GROPING DEMANDS FOR SKILLS AND KNOWLEDGE:

Learning and the Development of Expertise in the Information Society

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Rapid change that strongly affects the structures of knowledge production and the role of experts in society is peculiar to today's society and working life (Achtenhagen, 1994; Gibbons et al., 1994; Reich 1992; Scott, 1996; Stehr, 1994; Tynjala et al., 1997). At the same time the development of information technology and information networks has changed the access to information and knowledge. These changes in society, professional culture and knowledge production make it necessary to reanalyse the nature and the content of professional expertise. Today's experts must, for example, be able to work in different contexts, possess diversified social and communication skills, make use of modern information technology, select relevant information from growing information streams and, above all, they must continuously construct and re-construct their expertise in a process of life-long learning.

One of the most important developments in modern society concerns the dissemination, management and use of information. We do not necessarily need to search for information from books or journals any more, because we can make use of the enormous information storage that the Internet and other electronic networks provide. Basic skills in information technology are becoming citizen skills that everyone has to acquire. Learning information technology skills is becoming important also in the acquisition of domain-specific expertise - even for the traditional professions, such as doctors, lawyers and teachers. «Computer literacy» is a form of cultural capital that will heavily determine individuals' social status in the post-industrial society.

In addition to the management of information technology, social skills and social networks are becoming more important. For example, applicants for a job may be asked not only «what can you do» but also «whom do you know?» or «with whom do you co-operate?» (Olkinuora & Makinen, 1999). The recall of facts is not very important in a high tech culture because access to information sources is fast and easy. Instead, media and communication skills are becoming pivotal in a networked society. On the level of organisations and communities the significance of networking, shared expertise and distributed cognition is becoming strongly emphasised due to ever growing supply and complexity of information (Hutchins, 1991, 1995; Sinko & Lehtinen, 1999). Probably the most characteristic organisational model in information society is a network company because it is best suitable for technological changes and real-time decision making of the global economy.

Although Computer Supported Social Networks (CSSN) have their restrictions, they also may allow more creative, unrestricted and direct interaction than personal contacts. Because of their regularity and mutuality CSSN may create strong connections between individuals. On the other hand, the absence of important social cues, such as gestures and looks, may weaken the connections. In any case, CSSN have a strong impact on the level of the society, emphasising the possibilities of local activity in promoting global communication. (Wellman et al. 1996, 213-238). On the whole, social aspects seem to play a significant role in expertise of information society.

From the educational viewpoint, the development of the information society should lead also to the development of the learning society (see, e.g. European Commission 1996a,b). The changing nature of expertise thus poses considerable challenges to educational systems and also to different forms of learning in work places. In recent years researchers have paid attention to the fact that educational practices differ from practices and activities required in real expert environments for which students are supposed to be prepared (Bereiter & Scardamalia, 1993; Geisler, 1994; Mandl et al., 1996; Resnick, 1987). It is claimed that traditional forms of university instruction produce «inert knowledge» in students. Such knowledge can be used in instructional settings but cannot be transferred into complex problems of working life. An important challenge to today's higher education is to develop instructional practices that would better develop the skills needed in the real world. Such practices would integrate studying domain-specific knowledge with practising personal transferable and generic skills, such as critical thinking skills, communication and co-operation skills and skills of using information technology. This kind of pedagogy has been developed under different paradigms of learning (e.g. process-oriented instruction, de Jong & van Hout-Wolters, 1994; problem-based learning, Albanese & Mitchell, 1993; constructivist learning environments, Duffy et al. 1993; Lonka & Ahola, 1995; Lonka 1997; Tynjala, 1997, 1998 a,b, 1999), but common to these approaches are the constructivist view of learning, the use of information technology for supporting the learning processes and the emphasis on collaborative activities in learning.

However, the construction of prerequisites of expertise is not only a matter of pedagogics or educational psychology; neither should learning be seen separately from its social and cultural context. Sociological studies have indicated that individual success in educational competition is closely related to the cultural capital of the students (e.g. Johnson et al., 1995; Liljander, 1998; Liljander & Maatta, 1994). Therefore we need a multi-level analysis of expert develop-ment, an analysis which unites both psychological and sociological factors and takes into account also the changes generated by the information society. In the present paper we shall examine those current challenges of education and educa-tional research which have emerged along with the information society development and which need integrated psychological-sociological analy-sis.

INFORMATION SOCIETY, EDUCATIONAL EQUALITY AND NEW CHALLENGES FOR LEARNING

The emergence of information society is not a completely positive phenomenon that one should accept without any criticism. On the contrary, the consequences of the expansion of the information

society should be thoroughly analysed because it may increase unequality among different groups of people. The winning group contains mainly young and well-educated citizens who have certain core competencies or *the relevant cultural capital* (Olkinuora & Makinen 1999) demanded by information society. The formation of information based society may lead to increased societal differentiation and marginalization and eventually to general passivity of marginalized groups. These phenomena are related to a stratification of people to A- and B-classes which is more and more linked to the ability to use new information techonology. A-class citizens master well multiple demands of the information society, whereas the B-class citizens do not. In addition to the new communication techonology, A-class citizens also need, for instance, to manage certain social skills. These kinds of developmental trends are also supported by organizational structures of workplaces that favour horizontally organized open and interactive social networks of individuals or teams.

At the moment structural unemployment - employees and jobs do not meet one another - is one indicator of the unequal conditions of citizens. Certain top level professional branches - called *the elitist knowledge sector* - suffer from the continuous lack of highly educated labour force, while in some other sectors the amount of young people who have been without work for a long period - called surplus *young - is* still growing (Rifkin 1997). Previously the academic degree guaranteed safe positions in the labour market, but nowadays the risk of unemployment and displacement is a reality also for academic people. This state of affairs produces a great challenge for the educational system: how to create such learning environments - especially within universities - that prepare students to meet the demands of the information society and the growing competition in labour market? Also, in working life the traditional models of training of personnel are no longer adequate. Instead, research based new models for learning at work are needed.

We assume that the information society is also a society of schooling. This is why the study of the development of expertise cannot leave educational processes without consideration. Information technology is in an important position in higher education in modern societies (see, for example, IBM-Gallup 1999; Sinko & Lehtinen, 1999). If used in a proper manner it may enrich the forms of academic instruction and also narrow the gap between studies and developing working life. For instance, studies may be linked to authentic problem-solving situations of different workplaces by means of information networks. Still, the amount of computers in certain educational institutions does not guarantee equal use of them by all students. Students' gender, social background and educational choices are related to the amount of using and the ways of utilising information technology (IBM-Gallup 1999; Sinko & Lehtinen, 1999). According to some studies early familiarity with computers seems to favour boys and therefore information technology may form the basis of a new 'wave' of unequality between men and women from the viewpoint of development of professional expertise. On the other hand, some studies have shown that this is not necessarily the case because girls seem to be more active users of IT for example in their studies (IBM-Gallup, 1999). The relationship between gender and the use of IT is an interesting and problematic issue which calls for further investigation.

THE THEORY OF CULTURAL CAPITAL IN THE SCOPE OF INFORMATION SOCIETY

The Field theory and the concept of cultural capital by Pierre Bourdieu (1986) describes the societal selection and the developmental mechanisms of the professional hierarchies in the context of industrial societies. Typically, higher social classes try to make a distinction from lower social strata, and at the individual level people try to strenghten their positions within a certain social class, for instance by forming specific *babitus.* In the post-industrial society the importance of this kind of capital may still exist, but nowadays the formation of individualistic careers by one's own skills and achievements may be more important. However, the concept of «field struggle» is relevant in our society for describing the competition between individuals utilising their symbolic capital for achieving valued positions in the labour market. Thus we would like to speak about *«skill-based society»* in which everyone has to sell one's own competence in order to become recruited. Furthermore, indivual competence must be continuously updated. Despite the new technological devices that enable extensive networks of global communication, all people are actually alone and responsible for their own (professional) competence.

According to Bourdieu, the adoption of symbolic capital takes place basically by means of family socialization. From the viewpoint of the information technological capital the role of the family is, on one hand, to create conditions (furnishing computers and applications) and, on the other hand, to control and/or support the use of techonogical devices at hand. In our country, Finland, for instance, there is a correlation between the family's educational and economical level and the availability of information technology in the home. Until a certain income level the following relationship has been found: the greater the income the more probable is the purchase of a home computer (Nurmela 1997). However, some families in spite of a lower income level, may buy a computer because «they want to guarantee their children's success at school» (Sinko & Lehtinen 1999). This shows how important a position mastering the information technology has achieved in parents' minds.

What kind of cultural capital is relevant at the moment? If parents are familiar with information technology, either because of their jobs or their spare time activities, it is presumable that children are familiar with such technology too, and thus do not have much difficulty at school when they meet with information technology in instruction. On the other hand, if the instruction is traditional (one-way lecturing allowing no independent seeking and processing of information) the pupil who is able to use the information technology in an experienced manner may feel frustrated and thus cause behavioural disturbance in the classroom.

In sum, we may conclude that the symbolic capital determining an individual's success in the information society can be figured out from the point of view of Bourdieu's Field theory but new elements are needed to be added to it in the form of specific cultural capital of the information society (Table 1). From the viewpoint of the present higher education the main question is what kind of forms of cultural capital promote students' study careers in higher education. And because one of the main functions of the higher education is to produce academic labour, the question can also be addressed in terms of expertise: what kind of forms of cultural capital are important or relevant for experts in work environments?

TABLE *1. New components of the cultural capital under the conditions of information society compared with the: traditional model of Bourdieu* (Olkinuora & Makinen. 1999)

Traditional cultural capital	Capital of information society
• family socialization as a most influential factor, often relatives have some importance, too	• besides family socialization other factors (media, www, friends) more and more important, relatives rarely important
• social stratum as a determinant of cultural capital (parents' education, occupational status and prosperity)	• in addition to socio-economical position, the social capital, social networks and shared expertise are relevant
• importance of institutionalized cultural capital (education as one of the determinants of social career)	• education as a necessity because of mass higher education and «inflation of degrees»; formal education is not enough, most advanced skills are mediated through peer networks
• importance of embodied cultural capital, habitus (cultural activities, language, behaviour, etc.)	• general activity and keeping up with the time, intellectual curiosity and tolerance for uncertainty
• importance of objectified cultural capital (books, works of art, etc.)	• rich information technologies at hand and knowing how to cope with «the information jungle»
The traditional professions with well-structured demands as the goal of an individual	New *high status knowledge sector expert positions» with ill-structured demands as the goal of an individual*

STUDY ORIENTATIONS AS A MEDIATOR BETWEEN STUDENTS' BACKGROUNDS AND STUDIES IN HIGHER EDUCATION

It is quite obvious that various preconditions for studying, for example differences regarding the cultural capital, have also notable connections to students' orientation patterns. Orientations, on their behalf, seem to be related to students' study strategy choices and study success (cf. Eronen et al., 1998; Olkinuora & Makinen, 1999). We use the concept of *generalized orientations* in the sense of the relatively permanent ways in which one is directed towards studying. Generalized orientations refer to personal meaning that students give to university studies. For some students, as a consequence of purely intrinsic motivation, studying is an inherent value and this expresses itself as strong theoretical or academic orientation. An almost opposite orientation could be called professional, i.e. instrumental and practical, orientation. (e.g. Bergenhenegouven 1987.) In reality, of course, there are plenty of intermediate forms of orientations between the two extremes.

We assume that the growth of the information society increases the societal differentiation so that the above mentioned orientations will also be more differentiated. For a more elaborative analysis of the connections of the different levels of orientations to other intra-individual variables influencing one's studying and learning, also such psychological elements as students' action control, relevance structures and experiences of self-efficacy must be taken into account (see e.g. Bandura, 1997).

In addition to generalized orientations, human action is directed by more differentiated and specialized mechanisms which could be called *domain specific orientations.* They are more dependent on the contents and learning environments of certain subjects or courses than generalized orientations are. Entwistle and his colleagues (1991; Entwistle & Ramsden, 1983) have identified the following forms of domain specific orientations: the personal meaning orientation, the achieving orientation, the reproducing orientation and the non-academic orientation. Different domain specific orientations are further related to learning approaches such as deep, strategic and surface apathetic approaches of learning (Tait, Entwistle & McCune 1997).

Orientations most sensitive for contextual changes are *situational orientations* (Olkinuora & Salonen, 1992; Salonen, Lehtinen & Olkinuora, 1998). These orientations describe different modes of adaptation of an individual to the learning (or performance) situation based on his/her interpretation of it. In other words, situational orientations involve socio-cognitive coping reactions to learning situations. For example, challenging and demanding tasks may trigger either approaching behaviour (task orientation) or avoiding tendency (non-task orientations) (Lehtinen et al., 1995.) The latter orientations can be divided into two main categories: 1) social dependence orientations and, 2) ego-defensive orientations. Cumulative learning difficulties and continuous failures may lead to the experience of a «blind alley» which may cause a defense of denying the value of studies and finally to a non-committed orientation. As an extreme consequence of this kind of regressive cycle a student may change the major subject or abort their studies altogether. It is very probable that the increasing use of information technology in different learning and studying situations may trigger situational orientations much in a similar way as in other demanding learning or performance situations. Then students who have not much experience in using computers may find those situations frustrating or frightening, leading to avoidance tendency. In contrast, for the students with advanced skills in the use of IT, computer assisted instruction may promote task orientation.

EXPERTISE AND COMPONENTS OF EXPERT KNOWLEDGE

On the basis of his analysis of research on expertise during the past 20 years, Sternberg (1997) states that expertise can be seen as a multidimensional prototype including, in varying degrees, the following attributes: 1) advanced problem-solving processes; 2) a great amount of knowledge; 3) advanced knowledge organisation; 4) an ability to use knowledge effectively; 5) creative ability, which involves creating new knowledge on the basis of knowledge that one already has; 6) automatised actions; and 7) practical ability, which involves knowing how to get ahead in one's field. The attributes of the prototype may vary over time and space and they may also differ from one domain to another. Expertise is thus domain-specific (cf. Chi et al., 1988; Ericsson & Lehman, 1996). However, independent of a domain, a general, essential part of expertise is expert knowledge and its organisation rather

than talents, intelligence, diligence, practice, etc. (although these factors, too, have an important role in expertise). Therefore, research on the development of expert knowledge is of fundamental importance from the viewpoint of understanding the acquisition of expertise.

Recently, several analyses have been presented on the nature and different constituents of expert knowledge (Bereiter & Scardamalia, 1993; Eraut, 1994; Etelapelto & Light, 1999). In spite of their differences in details and terminology, these accounts usually divide expert knowledge into three main components: 1) formal knowledge, 2) practical knowledge, and 3) self-regulative knowledge.

Formal knowledge belongs to the category of what cognitive psychologist have called declarative knowledge. Such explicit and factual knowledge has played a major role in education and learning, and as such it constitutes the core of professional competence. The second constituent of expertise, practical knowledge, often called procedural knowledge, manifests itself as skills or «knowing-how». While formal knowledge may be described as universal and explicit, practical knowledge is, on the other hand, personal and tacit, being thus intuition-like and difficult to express explicitly. The third component, self-regulative knowledge, consists of meta-cognitive and reflective skills that individuals use to monitor and evaluate their own actions.

In addition to analysing the components of expertise, some researchers have pursued finding out what explains the fact that not all experienced people can be called experts despite their long practice in their field. For example, Bereiter and Scardamalia (1993) have differentiated between experts and experienced non-experts. Characteris-tic of experts is that they progressively advance on the problems constituting their field of work, whereas non-experts seek to develop routines as their skills grow, leading to the gradual constriction of their work. Experts, too, develop some routines but for them the routinasation of some actions mean that they can re-invest their mental resources for addressing new problems at higher and higher levels. This way experts work at the growing edge of their competence and address themselves new challenges as earlier problems have been solved. Thus Bereiter and Scardamalia define expertise as a process of *progressive problem solving* in which people continuously rethink and redefine their tasks and surpass themselves. Conceptualising expertise this way captures not only individuals' knowledge and skills as components of expertise but also their potential for continuous learning and development. Further, expertise as a process of progressive problem solving does not confine itself to individuals but can be applied to larger entities such as teams, groups and expert cultures.

LEARNING PROCESSES AND LEARNING ENVIRONMENTS IN CONSTRUCTING EXPERTISE

The development of expertise is a long process during which the different elements of expert knowledge are integrated into a coherent whole. Thus, typical to high-level expertise is the integration of theoretical and practical knowledge. Accordingly, from the educational viewpoint the central question is how this integration takes place. Leinhardt and colleagues (1995) argue that true integration of theoretical and practical knowledge is best fostered when university students transform abstract theories and formal knowledge for use in practical situations and, correspondingly, employ their practical

knowledge to construct principles and conceptual models. Thus, *theorising practice* and particularising *theory* are suggested as keys to the development of expert knowledge.

As described above, Bereiter and Scardamalia (1993) define expertise as a process of progressive problem-solving. Grounding on Anderson's (1982, 1987) view of skill acquisition they emphasise that problem-solving is a mediating tool for integration of different components of expert knowledge. According to Bereiter and Scardamalia, converting formal knowledge into an expert's informal knowledge and skills is pivotal in the development of expertise. This takes place when formal knowledge is used for problem-solving. Thus, formal knowledge acquired from textbooks and lectures is converted into an expert's informal knowledge by being used to solve problems of understanding. Similarly, formal knowledge is converted into skill by being used to solve problems of procedure. Thus, solving authentic problems has an important role in the process of the development of expertise. Pedagogically this implies that when formal knowledge is studied by reading textbooks and attending lectures, carrying out different problem-solving tasks is a much more effective way for a student to develop expert knowledge than taking tests of factual information and reproducing book knowledge as such. Traditionally the problems that students have solved in educational settings have been well-defined problems. In contrast, characteristics of working life are ill-defined problems. Such problems require that several factors are taken into account at the same time, and there is not just one right solution to the problem. It is important that future experts have to work out complex and ill-defined problems of this kind during their education.

Professional expertise is constructed mainly in two environments: while the prerequisites for expertise are created in educational contexts, deep professional expertise develops only in authentic working life. Therefore, it is very important that the gap between educational environments and working life will be narrowed by different pedagogical innovations and by promoting co-operation between educational institutes and work places. Furthermore, analysing learning and problem solving processes in working life is important for developing new forms of studying and learning environments for formal education.

One pedagogical innovation which applies the ideas of integrating theory and practice by problem solving and by bringing working life problems closer to students is problem-based learning (PBL) (Albenese & Mitchell, 1993; Boud & Feletti, 1991). In PBL the starting point of studying is some theoretical or practical problem instead of a discipline or a category of knowledge. PBL involves both group work and individual study phases and is supported by a tutoring system. It is nowadays widely used in medical education and in some other professional fields such as in law education.

Another promising educational approach for university courses is working life oriented project learning (see Etelapelto & Tourunen, 1994; Latham, 1997; Tourunen, 1992; 1996). For example, in a university course of information systems design (Tourunen, 1992, 1996) student groups devise and carry out an information system project for an authentic client company. This way students can apply theories into practice and learn group work as well as communication and co-operation skills in an authentic learning environment (cf. Resnick, 1987).

Both PBL and working life oriented project learning are applications of the constructivist view of learning, the paradigm that has questioned the traditional objectivist and knowledge transmission paradigm of knowledge acquisition. According to constructivism, learning is not about passive reception of information but learners' cognitive and social activity where they construct knowledge on the basis of their previous knowledge and beliefs. Learning environments that have been designed on the basis of constructivist thought emphasise the significance of learners' previous knowledge in learning, metacognitive and reflective activities, use of multiple representations of concepts and information, social interaction, negotiation of meanings, shared understandings, and diverse assessment methods of learning. Many recent developments in university pedagogics have integrated the ideas of constructivism and knowledge produced in research on expertise (e.g. Lonka, 1997; Mandl et al., 1996; Tynjala, 1998b, 1999; Tynjala et al., 1997). Now we suggest that this research line should be extended to cover also challenges for expertise raised by the information society development, because fast development in information technology and changes in production and organising work have caused a need for continuous updating and re-constructing of skills and knowledge of experts.

CONCLUSION

The emergence of the so-called information society has brought about many kinds of changes in the working life: in the structure of professions, in the nature of jobs, in the qualifications needed to solve problems and manage in work, and in the symbolic, social and cultural capital behind those competencies. Because of the somewhat obscure picture about the real nature of the information society and the manyfaceted changes taking place in many postindustrial societies we need focused research on them and their consequences to class structure, home socialisation, educational needs of the emerging work force, students' orientations in higher education etc.

In any case, the ongoing development towards information society raises new kinds of challenges for experts in working life and for producing expertise in higher education. In addition to information technology skills, different social and communication skills are emphasised. In traditional training at universities the development of these types of skills has not received much attention, for the main emphasis has been focused on the acquisition of domain specific theories, methods and skills. Thus, we should develop novel educational practices in which skills required by an information society can be developed in integration with domain specific knowledge. However, despite the increasing demands that working life requirements should be taken into account, we should not forget universities' traditional values and the mission of cultivating general academic skills such as scientific and critical thinking and an ability to produce new knowledge.

Altogether, educational systems, especially university education, are facing a challenging demand of producing at least three types of learning outcomes of equal priority: 1) domain specific knowledge and skills, 2) transferable personal skills, for example capabilities of self-regulated and collaborative learning, of working in teams, of coordinating activities and network relations, skills of utilising information technology etc., and 3) general or generic academic outcomes, such as critical thinking skills, making use of information as well as analysing and synthesising knowledge and information (cf. Allan, 1996). Perhaps the last-mentioned skills are needed more than ever when one has to cope with the rapidly expanding 'information jungle'. Carefully designed pedagogical applications of new information

technology as well as certain educational innovations such as problem based learning, working life oriented project learning and different applications of the constructivist view of learning can offer possibilities for creating new kinds of learning environments aiming at the integration of different learning outcomes.

As we develop new pedagogical tools we should also analyse how the information society affects the educational equality and how students coming from different sociocultural backgrounds can make use of different learning environments and studying methods and how the use of information technology is reflected in students' study orientations. This means that we need multidisciplinary and multilevel approaches to research on learning, studying and development of expertise in the information society.

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