Diffusion of ICT in teacher education
- common targets and visions by four colleges in Sweden

Eva Fors
Swedish School of Sport and Health Sciences, Sweden
eva.fors@ghs.se

Annika Hössjer
Stockholm Institute of Education, Sweden
annika.hossjer@lhs.se

Lena Olsson
Stockholm Institute of Education, Sweden
lena.olsson@lhs.se

Christopher Sönnerbrandt
Royal College of Music in Stockholm, Sweden
christopher.sonnerbrandt@kmh.se

Abstract: In this paper we will reflect on how diffusion of information- and communication technology, can be real in Swedish teacher education. We will describe how the Bologna process affects the work with systematic implementation of ICT and how the CDIO Initiative is used as a framework for the development of the LIKA matrix. Discussions within the project are guided by research within the field of ICT and education. This enables us to understand how what teachers need to be motivated to use ICT in their profession. The LIKA project was launched at the beginning of 2006 and is a six year collaboration project, between four teacher education colleges. The project is financed by the Swedish Knowledge Foundation and the participating institutions. LIKA stands for the processes of Learning, Information, Communication and Administration. Processes which nowadays requires digital competences in order to carry out and develop everyday professional teaching and learning activities.

Working with ICT in teacher education

As a result of rapid changes in a digitalized society, an initiative is now taken by the Swedish Knowledge Foundation (http://www.kks.se), with focus on ICT in Teacher Education. The knowledge Foundation was established in 1994 with the main task to enhance the Swedish competitiveness by supporting research in higher education, competence development in industry, promotion of IT in schools, education and health care and the restructuring of industrial research institutes. The LIKA project was launched, together with two other projects at the beginning of year 2006 (http://www.likadigital.se/). It is a collaboration project between The Royal Institute of Technology (KTH), Stockholm Institute of Education (LHS), Royal College of Music in Stockholm (KMH) and the Swedish School of Sport and Health Sciences (GIH). Teachers are considered a key group, and their acquiring of generic skills such as information and digital literacies is seen as a condition for economic development in the knowledge society. Teachers must be equipped with generic, digital competence and this has to melt in together with good pedagogic competence. Excellent competence in this area will enhance the desire to learn among young children and students.
How we think and work with the implementation in teacher education

What do we know from research concerning implementation of ICT in teacher education? If we want to ensure digital literacy in teacher training and to define and integrate ICT in courses and programs throughout the education, we need to know more about the mechanisms behind the implementation process. One important factor is that an implementation gains a lot if it is supported by the leaders in the organization. In the case of the LIK project, it is the deans that signed the agreement that ICT should be an important ingredient in a modern teacher education. The board of the LIKA project consists of the deans or professors at each collaborating institute, which gives the project its weight. Two project managers, the vice dean of KTH and the director of the Learning Resource Centre, Lärum at LHS, manage and coordinate project resources as well as report to the board and the Knowledge Foundation. The work is held together by four process managers, one for each college. The process managers are responsible for executing the project and administrating the processes. They are constantly evaluating the process and are also the link between different groups participating in the project.

Implementing ICT in teacher education makes us realize that Torneo (2004) is right in his assumptions that digital literacy has both an instrumental and a cultural dimension, and teachers need to understand and master both. To succeed, we need to work with multiple dimensions that can motivate teachers to use ICT. How teachers act is situated in a social context with deep historical and cultural traditions. Säljö (2005) means that institutions are units of social practice, having their own cultural tools in a physical, cognitive, communicative and historical context. We are also involved in a number of communities of practice and within this community we share some common resources (such as routines, vocabulary and artifacts) that accumulate knowledge within the community where members are involved in relationships important for learning (Lave and Wenger, 2003). All of this has an impact on teachers. When we implement ICT we discuss it from different points of view. How is a subject teacher in Physics, English or Social Science thinking when it comes to pedagogical questions related to ICT? It is important to be keen on that as an ICT pedagogue.

Within the LIKA project ICT experts and educationalists (e.g. ICT pedagogues) work as a support group and give advice and educate teacher educators. In our project we are working with awareness that our ICT pedagogues have knowledge about the depth of the cultural and psychological factors that have such an impact on how the implementation can work. When ICT pedagogues meet, we discuss relevant research about this. In condition of post modernity, and with the introduction of ICT, boundaries are affected in different divisions within schooling. It has an impact between students and teachers, space and time, curriculum and subjects. The greatness of this impact is mixed. Academic subjects are much more resistant, but space and time dissolve. Researchers have found out that unless the technology involves an element of education, it will not be transferred into the classroom. Teacher will only continue to develop their knowledge in ICT if their training meets their individual classroom needs (Lawson and Comber, 2000). In the LIKA project, ICT-experts who also have a teacher education, work within the course frame, which we believe will help us overcome this boundary.

Teacher education programs need to prepare and support teachers in the appropriate choices and uses of ICT environments. Furthermore, teachers’ fundamental beliefs about how to teach their subject and how specific ICT resources can enhance and fundamentally change the way in which their students learn, needs to be challenged. (Cox and Marshall, 2007). If we can pick up this challenge and not continue in an old fashion way, we can change more fundamental beliefs in how teaching and learning occurs in a real classroom situation. Projects that focused just on technical skills tended to dampen enthusiasm among teachers, but exploring ICT in a relevant learning context and focusing on using ICT for learning not just learning to use the technology, was much more useful (Cox and Marshall, 2007). The motivation among teachers becomes much higher.

A key element is access to computer network (Lawson and Comber, 2000). We can see that our different Learning Management Systems works as a catalyst for working with more ICT in the courses. And in learning environments in our colleges where computers are rare, digital networks are not complete and other important technical equipment (e.g. digital cameras and projectors) are missing, we also find less development of ICT used for learning in the courses. Therefore it is an important task for the LIKA project to describe the specific needs for development of the ICT-infrastructure in the perspective of digital competence. The institutions need to have a well-reasoned information technology strategies, including learning issues.
We want to reach our target groups for LIKA, which are: 1) Teacher educators 2) Teacher students and 3) In-service teachers in partner schools. Teacher educators work with both method development and course development. We realize that psychological factors have a great impact on teacher’s willingness to integrate ICT. Teachers confidence in their skills are of great significance. Community to support and encourage them to learn more is important (Sime & Priestley 2005). Our ICT pedagogues are there for the teacher educators, not only during one semester, but support them on a more longterm basis. According to research we know that there are barriers for teachers to adopt ICT and there are some negative attitudes towards the use of IC. It was shown that the use of ICT was limited by the teacher’s expectations and understanding of the ICT resources (Cox and Marshall, 2007). We are aware of this and we are discussing this motivation problem. It is when the teachers can see the usefulness of using ICT in their own courses they will be more motivated to use it.

It is a challenge for teachers to work in a time of pedagogical change where the shift towards a more student-centered education is a central force. Students are nowadays much more in to new technologies than getting knowledge from worksheets. The teacher must take the new role as a facilitator and accept the shift in power relations. In the research they could see that Internet promoted a different style of teaching and those teachers and students have to find new ways of working together (Lawson and Comber, 2000). Using ICT in the classroom will affect the method and content of teaching. The teacher’s role in a classroom shows a great variation, such as a central leading person, an advisor, a mentor, a planner, a technician, a link between the student and the computer, an educator or a combined technician and educator (Jedeskog 2000). Other roles can be a subject authority, an organizer, a task interpreter, an interlocutor or a user support. The facilitator role for learning that stimulates students to reflect on problems, with emphasis on metacognition, scaffolding, conflict resolution and task designing is important today. (Hansen & Asand 2002). ICT changes the way we, as teachers, teach. Teachers also realize that not only the method of teaching but also the content of teaching will be affected by using ICT in the classroom. ICT is changing the way in which we teach the important influence of the teacher who decides: how the ICT resources are chosen, how they are used in schools and the classroom and how the pupils interact with the materials. Teacher’s input will crucially affect the impact of ICT use on students’ learning (Cox and Marshall, 2007).

Teachers also need to develop their own forms of reflective classroom practice when using ICT even though some pedagogical evolution has taking place (Hennessy, Ruthven and Brindley, 2005). Interactive teaching could be one solution to this with its active learning such as collaboration, communication and creation of meaning and understanding (English, Hargreaves & Hislam 2002). For us in the LIKA-project, teacher students are an important group to ensure that teacher students shall be able to apply ICT in the school environment. One way of doing that is to attempt to collaborate with in-service teachers in partner schools working as mentors for teacher students during periods of practice. We still have a lot to do here.

The intersection between LIKA, the Bologna process and the CDIO Initiative

LIKA and CDIO Initiative

Diffusion of ICT into Teacher Education requires course analyses and course development. One of the most important objectives within the LIKA project is to put courses and programs through a translucent process, in order to identify and integrate ICT as a generic and progressive skill that needs to be examined during Teacher education.

The CDIO initiative, introduced by the Royal Technological University (KTH), has served as a useful framework for this development process. The CDIO™ presents itself as an innovative educational framework for producing the next generation of engineers, stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating real-world systems and products. KTH (The Royal Institute of Technology) has successfully used the CDIO method to analyze existing courses and to rewrite aims and learning outcomes.

Another possible grid is provided by the Bologna examination system. The objectives of LIKA project will be matched with the objectives of the Bologna process. Since there is an aspiration in the Bologna system to acknowledge generic competences, we can see there could be a synergy effect. Digital literacy is a generic skill that needs to be examined during teacher education.
The Bologna process

The higher educational system in Sweden has recently changed a great deal on account of the so-called Bologna Process. In 1999, around 30 European states signed the Bologna Declaration and declared their aim of establishing a common European Higher Education Area by 2010. The overall objectives for the Bologna declaration are to promote mobility, promote employability and to promote the attractiveness of the European Higher Education Area on a global level. A central element of this effort is to make academic degree standards and quality assurance standards more comparable and compatible throughout Europe. Since July, 2007, Sweden has introduced a new national systems based on the Bologna framework of three cycles, the 3 – 2- 3 system, which indicates years of study to reach Bachelor, Master and Doctorate degrees. With the Bologna process comes also the ECTS (European Credit Transfer System), which is a standard for comparing the study attainment and performance of students. One academic year corresponds to 60 ECTS-credits that are equivalent to 1500-1800 hours of study in all countries. Some Swedish universities have also decided to introduce the ECTS standard grading scale (a seventh grade scale) for all students, while others will use it for international students only. In the Swedish educational system, criterion referenced grading is practiced instead of relative grading, and therefore Universities in Sweden can decide however to use the 10%, 25%, 30%, 25% and 10% distribution of A, B, C, D and E grades

The most extensive work within the Bologna process is the rewriting procedure in order to align course plans and course descriptions with the central concepts in Bologna: expected study results and learning outcomes. In brief these conceptions could be described as different expressions of what kind of knowledge a student should have after completing a course. Thereafter, grading describes to what extent or to what level of quality students have reached the stated learning outcomes or expected learning results.

New is also the diploma supplement which is a descriptive document in English, for the specific knowledge and skills the student should have acquired. This document should easily be understood by employers and European Universities. It comes as an attachment to the Examination document.

The ongoing Bologna process at the Swedish School of Sport and Health Science has given the LIKA project an opportunity to work with the development of a generic competence for the integration of ICT. Course objectives has been rewritten and specified, where the student’s expected learning outcomes at the conclusion of the course should be described.

Below there are two excerpts from course plans at GIH, where digital competences have been integrated

Course: LEARNING AND EVALUATION, 7.5 credits

- Expected study results:
  “Student should be able to demonstrate and evaluate how and where ICT support communication processes could be used in everyday teacher professions”.

- Work methods:
  “Students will use the digital portfolio tool in Fronter (the Learning Managing System, LMS used by GIH) to document their in-service training practice, focusing on their own learning process”.

- Examination:
  “Produce a written local course plan and present it with support of a digital presentation program and perform a peer review of a local course plan.”

- Literature:
Course: PUBLIC HEALTH SCIENCE A, DIRECTED TOWARDS PHYSICAL ACTIVITY, 1-30 credits

- Expected study results:

“Students should be able to apply ICT into the work with public health and understand the concepts of integrity and secrecy in a digital culture.”

Formulating objectives for every course clarifies the knowledge each student is expected to possess in order to pass the course. An important part of the LIKA objectives in the Bologna process is to affect the reference literature connected to the course. This will directly influence the alignment between the learning outcomes, teaching and learning activities, assessment and examination (Biggs, 1999).

![Figure 1 Model for related processes and factors within the LIKA project](#)

**Processes embracing digital competence**

In LIKA we work with processes in Learning, Information, Communication and Administration. We consider three parts of digital competence important when planning educational courses:

1. **Didactical competence** - A digital didactical competence is to be able to judge when, what, why and how ICT should be used as a pedagogic and methodological support for learning. Teachers should be able to choose methods and digital tools suitable to the content, considering the pedagogic of the tools when planning the education. Also knowledge about examination tools is included in this competence.

2. **Theoretical competence** - A digital theoretical competence implies that the teacher has knowledge about ICT-pedagogic theories and methods for teaching and learning, and is able to use them practically in the professional pedagogic activity. The teacher should also be knowledgeable about research within the ICT area.

3. **Technical competence** - A digital technical competence implies that a person can decide when and what digital tool to use in a pedagogic environment. The person should have technical skills and be continually updated within this area.
These conceptions make it possible to analyze and reflect on digital competence in our courses. They also allow us to meet the needs from teacher educators on a deeper level than just giving the technical competence. Research supports us in this area.

Below is an example from Stockholm Institute of Education, how these different perspectives can be useful as tools for reflection and analyses. In some courses, digital portfolios have been implemented. The teacher educators show the students how portfolios will vary depending on the choice of the theoretical perspective. If you construct a portfolio from an individual constructivist or sociocultural point of view you will see different kind of results. The theoretical starting point has a great impact on the learning aspect which becomes obvious in these examples. The students are given opportunities to experiment with different digital tools, within their portfolio work. Finally they will be educated in how to use a digital portfolio for their own learning experience and how to use it in a didactical environment, for children in schools. During the course, a learning management system helps students and teachers to communicate and exchange information within the course. This collaborative learning environment will rise the awareness of the students own learning process and it may set patterns for their coming teacher professions.

The LIKA - matrix and digital literacy in alignment with European Policy

Digital literacy is, in the European context recognized as one of the most important goals for education as well as a set of individual skills which guarantees employability and social inclusion as formulated in the Lisbon Agenda. The Lisbon agenda’s more elaborated policy, the i2010, “Information Society for growth and employment” initiative, was launched in June 2005 as a framework for addressing the main challenges and developments in the information society and media sectors up to 2010. It emphasises ICT as a driver of inclusion and quality of life. A follow up on this initiative was presented September 2007, and addresses a long-term E-skills agenda, recognizing that digital illiteracy is still persistent on a large scale in Europe. (EU com. 2007). The agenda states that the traditional notion of literacy needs to embrace the complete set of e-skills and media competences required in a knowledge-based economy and society. Performance of the agenda is mainly a responsibility of the member stated but long term cooperation will be supported.

The aims of the LIKA project are to a great extent, coherent with European policy statements and aspirations. Digital literacy is, in the European context, not yet conceptualized or still most tentatively defined. A very broad definition was formulated by Hans Pelgrum (Pelgrum, 2006) at the EU E-learning conference in Helsinki 2006. He views digital literacy as “process awareness, attitude and ability of constructive social action and to reflect upon this individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable”.

It can thus be suggested that LIKA is applying a working definition of digital literacy to the specific processes and situations encountered by teachers and students. By performing and evaluating these processes the LIKA-project will contribute to specify a European concept or framework of digital literacy. Applying this broad definition to the goals which LIKA is trying to attain, the LIKA matrix stands for the different aspects: learning, information, communication and administration. The context in which these literacies are tried out are the technical, the didactical and the theoretical perspectives of teaching and learning, which the target group of LIKA, teacher trainers and students has, to deal with.

In coherence with the agenda of the European Commission it has been suggested by Drenoyianni et al.that the concept of digital literacy should be built and constructed by a mutual understanding of experts and projects constituting a pan-European framework concerning digital literacy education in primary and secondary education (Drenoyianni, 2007). Digital literacy is thus understood as a moving target defined by experts/projects. We suggest this, as well as a model for LIKA, contribute to the European context.
Conclusion

As the diffusion of ICT increases in the society the teacher education programs have to meet and incorporate challenges of established views and practices, regarding aspects of ICT in teaching and learning. This is, of course connected to ideas of how teacher education should be organised and carried out. ICT creates new opportunities for thinking and acting in the postmodern society. When teachers and teacher training institutions continue to work with the implementation of digital competence in the schools and in the teacher education, it creates rethinking of learning theories and practice.

Some aspects of the rapid changes have been discussed earlier in this paper. Other aspects, e.g. the consequences for higher education institutions of the emerge of open educational resources is discussed by the OECD, Centre for Educational research and innovation (2007). This aspect is one example that can be expected to affect curriculum, pedagogy and assessment. To meet the changes we have to develop digital competence in teacher education. In the LIKA project we have found it important to act together – to work with teachers and teacher students in courses, aiming to test new pedagogic ideas and explore new opportunities that come with new technology. It is also necessary to arrange environments for collaboration where ICT expert, teachers and students will analyze and discuss common experiences in the light of new research in the field of ICT. In return the experiences and good practices found within the LIKA project helps us to identify, describe and integrate digital competences.

The national changes in the educational system due to the Bologna process can serve as a catalyst to reach some of the targets set by LIKA. The constructive alignment and the direction towards a more student centered educational system are coherent with the aims in LIKA, as sustainable results regarding digital competence will be integrated in teacher education. The LIKA project and the LIKA matrix are efforts to make quality assurance of digital competence in teacher education in Sweden. Its models and results may have sustainable value for institutions and scholars in many contexts, and work as inspiration for new research and development of digital competence and teacher education.

References


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