

## **KNOWING ABOUT ICT IN EDUCATION: REDEFINING DIGITAL COMPETENCE FOR TEACHERS?**

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### **Abstract**

This paper concerns Teacher Professional Development (TPD) and ICT. It is sometimes assumed that teachers' use of ICT should promote a digital literacy, and that teachers' knowledge could be described as a digital competence. This assumption disregards that digital competence often refers to the policies of life-long learning (European Union, 2006). This paper aims to discuss digital competence in the context of ICT in Swedish schools as it appears in national and international surveys. It is argued that teachers' digital competence has to be framed differently in order to give a relevant picture of the situation in Swedish schools.

### **Introduction**

In the last decade, there has been an increased attention in research as well as practice given to teachers' use of ICT. The Information Society has, at least in the Western parts of the world, meant a boost in the information and communication systems in society. The increased use of the Internet, and the communication oriented software sometimes referred to as Web 2.0, has brought about changes that affect different groups in different ways. In the above mentioned tension between the industrialised West and the developing countries, this has been described as a digital divide (Carr-Shellman, 2006). But also between generations in the west, a divide in the use of ICT has been said to exist. Young people's use of ICT is different from that of older people — they are more open to its use and less hesitant (Fors, 2007). This divide is also affecting schools (Krumsvik, 2008). Teachers, then, need to develop their own use of ICT, and to integrate ICT in education in a way relevant to schools (Rosado & Belisle, 2006). Teachers seem to be in need of professional development for this purpose. But what should that professional development aim at?

### **ICT Knowledge in the Information Society**

The kind of knowledge needed to live in the information society has been debated, but often it has been described as information literacy. Gilster (1997) defined "digital literacy" as:

the ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers. The concept

of literacy goes beyond simply being able to read; it has always meant the ability to read with meaning, and to understand. It is the fundamental act of cognition. (pp. 1–2)

Rosado and Belisle (2006) acknowledge Glister's definition, and analyse ten different frameworks for digital literacy. They conclude that teachers face a challenge to change their understanding of their activities to a constructivist approach and to have a socio-cultural understanding. Today students seek the other experiences in academic settings. Students' use of knowledge is more pragmatic, functional and utilitarian nowadays. Schools, they say, are not the only place for knowledge experiences.

### **Digital Literacy for Digital Competence**

Lately, following the EU policies on lifelong learning, digital literacy has also been described and related to digital competence. In Norway, Sørby (2003) described the kind of knowledge needed for teachers by linking digital literacy to digital competence. Sørby also linked those Norwegian ambitions to the EU work of defining digital literacy. Olsson and Edman-Ståhlbrandt (2008) connect the EU striving for digital literacy to digital competence and point to new definitions of digital literacy. In November 2008 the International Conference on Digital Literacy sponsored by the European Commission at Brunel University had as a strand the definition of digital competence and its assessment in which the challenge of today's society, due to complexity and globalization, was related to digital competence.

Krumsvik (2008) outlines a framework for teachers' complex digital competence. This can be seen as an attempt to capture what he sees as an increasingly digital reality in today's Norwegian schools. Krumsvik also points out some of the many possibilities, challenges and dilemmas that have arisen in the digital world of young people.

In a policy brief concerned with digital competence for lifelong learning (Ala-Mutka, Punie, & Redecker, 2008), there is a description of how teacher training in all fields should include advanced digital competence for teachers and their teaching. The brief also concludes that students should be both allowed and encouraged to use ICT for their learning, for information searching and for creation tasks. The intention is that students learn to use and be creative with digital tools and media in context, within different subject fields, and thereby taking into account the subject-specific considerations. The brief says that ICT for learning has the potential to put learners at the centre. If being engaged actively in the learning process, by for instance promoting discovery and experiential learning, this will bring forward at the same time other skills related to advanced

digital competence, such as online collaboration with confident and critical use of the digital tools.

In April 2008 a joint seminar between the two different areas of cooperation in the EU Education and Training 2010 Work Programme, Teachers and Trainers and Key Competencies and Curriculum Development was held. Uzerli and Kerger (2007) describe the continuous professional development of teachers within the EU and the connections to the key competencies of lifelong learning, among which digital competence is one. For this reason, they also point to the need for teachers to develop new competencies, for instance in the subjects field. All in all, there seems to be a need for teachers to develop new approaches to teaching and learning, in which ICT is an integrated part.

### **Professional Development in Sweden Related to ICT Use**

In Sweden the development of such a competence has, over time, been promoted by the Swedish Government and other actors (such as the Knowledge Foundation) through different kinds of national initiatives and programs. For more than 10 years, the knowledge Foundation has supported and developed the use of ICT in schools. Beginning in the 1990s with the lighthouse projects (Jeddeskog & Nissen, 2004), and today in the 2005 initiative for integrating ICT in teacher education. The major government programme being the ITiS-programme of the Swedish Government in early 2000. These programmes all promoted the use of ICT to improve teaching and learning in schools.

In contrast to most of the writings referred to above, in which there are normative tendencies to define the content needed by teachers based on policy or by inferred demands from a knowledge or information society, Mishra and Koehler (2006) suggest a model of teachers' technological, pedagogical content knowledge that is empirically based and situates teacher's use of ICT in their practice. This framework, the TPCK-model, seems to be a model suitable for analytic purposes, Mishra and Koehler mentions it as a framework for research. As such, this paper will try to contrast it with the EU framework for lifelong learning and the key digital competence.

### **Aim**

The aim of this paper is to discuss a possible conception of a digital competence for teachers through the framework of the European Key Competencies for Lifelong Learning and the TPCK-model of Mishra & Koehler (2006) by relating to teachers' use of ICT in Swedish schools as it appears in national and international surveys.

## **Digital Competence within a Framework of Lifelong Learning**

In December 2006 the European Union launched its recommendations on key competencies for lifelong learning (European Union, 2006). The recommendation is considered to be a reference tool for the Member States, to ensure the full integration of the key competences into their strategies and infrastructures, in the context of lifelong learning.

Competences are defined as a combination of knowledge, skills and attitudes that are appropriate to the context. Key competencies are those which all individuals need, reasons given are for personal fulfillment and development; active citizenship; social inclusion; and employment. The Framework sets out eight key competences: communication in the mother tongue; communication in foreign languages; mathematical competence and basic competences in science and technology; digital competence; learning to learn; social and civic competences; sense of initiative and entrepreneurship; and cultural awareness and expression.

Each of the key competences are considered equally important. Each can contribute to a successful life in a knowledge society. Since many of the competences are said to overlap and interlock, they need to be given as part of the whole. For example, competence in the basic skills of language, literacy, numeracy, and in information and communication technologies (ICT) are said to be essential for learning, and the competence defined as learning to learn supports all learning activities.

In the recommendation, digital competence is defined as:

Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet. (European Union, 2006)

Digital competence is said to require a sound understanding and knowledge of the nature, role and opportunities of IST in everyday contexts. In this is included word processing, using spreadsheets, using databases, information storage and management, and also an understanding of the opportunities and potential risks of the Internet and communication via electronic media, for work, leisure, information sharing and collaborative networking, learning and research. It is also said that individuals should understand how support for creativity and innovation can be found in the use of IST, and have an awareness of issues of validity and

reliability of available information, as well as of the legal and ethical principles involved in using IST.

The skills needed and stated include abilities to search, collect and process information, in a critical and systematic way, assessing relevance and distinguishing the real from the virtual. Individuals should also have skills to use IT as a tool to produce, present and understand complex information and to access, search and use internet-based services, as well as to be able use IST to support critical thinking, creativity, and innovation.

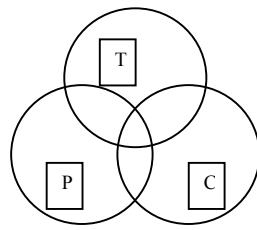
A critical and reflective attitude is said to be needed towards the sources of available information as well as a responsible use of the interactive media. Support for a digital competence is said to include an interest in engaging in communities and networks for cultural, social and/or professional purposes.

### **Pedagogical Technological Content Knowledge**

A different framework for understanding teachers' use of technology is offered by Mishra and Koehler (2006). They argue that part of the problem of understanding why teachers' use of technology is falling behind has been a tendency to only look at the technology and not how it is used. They say that merely introducing technology to the educational process is not enough. Their primary focus lies on studying how technology is used. Their framework is based on an understanding of teaching as a highly complex activity that draws on many kinds of knowledge

In their framework they highlight the relationships between content (subject matter that is to be learned and taught), pedagogy (the process and practice or methods of teaching and learning), and technology (both commonplace, like chalkboards, and advanced, such as digital computers). The framework emphasizes the connections and interactions, between and among content, pedagogy, and technology. In their model, knowledge about content (C), pedagogy (P), and technology (T) are central for developing good teaching, but rather than treating these as separate bodies of knowledge, the emphasis is on the complex interplay of these three bodies of knowledge. In Figure 1, the intersections between the different knowledge domains are illustrated.

Figure 1: The Intersections of Technology, Pedagogy and Content



After Mishra & Koehler, 2006

In other words, to have a digital competence as a teacher, the teacher must know more than just how to use technology. The teacher needs to know how to use technology for pedagogical purposes in relation to a specific content matter. Having a digital competence would reflect the intersection between these knowledge domains, the intersecting area of all three circles in Figure 1. Thus, this model of technology integration in teaching and learning implies that developing good content requires interweaving three sources of knowledge: technology, pedagogy, and content. Mishra and Koehler (2006) argue that there is no single technological solution that applies for every teacher, every course, or every view of teaching. Developing a nuanced understanding of the complex relationships between technology, content, and pedagogy is needed.

### **The Use of ICT in Swedish Schools — Some Survey Results**

According to the European Commission (European Commission Information Society and Media, 2006), all Swedish schools used computers for teaching, and had Internet access in 2006. Broadband connection was the most common, 89% of schools, and about 95% lower and upper secondary schools had a broadband Internet connection, while the figure for primary schools were lower, 86%. Sweden ranked at number 3 of the 27 countries in Europe according to the survey. ICT was integrated into teaching subjects in more than 90% of the schools. According to the teachers, only 11% of teachers in Sweden did not use computers in class. The majority of the teachers (54%) used computers in less than 10% of all lessons. Lack of computers in their schools was reported as the most important barrier for increased use. The majority of Swedish teachers, though, were satisfied with the access they had at their schools to technology, but they state they have problems to find adequate learning materials (62%), as well as argue that the existing materials are of poor quality (54%).

The first inter-Nordic study concentrated on the impact of ICT on education. E-learning Nordic 2006 Impact of ICT on Education involved four of the Nordic countries (Finland, Sweden, Norway and Denmark). In this study, more than 8000 people (teachers, pupils, headmasters and parents in primary and secondary schools) participated. The aim was to discover and document the perceived impact of ICT on education. The study had three key areas: the pupils and their performance, the teaching and learning processes, and finally knowledge sharing, communication and home-school cooperation. One of the major findings was that pupils and teachers as well as parents believed that ICT had a positive impact on improving pupils' performance, especially subject related performance, and on basic skills such as reading and writing. ICT was also thought to support differentiation for both academically strong and weak pupils. In general, ICT was assessed as having a positive impact on teaching and learning, but its revolutionary impact on teaching and learning processes in schools was also expected to be greater (E-learning Nordic 2006, 2006).

The Knowledge Foundation has continually investigated pupils', teachers' and school leaders' attitudes toward ICT and the use in schools. In 2006 they conducted the latest investigation, which shows that a great majority of pupils, and many teachers, appreciate using ICT in school assignments. In upper secondary schools, 7 of 10 pupils use computers during lectures at least once a week or more. Of the teachers, more than half use computers during their lectures at least once a week or more. Eight of 10 teachers' use computers daily outside of the lectures. Computer use among the school principals is high. In relation to their work, more than 4 of 10 headmasters use computers for more than 20 hours a week. Teachers have enough knowledge of IT according to a majority of the pupils, but only half of the teachers themselves assess their knowledge on IT as good enough. Also showed is that the communication supported by IT has increased greatly. Communication via e-mail between teachers and pupils is reported by 7 of 10 teachers. Communication with the parents via e-mail is reported by 6 of 10 teachers. In upper secondary schools, the pupils use IT to a very high degree to communicate with each other on questions related to school assignments, for instance via MSN/Messenger and SMS (KK-stiftelsen, 2006).

## **Discussion**

In relation to the EU framework on digital competence, there seems to be possibilities to find aspects of the defining features of a digital competence in the use of ICT reported in the surveys.

For instance, using e-mail to communicate with pupils and parents could be said to reflect a sound understanding and knowledge of the nature, role and opportunities of IST in everyday contexts; that is for information sharing and communication. Teachers are also reported to believe that pupils perform better on basic skills, reading and writing using computers.

In relation to the TPCK-framework of Mishra & Koehler, there seems to be other aspects of the use reported in the surveys that might be discussed.

For instance, the reports of teachers stating that they are having trouble in finding adequate learning materials and that materials are of poor use could point to a pedagogical-technological knowledge included in the TPCK-model. Further, that the majority of the teachers' use computers in less than 10% of their classes' could be a sign of weak knowledge of the content-related use of ICT. This interpretation might be supported by the reports that teachers' use of ICT is higher outside of the classroom. They have the technological knowledge, but lack the knowledge of how to use ICT for pedagogical purposes. The TPCK-model might point towards this kind of knowledge.

In relation to each other, the digital competence framework is clearly formulated outside of the context of the educational system. The framework points towards a more common, or de-contextualized, use of ICT. In the TPCK-model, the use of ICT is much more contextualized within a pedagogical practice, and the basic skills and ICT competencies of the digital competence framework might be part of the technological aspect of that model. What the model then implies is that the technological knowledge and the digital competence need other kinds of knowledge structures to become useful in pedagogical settings.

## **Conclusion**

What then can be concluded from this analysis? What seems obvious is that the digital competence framework will provide a way of relating teachers' use of ICT, both in and outside of classrooms, to the basic skills in using ICT for more simple aspects of tasks such as word processing, information seeking and communicating. But when it comes to the informed choices needed in complex pedagogical settings, there seems to be little guidance in the digital competence framework. It seems that this is not a framework that can be used in that specific manner.

What can be concluded about the TPCK-framework is that it might have an analytic potential in building an understanding of the lack of ICT use in certain areas. In the framework, what is described as complex relations between deep knowledge of content and pedagogy in relation to deep knowledge of technology is what is needed to develop a sound use of ICT in the teaching and learning.

There seems to be somewhat of an overlap in the definition of these complex relations to the kind of use that still seems to be lacking in schools. That is, teachers' informed use of ICT both related to pedagogy and related to content.

So, perhaps there is a need to redefine the framework for digital competence when it comes to teachers and teaching. Including the kind of knowledge that is captured in the TPCK-framework seems as a decent way to start.

### References

- Ala-Mutka, K., Punie, Y., & Redecker, C. (2008). *Digital competence for lifelong learning*. JCR Technical Notes. JRC 48708.
- Carr-Shellman, A. (2005). *Global perspectives on e-learning. Rhetoric and reality*. Thousand Oaks, CA: Sage.
- European Commission Information Society and Media. (2006). *Information and communications technologies (ICTs) in schools*. Retrieved November 1, 2008, from [http://ec.europa.eu/information\\_society/newsroom/cf/document.cfm?action=display&doc\\_id=175](http://ec.europa.eu/information_society/newsroom/cf/document.cfm?action=display&doc_id=175).
- Elearning Nordic 2006. (2006). *Impact of ICT on education*. Retrieved November 1, 2008, from [http://www.edu.fi/julkaisut/eLearning\\_Nordic\\_English.pdf](http://www.edu.fi/julkaisut/eLearning_Nordic_English.pdf).
- European Union. (2006). *Recommendation of the European Parliament and of The Council of 18 December 2006 on Key Competences for Lifelong Learning*. Official Journal of the European Union.
- Fors, V. (2006). *The missing link in learning in science centres*. Doctoral Thesis. Luleå University of Technology, Department of Educational Sciences.
- Gilster, P. (1997). *Digital literacy*. New York: Wiley.
- Jedekskog, G., & Nissen, J. (2004). ICT in the classroom: Is doing more important than knowing? *Education and Information Technologies*, 10(1), 37–45
- KK-stiftelsen. (2006). *IT i skolan — Attityder, tillgång och användning*. Retrieved November 1, 2008, from [http://www.kks.se/upload/publikationsfiler/it\\_i\\_utbildning/it\\_i\\_skolan\\_2006\\_2006\\_publ.pdf](http://www.kks.se/upload/publikationsfiler/it_i_utbildning/it_i_skolan_2006_2006_publ.pdf).
- Krumsvik, R. J. (2008). Situated learning and teachers' digital competence. *Education and Information Technologies*, 13(4), 279–290.
- Mishra, P., & Koehler M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record* 108(6), 1017–1054.
- Olsson, L., & Edman-Stålbrandt, E.(2008). Digital literacy as a challenge for teacher education. *Learning to live in the knowledge society, IFIP World Computer Congress 2008*.
- Rosado, E., & Bélisle, C. (2006). *Analysing digital literacy frameworks. A European framework for digital literacy*. Lyon: LIRE, Université Lyon.

- Søby, M. (2003). Digital competence: From ICT skills to digital “bildung”. Oslo: ITU, University of Oslo
- Uzerli, U., & Kerger, L. (2007). *The continuous professional development of teachers in EU member states: New policy approaches, new visions*. ENTEP. Retrieved November 1, 2008, from <http://entep.bildung.hessen.de/>.