informal learning and problem-solving strategies. For example, they sought help from a local expert or a peer who was easily available and shared the same situation-specific knowledge and language. The interviews also showed that some employees were reluctant to contact the Help Desk or other such support functions because they did not know the people working there. This observation and the interviewees' tendency to rely on local experts and peers indicate that it is important to organize Help Desk operations in such a way that employees have their own support persons, whom they can get to know and trust, and find it comfortable to contact.

The study suggests, in line with earlier studies (e.g. Bullen & Bennett, 1990; Lee, 1986; Spitler, 2005; see also a review by Orlikowski *et al.* 1995), that there is a clear social element at play in learning how to use an ICT system; in addition to solitary learning, the interviewees learned through social interactions and even sometimes collectively or jointly with others. Our study shows that the interviewees used more collaborative (and some collective) strategies while learning in an ongoing manner about the use of the ICT; i.e. they preferred to solve problems with the help of others or together, and more seldom alone. However, learning alone played a somewhat larger role when starting to learn how to use the ICT. The study also provides indications that those employees who engaged in collective learning were very satisfied with such learning strategies. Additionally, in line with earlier studies (e.g. Spitler, 2005; Twidale, 2005), the employees learned most about the use of ICT while working – learning how to use ICT does not occur solely by participating in a user training session, but rather gradually while working and collaborating with peers, and receiving advice and guidance at the same time.

The interviewees did not usually rely on the formal user training available in the organizations. One reason was that the user training seemed not to meet employees' needs and preferences for ICT support. However, learning how to use ICT systems should also be supported by strategies characterized by formal learning. User training was experienced as being effective by the interviewees if they had an opportunity to practise the use of the system in connection with their own work. The most important fact seems to be that employees have opportunities to gain knowledge and skills that immediately support their work tasks. User training can also be valuable because it makes it possible to learn the necessary concepts and operational principles of the use

of the system. The interviewees did not want to use manuals, but perhaps this should not be interpreted as manuals being superfluous. Manuals that offer simple and user-friendly help should be developed.

When supporting employees' learning, it is also important to identify their approaches to learning: whether the aim is to deal with an occasional work task, or whether the system is a central tool with which to perform and organize one's work. In the organizations we studied, the motivated employees with a deep approach to learning were clearly an asset to their organizations; they sought to support other employees and inspire them to use ICT systems. But, on the other hand, a surface approach also had its advantages as it allowed some interviewees to adopt a resource-effective way to perform minor work tasks with the system. The study also indicates that those interviewees who chose a surface approach had a somewhat resistant attitude towards the ICT system.

Conclusions

Practical implications

Users' learning approaches, the characteristics of the ICT system and the learning contexts shape the learning activity (see Figure 1). This has practical implications for organizations. This study provides an indication that the use of ICT systems in contemporary organizations provides chances for self-directed workplace learning and should be organized and supported by taking the specific nature of this kind of learning into account. First of all, ICT support has to identify the learning approaches used by the learners. In our study, for instance, those people who were interested in the use of the system and aimed at mastering it (a deep approach) often applied collective learning strategies; that is, they learned jointly with others. The learning strategies emerge from the social and organizational learning contexts and in our study people – when facing an ICT system as a learning object – preferred to rely on informal strategies that they used alone or with help from others. ICT learning can therefore be supported by providing time and space for informal learning guided by the learners themselves.

A preference for such collaborative and informal learning can also be seen as a great opportunity for organizational learning, as users seek help from peers, local experts and Help Desks. A shared problem may finally contribute to triple loop learning, where members of an organization are challenged to understand how problems and solutions are related, discover how they and their predecessors have facilitated or inhibited learning, and how they can produce new commitments, structures and strategies for learning (Romme & Witteloostuijn, 1999).

It is also important to notice that the use of the system brings one extra level to integrate into learning: it is not enough to learn the work tasks, but the employee also has to learn how to use the tool in order to perform the task. That is why the use of the system should be supported in its context, and the focus should be on how employees can perform their work tasks with the system. Employees have to experience the tool as being useful and beneficial while working in order to use it.

Theoretical implications

This study suggests that the use of ICT systems should be addressed as a case of ongoing collaborative learning or as learning that is strongly rooted in social interaction and a dynamic work context. Learning how to use ICT is not only an individual matter because so many factors are involved and relate to the systems' characteristics and the way in which they are used: other people design, produce, maintain and control the system, and offer user support and training. These factors are linked to what and how an individual learns. The use of ICT systems also seems to promote collective learning – or learning together with others – to some degree. Therefore, we have suggested (with the support of the existing literature, e.g. Cheetham and Chivers, 2001; D'Abate *et al.*, 2003; Doornbos *et al.*, 2004; Eraut *et al.*, 1998) one additional behavioural learning

strategy to add to Warr and Allan's (1998) classification: the strategy of 'collective practical application', which refers to joint or collective learning taking place while trying things out together with peers in practice and assisting each other while working.

Further topics for research

This study does not focus on learning outcomes; the theoretical part (Figure 1) and the empirical data of this study do not specifically explore whether and to what extent employees learned to use the systems. Nor does this paper explain how the approaches to learning and the actualized learning strategies are connected to the outcome of learning. Future research should study how the elements of a learning activity in the context of ICT systems at work interact in order to best promote the desired learning outcomes. However, our paper offers a valuable contribution to distinguishing various elements in ICT learning and also to addressing what approaches to learning and what learning and problem-solving strategies people choose when they learn in the workplace.

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Appendix 1: The interview protocol

1. Briefly describe your work and its content.
2. Briefly describe when, how and for how long you have used the ICT system. Please evaluate the support the ICT gives to your work.
3. Describe your skills in using the system.
4. Describe how you initially learned how to use the system. Please evaluate your ways of learning.
5. Describe some problems you have confronted while learning to use the ICT system and while working with the help of the system.
6. Describe the user training and support functions you have utilized. Please evaluate their effectiveness.
7. Describe how you solved problems related to the use of the system. Please evaluate your ways of solving problems.

Appendix 2: Descriptions of the levels of expertise

The users have been divided into groups according to their levels of expertise in using the ICT systems being studied. The level of expertise of each interviewee emerged from the interviewee's descriptions of her or his skills and experience (also in years) in using the particular system and the author's analysis and estimations on the basis of the whole interview session (see Table A2.1). The levels of expertise are adapted from Dreufys and Dreufys (1986).

Table A2.1: Interviewees' levels of expertise in using the systems studied

Organization	Expert	Proficient	Competent	Novice	Total
University	–	2	6	1	9
Defence Forces	–	2	11	–	13
Company	1	1	1	7	10
Total	1	5	18	8	32

1. *Novice users* have very little experience using the system, and they follow the rules and plan of actions schematically.
2. *Competent users* have some experience of use, and they are able to use the system to manage ordinary work tasks.
3. *Proficient users* have enough experience to use the system quickly and flexibly to support their work.
4. *Experts* have a lot of experience and can use the system in a flexible and varied manner. They are able to find the right solutions for its use easily, and know the possibilities and limitations of the system.

Appendix 3: How interviewees did not want to learn the use of ICT systems

Learning strategy	Reason not to choose	Total
Participating in user training sessions	User training is unnecessary An employee has no time to participate An employee experiences user training as good, but has no motivation to participate An employee does not understand the trainer's technical advice	13
Reading manuals	Manuals do not work Manuals are the very last resort Try to manage without manuals	12
Contacting Help Desk or computer support service	An employee does not want to disturb unknown people An employee found that Help Desk staff cannot help An employee does not understand the technical advice An employee assessed the problem as being so minor that there was no need to contact the Help Desk	11
Taking a self-study course in the organizations' web pages	An employee has no motivation to take a self-study course	2

Appendix 4: Interviewees' problems related to the use of ICT systems at work

Problem	Description of problem
Technical difficulty or poor usability	Lack of system capacity, system crash, interruptions in use, poor network connections
	Problems with voice connections and microphones during online training or meetings
	Considerable number of software updates
	The use of the system is troublesome or cumbersome
	Navigation (or employees do not find the information they are searching for)
Users' lack of skills	An employee cannot use the system through lack of technical competence
	An employee cannot integrate the system use into her work practices