From National Commitment and Initiatives to Implementation in the Classroom: Some Critical Issues on Integration of ICT into Education in the Swedish Context

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Abstract
Since 1994 Sweden has carried out a number of initiatives funded by the government and other actors for integrating ICT into education. Huge amounts of money have been invested in developing infrastructure and raising teachers’ level of ICT knowledge and competence. However, it seems that there is still a gap between the claims for ICT use in education and the current practice of integrating ICT into the classroom. Some recent investigations indicate that a majority of Swedish teachers actually do not use computers in the classroom as much as they are expected to do. Knowledge about the use of ICT in teacher education is reported as being not good enough. This paper intends to describe the status quo of ICT integration in education in the Swedish context and discuss some critical issues on effective ICT practice in schools in relation to the demands on teachers and their professional development, and thus provide some backgrounds for suggesting models of Technology Enhanced Teacher Professional Development.

Introduction
Information Technology (IT) is one of the most important political issues for the Swedish Government (Government Bill, Proposition 2004/05: 175). In education, European policies concerning Information Communication Technology (ICT) in education have also had great influence on the Swedish national strategies for ICT in education system. Following the Lisbon Council policy of EU (European Council, 2000), Sweden has carried out a number of projects funded by the Government and other foundations (e.g. the Knowledge Foundation, http://www.kks.se/) to promote integrating ICT into education. Most of these programs were nationwide, and huge amounts of money have been invested in developing infrastructure such as Internet access, e-mail use, hard- and software installation in classrooms, as well as in improving teachers’ competence in using ICT in teaching and learning through cooperation among municipalities, universities/ institutions, and schools. By 2006, Sweden ranked as one of the best among the 27 countries in Europe in ICT infrastructure in schools (European Commission Information Society and Media, 2006).

A recent commission staff-working document (Commission of the European Communities, 2008) reports on how the use of e-learning has developed since the Lisbon Council. However, the document states that the potential of ICT in supporting lifelong learning has not yet been realized, and the impact of ICT on education and training has not yet been as great as expected, so that embedding ICT in education requires further
changes. In its conclusions the report calls for a renewed approach towards ICT for teaching and training, aspects of which are upgrading digital competence and shifting from the issue of access to requirements on the quality of using ICT for learning. In Sweden, some recent investigations also indicate that a majority of Swedish teachers actually do not use computers in their classrooms as much as they are expected to do. Knowledge about the use of ICT in teacher education is reported as being not good enough (Knowledge Foundation, 2005, 2006). In brief, despite political commitment and financial investment on national level, it seems that there is still a rhetoric-reality gap between the claims for ICT use in education and the current practice that reflects the complicated process of implementation.

Based on the findings from a number of investigations on ICT in education conducted by the Swedish National Agency for Education, European Commission, e-learning Nordic, OECD and the Swedish Knowledge Foundation, this paper intends to describe the status quo of ICT integration in education in the Swedish context and discuss some critical issues on effective ICT practice in relation to the demands on teachers and their professional development, and thus provide some backgrounds for suggesting models of Technology Enhanced Teacher Professional Development (TETPD).

**ICT Policies, Implementation and Professional Development**

Integration of ICT into education has been extensively studied in various areas and in different perspectives during the last twenty years. Some studies focus on the important role of national policies concerning ICT in education, in which the functions of both strategic and companion operational policies are discussed (Jones, 2003; Kozma, 2003). Strategic policies can provide rationales, goals, and visions for integrating ICT into education to motivate changes and coordinating disparate efforts in order to improve the overall educational goals on the national level. Through companion operational policies, the possibility to carry out programs is provided and resources are allocated to enable changes and development. But national commitment and initiatives do not automatically guarantee successful and effective use of ICT in the classroom. Local conditions and school-related factors such as organizational culture, leadership, action plan, innovation, performance capacity, and contextual characteristics of schools are identified as important for implementation (Tondeur, van Keer, van Braak, & Valcke, 2008; Yuen Law, & Wong, 2003). Teachers’ individual characteristics, computer attitudes and experiences, beliefs and perceptions about ICT in education, as well as gender related factors are also regarded as crucial variables for ICT practice in the classroom (Albirini, 2006; Jimoyannis & Komis, 2007; Volman, van Eck, Heemskerk, & Kuiper, 2005).

A series of studies indicate a positive correlation between teachers’ ICT knowledge and their positive attitude towards the potential of computers in education, and that good ICT skills will contribute to a more effective integration of ICT into teaching where
computers are used as a part of stimulated environment that promotes students’ active and collaborative learning (Higgins & Moseley, 2001; Yildirim, 2000). Hu, Clark, and Ma (2003) also argue that teachers’ understanding of the usefulness of ICT is a significant factor in determining their intentions of integrating ICT into classroom instructions. Furthermore, how teachers implement ICT and their motivation to use ICT tools in the classroom are closely related to their understandings of the content and processes of teaching and learning and their level of competence with ICT. Mishra and Koehler (2006) provide a framework on knowledge needed by teachers to effectively integrate ICT into teaching and learning where knowledge of content, of technologies, and of pedagogy are considered as three key related components (technological pedagogical content knowledge).

Although increased access to ICT is commonly regarded to have potential advantages in educational and pedagogical outcomes, ICT is still underused in many schools around the world, and the potential of ICT is not being well realized (Conlon & Simpsons, 2003; Russell, Bebell, O’Dwyer, & O’Connor, 2003; Williams, Coles, Wilson, Richardson, & Tuson, 2000). Together with the potential barriers of environmental variables, teachers’ ICT related motivation, knowledge, and competence are also regarded as critical obstacles (Ertmer, 2005; Mueller, Wood, Willoughby, Ross, & Specht, 2008; OECD, 2009; Pelgrum, 2001; Wood, Mueller, Willoughby, Specht, & DeYoung, 2005). Briefly, the new challenges and new demands on teachers in the new technology age give new meaning to the profession of teacher and thus claim a new perspective on teacher professional development (TPD). Teachers’ ICT training connected to school subject specific practices as well as immediately and continuous support are regarded as important influences on how well ICT is embraced in the classroom (Baylor & Ritchie, 2002). In recent years, more research has been giving evidence to the significance of teachers’ informal and collaborative learning, bottom-up and context related models as well as “just-in-time” and ongoing “coaching” approaches for ICT integrated teacher professional development (Franklin & Sessoms, 2005; Granger, Morbey, Lotherington, Owston, & Wideman, 2002; Zhao, Pugh, & Sheldon, 2002).

National Initiatives for ICT in Education

In spring 1994, the Swedish Government appointed a Commission to promote widespread use of information technology in Sweden. One of its major initiations was the project of National Action Program for ICT in Schools (ITiS) launched by the Swedish Government (Regeringens skrivelse 1997/98:176). ITiS was an ICT-project as well as a school development project. It included all educational actors in pre-schools, compulsory schools, special schools, Sami (minority folk) schools, upper secondary schools, and municipal adult education. All Swedish municipalities chose to participate in all parts of the program. Several guiding principles underpinned the planning of the program and informed the implementation in the municipalities. Equal standards between schools and equal quality for students, as well as the dimension of school development were stressed.
A delegation was formed to take the responsibility for distributing state grants to the municipalities. In total, 1.5 billion Swedish crowns were put into the program by the government between 1999–2001, of which about 1.2 billion crowns were invested to provide technical support such as improving the Internet access of schools, creating opportunities for all students and teachers to have e-mail addresses, making computers available for home use by the teachers who had obtained an ICT certificate, supporting the development of the Swedish Schoolnet and the European School-net, and providing special arrangement for functionally disabled students. About 200 million crowns were used to raise the competence level of teachers by offering in-service training activities in teams for about 70,000 teachers, more than 50 percent of the total number of teachers in Sweden (Tebelius, Aderklou, & Fritzdorf, 2003; www.skolverket.se).

Swedish Schoolnet was another initiative carried out to develop ICT access and use in Swedish schools (in 2008 Schoolnet changed its name to “ICT for teachers”). It was an online framework for teachers, educators and student teachers, with the overall goals of stimulating and supporting active and collaborative learning by using ICT in schools. Schoolnet had the objective to provide a platform for the development of new educational approaches opened up by the Internet and new multimedia technologies. Among the important functions of Schoolnet were to give information to and support the decision makers at regional and municipal levels in developing suitable products for use in schools. It functioned also as an information centre, a library, and a news agency. Schoolnet was intended to be a useful forum for communication and activities of teachers and students to set up a network of contacts and initiate discussions with each other all over the world (www.skolverket.se).

In the beginning (1994) Schoolnet was provided by the Swedish National Agency for Education; in 2003 the National Agency for School Improvement took over the service. However, in 2008 the National Agency for School Improvement discontinued. Thus, the content and responsibility for ICT in education was again transferred to the Swedish National Agency for Education. In the Agency’s support for improvement, ICT in schools is one area. The Agency now provides a new website, “ICT for teachers,” as a platform for teachers with a common interest in using ICT as a tool for education. Through the new website teachers have access to several resources with a purpose of enhancing teachers’ skills in using IT in schools. Among these resources is the professional development tool PIM (Practical IT and Media skills). The PIM project, as a part of a mission given by the government to the Swedish National Agency for Education, is a combination of online supervisions, study circle, and daily support. It consists of ten guides in a range of fields covering all kinds of topics. Materials can be used by both individual teachers and teacher teams. The supervisions can even be carried out in daily work, for instance, when teachers and students need direct help and support in using some computer programs. All materials are of free use for all educators in Sweden (http://pim.skolverket.se/). By May 2008, about 100 Swedish municipalities had signed a contact with the Swedish National Agency for Education for PIM based education and training. Teachers in these municipalities were encouraged to participate in the PIM
program as an in-service training for teachers’ ICT competence development. Around 46,000 teachers were active in their use of PIM (OECD, 2009).

In 2005, the Swedish Knowledge Foundation started the greatest investment in Sweden on ICT in education since the ITiS project. About a hundred million Swedish crowns were supposed to be invested to strengthen ICT in teacher education during a ten-year period. One reason for this was the results from the investigation of student teachers’ attitudes, access, and use of ICT which reported that ICT was not well integrated into teacher education and that teachers were not prepared with sufficient knowledge and skills for the ICT required in their future classroom practice (Knowledge Foundation, 2005). The first step in the Knowledge Foundation program was to initiate three projects (i.e. Learning, Information, Communication and Administration; Competence development in Teacher Education through IT; Young Communication), intended to run between 2006 and 2010, to highlight certain areas of teacher education. These projects were to be carried out in cooperation with the municipalities, as well as with other actors such as industries and institutions in in-service teacher training. The next step, already in progress, is to build a network among all teacher educations in Sweden intending to support experimentation and development of joint projects aimed at increasing the use of ICT in teacher education at large (http://kks.se/).

**ICT Infrastructure and Use of ICT in the Classroom**

One major outcome of these national initiatives is the greater extension of access to ICT equipment in Swedish schools. By 2006, all teachers had access to computer and 45% had their own computers in schools, and 96% of teachers and school leaders had access to the Internet and e-mail (Knowledge Foundation, 2006). According to a survey of the European Commission (European Commission Information Society and Media, 2006), 89% of Swedish schools had access to Internet via a broadband connection by 2006. In fact, in the respect to infrastructure of ICT in school, Sweden ranked at one of the top of the 27 countries in Europe according to the survey.

In use of ICT in schools, more than 90% of Swedish schools have been reported as integrating ICT into teaching subjects in one or another way. However, more than half of the teacher respondents report that they use computers in less than 10% of all lessons. The majority of Swedish teachers are satisfied with the technical access at their schools, but they also state difficulties in finding adequate learning materials (62%) and say that the existing materials are of poor quality (54%). In this respect, no other countries in the European Union had such high figures (European Commission Information Society and Media, 2006).

E-learning Nordic (2006), which involved four Nordic countries (i.e. Finland, Sweden, Norway and Denmark), was the first inter-Nordic study focusing on the impact of ICT on education. The aim of the study was to discover and document the perceived impact of
ICT in education on teachers, pupils, headmasters, and parents within three key areas: 1) performance of the pupils; 2) teaching and learning processes and knowledge-sharing; and 3) communication and home-school cooperation. While pupils, teachers, and parents assessed a positive effect of ICT in education, the expectation was that ICT could and should have more revolutionary impact on teaching and learning processes in schools. The study indicates that the potential of ICT is not being fully realized in all schools and the use of ICT as a tool for pedagogical development is not in focus. ICT has been used in improving knowledge-sharing, communication and home-school cooperation, but the use is not sufficient and the belief is that ICT should be a more powerful tool in these areas (E-learning Nordic, 2006).

The Knowledge Foundation has for more than 10 years supported and developed the integration of ICT into education. During this period, the Foundation has continually investigated the attitudes of pupils, teachers and school leaders towards ICT use in schools. In the latest investigation conducted in 2006, 1200 teachers, 600 headmasters, and 1200 upper secondary school pupils participated in the survey. The results show that a great majority of pupils and teachers assess using ICT in school assignments as pedagogically useful, but almost one fifth of the teachers state that they do not use computers in their lessons at all. Teachers who have taken part in ITiS use computers more than other teachers, and older teachers use computers in their lessons more than younger teachers do. The results also show that the IT supported communication has greatly increased: 7 of 10 teachers communicate with pupils via e-mail, and 6 of 10 teachers communicate with parents via e-mail. In general, computer use in communication, administration, and information searching in school context by teachers is more frequent than direct use in everyday classroom teaching (Knowledge Foundation, 2006).

According to the survey, the majority of Swedish teachers have a positive attitude towards using ICT in teaching, but in comparison to headmasters and pupils, the percentage is lower. More than half of the teachers realize the usefulness and advantages of integrating ICT into teaching as a pedagogical tool, i.e. in facilitating information searching and computer practice, increasing pupils’ motivation, stimulating the process of writing and critical thinking, and making for easier communication between teachers and pupils. But on the other hand, more teachers than school leaders and upper secondary pupils realize the difficulties or barriers for using ICT in teaching. Major barriers identified by the teachers were poor equipment such as too few and too slow computers in schools. Development of technology is so fast that the teachers feel that they have not had enough time and opportunities to update their ICT related knowledge and skills. Many teachers do not think of themselves as having good enough competence with ICT. Moreover, concerns with the wrong use of the Internet by pupils and the risk of getting incorrect information on the Internet have also been reasons that teachers do not give priority to integrating ICT into the classroom (Knowledge Foundation, 2006).

In 2005, the Knowledge Foundation conducted a large investigation on student teachers. The results show that access to computers and the Internet among the students is high, but
their use is more frequent at home than at the university. They report having enough knowledge about e-mailing, information seeking, and word processing, areas in which they use ICT in teacher education as well, but their knowledge on using software for presentations and instruction is not enough. Only 3 of 10 students report that teacher education has dealt with new skills in the use of ICT, and a majority believes that the teacher educators’ ability to use ICT is not appropriate. Knowledge about the use of ICT in teacher education is not good enough, and almost half of the students state that they are not satisfied with the knowledge they got in their education about ICT use in their future teaching (Knowledge Foundation, 2005).

Discussion

In over ten years, the Swedish Government has had sustainable commitment and substantial investment in promoting ICT in schools and encouraging teachers to use ICT in their teaching. Strategic policies have been provided on both European and national levels. Undoubtedly these strategic policies have provided the possibility for common visions of significant expenditures required for employing ICT in education. Operational policies, framed as action plans, programs or projects in the Swedish case, have offered the opportunities to enable these visions to be reached (Kozma, 2003). The investigations show some positive outcomes from these national efforts — for instance in the areas of establishing and developing ICT infrastructure in Swedish schools; cooperation between schools, municipalities, industry and teacher education; and providing teacher training, especially in-service training, that emphasizes teachers’ knowledge and skills required in using ICT in classroom (Tebelius et al., 2003).

However, central policies or reforms do not automatically lead to practical changes in the classroom. The top-down initiatives should follow a greater attention to local conditions to ensure a successful implementation of policies. Implementation involves far more than a mechanical application/translation of goals and initiatives into routine procedures and actions. Schools’ and individual teachers’ understandings, interpretations, attitudes and efforts play important roles in this process. School policies, resources, leadership, and collaborative teacher team seem to be positively related to improvement of ICT in schools (Baylor & Ritchie, 2002; E-Learning Nordic, 2006; Tondeur et al., 2008). In the Swedish context, the explanations teachers give to the lower level of use of ICT in their teaching are mostly those concerning conditions at the organizational/school level such as poor quality of ICT equipment, limited resources of time and money, etc. The majority of teachers now do have access to ICT on a regular basis, but the issue could be an absence on both national and school level of long-term strategy for continual and sustainable investment and development for improving ICT environment in schools (OECD, 2009). Innovation in technology goes rapidly and requires renewing both equipment and knowledge to keep up with the advance of technology (Wood et al., 2005). However, to identify the real obstacles, further investigations on the status quo of the ICT environment in Swedish schools and their ICT strategies should be done.
In the field of classroom innovation related to ICT, teachers are the key determinants of implementation. Teachers cannot deny the existence of technology in schools, but how often and in what way the technology is used is heavily dependent upon individual teachers. Poor attitude toward technology or fear of using technology could cause teachers to avoid using ICT in their teaching, which has been evidenced by many studies (e.g. Ertmer, 2005; Mishra & Koehler, 2006; Mueller et al., 2008). According to Wozney, Venkatesh, and Abrami (2006), teachers’ acknowledgement of using ICT as a learning/cognitive tool in knowledge construction and their beliefs on their own capability of successfully implementing technology in classroom are important prerequisites for ICT practice. In the Swedish case, questioning their own competence with ICT is one of the explanations for under use of ICT in the classroom given by teachers. In fact, today’s teachers are more familiar with computers and the Internet in general, but to integrate ICT into teaching is something more than only the issue of being able to use technologies (Mishra & Koehler, 2006). What is important for teachers is not only to know how to handle computers, but also to understand why they use them and how to use them in the classroom in a qualitative way to improve pupils’ learning (Tebelius et al., 2003). Further studies on how teachers experience ICT practice in their own teaching and learning, what knowledge and skills they actually need to integrate ICT into their everyday teaching, and in what ways they learn effectively have to be conducted in order to identify successful models of teachers’ learning and professional development (e.g. by taking regular courses, participating online community, getting online support to apply “just-in-time,” and “ongoing coaching” approaches).

In Sweden, the focus for ICT in education seems to have shifted from policies and programs on providing infrastructure and promoting use of ICT to effective use by teachers in the classroom to enhance their teaching and thereby the learning of their students, which puts new demands on teacher education and teacher professional development. The Committee for Renewed Teacher Education in Sweden stated that the new teacher education should ensure teachers have the skills needed concerning choosing ICT and media for learning (Government Directive, 2007:103). In 2008, the government issued an additional directive relating teacher education to the eight key competencies for lifelong learning stated by the European Union (European Union, 2006), and giving importance especially to the responsibility of teacher education, teachers, and schools for developing a digital competence for the future Europe (Government Directive 2008:43). In autumn 2008, the Committee presented its inquiry for a new teacher education program (SOU 2008:109) which stated that ICT should be a component of all teacher education programs and should be used as an educational resource.

What we have learned from the Swedish case is that a successful and effective integration of ICT into education requires not only commitment and intervention of the central government, but also the full support and initiative participation of the locals and individuals. In this teachers’ knowledge of and skills with ICT and their attitudes and beliefs about ICT use in teaching and learning play a crucial role. ICT competence should be a central part of the teacher’s profession, not only as content of TPD that teachers should learn as their knowledge and skill basis but also as a means of promoting an
effective TPD. The power of bottom-up, long-term, reflective, differential, contextualized, collaborative, and pedagogical approach related models of teacher professional development has been stressed recently (Granger et al., 2002; Hargreaves, 2006; Jimoyannis & Komis, 2007; OECD, 2009; Toledo, 2005) — a technology enhanced teacher professional development model could be one of them.

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