ICT IN INITIAL TEACHER TRAINING: FIRST FINDINGS AND CONCLUSIONS OF AN OECD STUDY

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Abstract

This paper presents the preliminary findings of a recent study on the use of Information and Communication Technologies (ICT) in initial teacher training in nine OECD countries. The study aimed to address questions related to the national and institutional frameworks and requirements in place, the extent and types of use of ICT in initial teacher training by student teachers and their trainers, as well as the latter's views on their preparation and confidence in using ICT in the classroom. The findings suggest that although student teachers and teacher trainers have generally good access to equipment and an adequate level of technical skills, they lack competencies in the pedagogical use of ICT. A number of barriers to and drivers for the development of these competencies are discussed at personal, institutional and policy levels.

Keywords: Initial Teacher Training, ICT, technology.

1 INTRODUCTION

The OECD study on Information and Communication Technologies (ICT) in Initial Teacher Training aims to provide a detailed picture of how technology is used in initial teacher training in OECD countries from a comparative perspective, analyzing the views of the main stakeholders and issuing a number of policy recommendations both for teacher training institutions and governments in this domain. The study is a project strand within the OECD/CERI project *New Millennium Learners.* In most countries, a large proportion or even the majority of trainee teachers are New Millennium Learners. The question, therefore, arises as to whether or not this new generation of student teachers will be transforming the way in which ICT is used in schools and how they are prepared for this in their initial training.

The study includes an international review of the state of the art and new empirical data collected through surveys and institutional case studies. The following countries contributed to the study with empirical work: Austria, Chile, Denmark, Finland, France, the Netherlands, Norway, Sweden and the United Kingdom (England). With the exception of Chile, all countries have used the same research instruments translated into local languages.

The study aims to address and provide answers, where possible, to the following research questions:

What are the national frameworks and requirements regarding the use of ICT in initial teacher training in teacher training institutions in OECD countries? In a wider context of increasing institutional autonomy, teacher training institutions may have to comply with government regulations or expectations regarding the competencies that teachers need to develop based on national curriculum requirements. The political importance currently attached in many countries on 21st century skills may also have an impact on teacher training requirements.

What are the institutional frameworks and requirements regarding the use of ICT in initial teacher training in teacher training institutions in OECD countries? What are the objectives, definitions and descriptions of skills and competencies to be acquired by teachers in training? How are these implemented and how are they assessed and certified? What is the balance of responsibility between governments and teacher training institutions?

To what extent and in what ways is technology used in teacher training institutions in OECD countries? More knowledge is needed on the types of technology used by trainee teachers (*e.g.* whiteboards, mobile devices, PCs, types of software) as well as the different ways in which

technology is used (*e.g.* lesson planning, presentations, communication with colleagues, students and parents, and to enhance student learning).

In what ways are student teachers prepared to integrate technology in teaching in teacher training institutions in OECD countries? Are there separate technology courses or is technology integrated in subject-specific courses? Are student teachers expected to learn how to integrate ICT in their teaching by themselves as long as they have the basic technical skills? What is the role of internships?

If student teachers are not satisfactorily prepared, what are the main obstacles? Are obstacles the same in all countries? How do they differ?

How is policy evaluated? Are policies evaluated regularly and systematically? Are there relevant incentives? What are the means available for policy implementation? What is the role of school or college leadership in the process?

Does practice correspond to policy? If not, what are the barriers and obstacles? If so, what are the supporting and enabling strategies?

2 METHODOLOGY

The project consisted of three phases: analytical, empirical and comparative.

The analytical phase resulted in two major outputs: a review of the research literature (Enochson & Rizza, 2009) and a review of national policies (Rizza, forthcoming). The research literature review aimed to answer the following question: how do teacher training institutions prepare teacher trainees to integrate technology into their future classrooms? It covers research studies, mainly in English and French, from eleven OECD countries published between 2002 and 2009. The findings of the review provided the starting point for the development of the questionnaires and case study tools that were used in the empirical part of the project.

A review of national policies on ICT in initial teacher training in the 31 OECD member countries was also conducted in the initial phase of the project. As part of this exercise a variety of documents were examined and analysed, including official country reports, legal texts and research articles. A specific questionnaire was also sent to each country.

The empirical part of the ICT and initial teacher training project included data collection by means of four online questionnaire surveys and a series of institutional case studies.

The four structured questionnaires were completed online[1] by samples of college administrators or managers, student teachers (for persons studying to become a teacher and without a certificate), teacher trainers (for teacher educators on campus), and mentor teachers (for teachers supervising and guiding student teachers during their practical work in classrooms) in participating countries. The questions aimed to obtain a comprehensive overview of the pedagogical use of ICT in initial teacher training. To complement the data collected through the structured questionnaires each country also conducted case studies at two or three teacher training institutions[2]. They consisted of in-depth, individual or group interviews with student teachers, teacher trainers and mentor teachers, observations and analyses of policies, regulations, course documents and web presentations. Countries were advised, when selecting institutions for their case studies, to include at least one institution well known for its focus on ICT and one generally well regarded institution that had not been profiled as particularly innovative in the field of ICT. The role of the case studies in the overall design was to validate and deepen the understanding of the data collected through the structured questionnaires and to identify examples of successful and not so successful practices.

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1. *Except in Chile where printed versions were used.*

2. *Five in Chile.*

The main output of the empirical phase of the project was a series of national reports, drawing on the analysis of the data collected in each country[3].

The final phase of the study was the comparative analysis of both the quantitative and qualitative data collected in all countries, also drawing on the conclusions of the research and policy reviews. The findings and policy implications resulting from it are presented in this paper.

3 PRELIMINARY FINDINGS

At the time of writing this paper, not all countries have finalised their national reports and the comparative analysis of the results is still ongoing. As a result, the findings (except for those related to the literature review and the review of the national policies) reported here are preliminary and may need to be revised at a later stage. However, we believe that they provide an interesting first picture of the issues that stakeholders in the field are currently concerned with.

If we look at the national level, the review of national policies on ICT in initial teacher training in the 31 OECD member countries (Rizza, forthcoming) suggests that these policies can be put into three categories[4]:

i. Countries where relevant information on ICT in teacher training is missing (Canada [except Québec], the Czech Republic, Greece, Mexico).

ii. Countries that are developing awareness in the field of ICT in teacher training (Australia, Belgium [Flemish Community], Ireland, New Zealand, the Netherlands, Portugal, the Slovak Republic, Sweden).

iii. Countries where the inclusion of ICT in initial teacher training exists at four levels (the remaining OECD countries, Belgium [French speaking community] and the Canadian province of Québec): existence of recommendations at the national level but no obligation of training at the institutional level; implementation of national accreditation standards for the programs and compulsory training; definition of competence frameworks for teachers; and delivery of national certifications for teachers at the end of the initial training.

The research literature (Enochsson & Rizza, 2009) implies that ICT is not used in teacher training in a regular or systematic way, at least in the countries reviewed. Several reasons are suggested for this: a lack of positive role models, at the teacher training institution as well as on field placements; a lack of confidence in their own ICT skills, both technical and pedagogical ones; a lack of reliable equipment at schools and/or difficulty in accessing the equipment at all times. The following changes are deemed necessary at all levels for a successful outcome: at the policy level, clear expectations, guidelines and evaluations combined with sufficient flexibility in a rapidly changing field; at the institutional level, providing career advancement possibilities or other incentives to teachers and suitable, up-to-date equipment and clear expectations regarding the role of mentors; at the course-level, ensuring that basic technical skills are in place, the integration of ICT in subject courses and developing knowledge of the pupils' technological worlds.

In what follows, we have divided the discussion of the findings into six sections: sections 1 to 3 deal with the views of the three main groups of stakeholders: student teachers, teacher trainers and mentor teachers, as elicited through the research literature review, the structured questionnaires, and the semi-structured interviews and focus groups. Section 4 and section 5 deal respectively with obstacles and barriers, and the drivers and enabling factors in the area of ICT in teacher training. Finally, section 6 offers some preliminary policy implications of these findings.

[3] *These country reports are available on the project's website: www.oecd.org/edu/nml/itt*

[4] *Since the review of national policies on ICT in initial teacher training was completed in December 2008, reforms and updates of these policies implemented since January 2009 are not taken into account here.*

3.1 Student teachers

When it comes to technology access, student teachers are not different from the rest of the student population in the corresponding country. Although it would be inaccurate to state that all student teachers are equally positive in their attitude to technology, there is no evidence to suggest that they are different from the rest of university students in terms of access to technology, and most students are positive and keen to learn about the pedagogical uses of ICT. Nearly all of them own a computer, either desktop or laptop or both. For example, in the United Kingdom, the end-of-course ICT audit for the 2008-2009 cohort of student teachers at one institution showed that 84% owned a laptop at the start of the course, rising to 99% by the end of the course. In Sweden and Denmark 99% of the students that responded to the online questionnaire reported having either a laptop or a desktop computer at home, with about one in three reporting having both. Variation among student teachers in terms of their skills in using ICT is as high as it is in other study areas or educational levels: while some student teachers are extremely attached to technology to the point that they can be referred to as new millennium learners, others are not. Twidle et al. (2006) found that student teachers in the UK feel relatively unprepared to use ICT for pedagogical practices. One of the reasons for this was the students' lack of operational skills. The question is no longer whether or not ICT should be implemented in teacher education, but rather whether it is necessary with special courses to raise the students' technical competence.

Technically speaking student teachers are highly qualified and confident. Most student teachers appear to be competent users of computers and the internet. They are quite comfortable with productivity suites, internet browsers and email programs, and they use these applications widely to support their academic work. For example, data in Denmark collected as part of this study show that 83% of student teachers are 'very confident' or 'confident' in their use of ICT for preparing lessons while 84% are 'very confident' or 'confident' using it for organizing their work. In that respect, they cannot be said to be different from other university students or from upper secondary pupils. Student teachers in other countries also reported high levels of confidence in their personal use of ICT. According to Bétrancourt (2007) there is no correlation between student teachers' technological competencies and their pedagogical use of ICT. She underlines that recently trained teachers do not use more ICT than the more experienced ones and that the idea according to which the youngest teachers, who are naturally accustomed to using these technologies, are more comfortable with introducing them in their pedagogical practices, is false. She highlights the following paradox: on the one hand teachers' technical competences have increased over the last ten years, and today they master the basic data-processing competences, but on the other hand the pedagogical use of ICT in classrooms remains constant. The increased use in schools concerns the use of technologies in the phases of preparation of courses.

Teacher training institutions provide facilities for access in a variety of ways, but not always in convenient ways. In this area, the research literature review provides different examples and evaluations of ways for introducing ICT in teacher training. By considering ICT as a transversal subject, nobody feels responsible for it, and this was found to have a negative impact on teacher students' use of ICT in their teaching (Karsenti, 2005; Karsenti, Raby, & Villeneuve, 2008). Continuous and sustained training is needed to become comfortable and effective in implementing ICT (Sardone & Devlin-Scherer, 2008), but Kirschner & Davis (2003) also point at the importance for teacher training to meet the requirements for computer competence, so that new teachers do not need to spend time on this once they are practicing teachers. It seems that the method of combining working on attitudes and practical training best predictes classroom technology use (Vannatta & Fordham, 2004; Judge & O'Bannon, 2007; Dawson & Fitchman Dana, 2007). Finally, letting student teachers use technology for their own learning constitutes another way for them to acquire technology skills in separate courses. Several researchers show that technology is a very good tool for reflecting (Baron & Bruillard, 2003) and collaborating (Daele & Lusalusa, 2003a; Daele & Lusalusa, 2003b).

According to the findings of the present study, in some countries, institutions provide computer labs for public access to the internet, while in others even wireless connections are available. Only in a few of the participating countries, namely the United Kingdom (England), the Netherlands and France, are projectors and interactive whiteboards also seen in these institutions. In Sweden and in Norway, even if the equipment is in place, there are frequent problems reported in terms of lack of technical support or inconvenient arrangements. In Finland there has been small-scale experimentation with interactive whiteboards over several years, but wide-scale implementation only started in the academic year 2009-2010.

In fact, many teacher training institutions in the participating countries have not only dedicated websites but also LMS where students are expected to find critical information for their courses, manage administrative tasks and, increasingly, download study materials and learning resources.

Many student teachers are critical of the lack of training and experience regarding pedagogical uses of technology in the classroom. Even in those countries and institutions where students are expected to use some kind of intranet or LMS on a regular basis, many students complain about the lack of integration of technology into teaching. It is clear that, even when discipline or subject-related courses often incorporate some form of digital learning resources, student teachers would like to see a different approach to teaching and learning. They not only seem to be lacking the daily experience of a technology-enhanced learning environment as students but they also quite often complain about what they do not see happening in their field placements. In many of the case studies, it was acknowledged that the quality of support and guidance in the pedagogical use of ICT varied widely according to which school the students spent their placement experience in. There is evidence of some good practice but outcomes of training in the pedagogical uses of ICT are variable. For instance, in the United Kingdom (England), approximately two thirds of those in their first year of teaching felt that their preparation to use ICT in teaching was 'good' or 'very good', but a third regarded it as only 'adequate' or 'poor'.

New teachers have a lot to think about and do not always have time to think about incorporating technology, even if they consider it important (Davis et al., 2006), and this is a reason why these authors claim it is important to work with technology throughout teacher education so it becomes a natural part of teaching. Nevertheless, as it has been highlighted by Rizza (forthcoming) the introduction of ICT in initial teacher training and the curricula is not yet generalized and compulsory in all the OECD countries. For instance, Tan, del Valle and Pereira (2004) found that not all student teachers in the United States have access to courses which include technology. From a representative sample of 120 institutions where all course descriptions were collected and analyzed, it was found that 38% of the institutions did not offer courses on educational technology at all, and the courses offered were sometimes very short. Approximately 95% of the programs did not offer courses that involved the use and management of technology to support learner-centred strategies.

3.2 Teacher trainers

Teacher trainers can be important role models. The role of teacher trainers was viewed in many countries as critical, particularly by student teachers, as they can often act as positive role models for the creative use of ICT in teaching. This emerged as one of the important variables in terms of the development of student teachers' pedagogical capability in ICT. In the student responses to the online questionnaire in the United Kingdom (England) for example, only 28% of student teachers described their tutors' confidence in using ICT as 'very good'. Another variable was student teachers' views of the importance attached by their tutors to the role of ICT development in the course, with 77.5% reporting this as either important or very important. Trainer confidence and expertise was also thought to be an important variable in other countries. Nevertheless, Baumberger, Perrin, Betrix, & Martin (2008), Judge & O'Bannon (2008) and Whittier & Lara (2006) show that it is not always the case.

Teacher trainers report having a good level of ICT skills and there is practically a universal level of access to appropriate equipment and software in most countries.Teacher trainers also reported a good level of confidence in their use of ICT, both technical and pedagogical, although Enochsson and Rizza (2009) come to the opposite conclusion in their review of the literature. This good level of skills matches the findings on the same issue regarding student teachers. For example, data collected as part of this study show that the average rating of Swedish teacher trainers using technology to communicate with colleagues is 3.6 and 3.4 to organise and manage their work on a scale from 1 (never) to 4 (weekly). In the English case studies, teacher trainers acknowledged substantial improvements in ICT infrastructure in both training institutions and schools in terms of the facility to use ICT in ordinary teaching rooms because of the availability of data projectors and internet access.

There were, however, reservations expressed regarding the reliability and availability of equipment in some countries (e.g. in Norway and Sweden) there were some reservations expressed regarding the reliability of equipment or wireless coverage in classrooms. In addition, teacher trainers were not always happy about logistical arrangements regarding equipment (e.g. having to carry laptops or projectors from one room to another) or the availability of specific software. For example, data from Sweden show that teacher trainers give an average rating of 3.8 to the reliability of equipment in terms of its importance in increasing technology integration in their teaching, on a scale from 1 (not at all

important) to 4 (very important). Similarly, more Danish teacher trainers (76% of the sample) rated reliability of equipment as 'very important' than any other factor. On the whole it appears that teacher trainers want good quality equipment and software that they can rely on rather than what is offered by the latest developments in technology.

Earlier studies and overviews have also shown that the equipment is not always what could be expected (Moursund & Bielenfeldt, 1999). Although there have been improvements, it seems that these have not been sufficient (Mutton, Mills, & McNicholl, 2006; Sardone & Devlin-Scherer, 2008). Finally, even if Bamberger & al. (2008) state that available equipment and software was not a hindrance for using ICT in teaching, results from other researchers (e.g. Judge & O'Bannon, 2008; Lavonen et al., 2006; Whittier & Lara, 2006) show there is still room for improvement.

Lack of time was frequently mentioned as an obstacle to further development of skills. According to Judge & O'Bannon (2008), Whittier & Lara (2006), Aust, Newberry, O'Brien & Thomas' (2005) and Strudler & al. (2003) lack of time is reported by teacher trainers as a reason for not being updated in the field of technology. Another frequently expressed reservation by teacher trainers was the 'lack of time' for integrating ICT in their teaching. For example, the percentage of teacher trainers reporting this as a factor in this respect ranged from 44% to 70% of the samples that responded to the questionnaire in the five different institutions in Chile. Time to fully explore the pedagogic potential of ICT applications was mentioned as an issue by teacher trainers in all the countries where draft reports have been completed. At one level, this may appear a paradoxical statement, especially if one considers that ICT applications may have the potential to facilitate and improve teaching and therefore could be seen as a tool for saving time rather than as an additional task to be fulfilled. It is therefore possible that at one level what is needed is raising teacher trainers' awareness of this facilitating role of ICT and of how new technologies can help enhance and improve their teaching, rather than it constituting an extra burden in their already heavy workloads. On the other hand, the trainers' need for more time may be legitimate if by that they mean time for exploring the potential of the full range of new ICT applications and resources which have been developed in recent years. In this case, providing opportunities for dedicated time to trainers that can be used to this end may be an incentive worth considering by institutions or regional/national authorities interested in increasing the pedagogical use of ICT.

There is not enough sharing of good practices between more and less 'advanced' practitioners. In some countries (e.g. the Netherlands and the United Kingdom) there was felt to be a gap between a few trainers with strong interest and very advanced skills in the pedagogical uses of ICT and the 'silent majority' of trainers who were more neutral in their attitudes or who were less confident and well informed about recent developments in ICT. This is an interesting finding, as it implies that there is a need for more platforms and channels for sharing good practice amongst trainers. It is also linked to the fact that a lack of a robust body of evidence on the effects of ICT on teaching may be acting as a barrier for a wider adoption of new technologies by teacher trainers (see also section on barriers and obstacles below)

3.3 Mentors

Despite the large variations in the role of mentors within and between countries, they were generally regarded as very important in developing student teachers' skills and confidence in using ICT. Evidence from the participating countries suggests that there are large variations in and between countries. Input from the Netherlands shows a large degree of variation among respondents. This is also the case in the United Kingdom (England) where the variation is visible across different university departments and in the schools in which student teachers undertake their school placement. Variations can also be observed in the actual role of mentors and in the formal descriptions and requirements regarding the role of mentors in initial teacher training. Although there is no standard definition of mentors, in most countries the mentor is the pedagogical supervisor/tutor of the student teacher during field placement. In the United Kingdom, mentors play a critical role in preparing students to using ICT in pedagogical practice and ensuring that ICT is embedded in teaching and learning. The role of mentors is also visible in Chile. Here, mentors see their primary roles as agents of ICT integration into pedagogical practice. Finally in Sweden, a correlation was found between mentors' use of ICT in teaching and the future teachers' confidence in using it for teaching purposes.

These findings confirm to a large extent what was found in earlier studies. For example, according to Larose, Lenoir, Karsenti & Grenon (2002), student teachers'use of ICT in their future teaching strongly depends on representations and practices of teachers they meet during their field placements and

training. Haydn & Barton, (2007) also underline that student teachers ask for role models at schools. Nevertheless difficulties for student teachers in seeing innovative ICT use in the classroom is reported in the research literature review (e.g. Clifford, Friesen, & Lock, 2004; Larose & al., 2002; Twidle & al., 2006; Whittier & Lara, 2006). This seems to be due to both mentors' lack of knowledge and /or interest, and the lack of equipment (Haydn & Barton, 2007; Judge & O'Bannon, 2007; Pierson & Cozart, 2005; Twidle & al., 2006).

4 BARRIERS AND OBSTACLES

Most barriers are relative to context, institutional policy and role in the process of teacher training. Alternative combinations give rise to different situations. The following paragraphs present the factors which are more consistently emerging in all contexts.

Lack of time appears as the most important obstacle at the personal level, but can be interpreted in different ways. At the personal level, the lack of time is by far the most serious perceived barrier. This is likely to stem from three different factors:

a) *Technology is moving fast* so there is a need for time and effort to keep up with new developments. Social applications or web 2.0 services are often mentioned as issues that would require further attention.

b) *There are too many new requests.* Trainers, and often mentor teachers, often mention that they find it very hard to cope with constantly changing regulations and expectations. There seems to be a shared opinion according to which things should be slowing down. In this respect the fact that technology use is seen as one *additional* load for most of them comes as no surprise.

c) So far, it seems as if *technology is perceived as an add-on instead of a means for changing teaching and learning*. Accordingly, the reference to the lack of time could be seen as an indication of a misunderstanding of the value of technology in education: is it about doing more things *with* technology, or about doing different things *because* of technology?

Also at the personal level, the lack of significant pedagogical training emerges as a barrier. It is not that trainers, mentors or student teachers do not feel well equipped with technical skills but that there seems to be no common public understanding of what works in technology integration. In the absence of a clear vision of what there is to teach and learn in a knowledge-intensive, technology-mediated environment, pedagogical training becomes somehow flawed. Student teachers in particular refer to the lack of good role models, be that trainers or mentors, whose pedagogical practices embodied such an apparently missing vision. What appears to happen in practice in many countries is that teachers and their trainers lack the competencies for integrating fully ICT into their teaching; instead, they seem to view ICT as something extra to be done in addition to their teaching of their subject.

At the institutional level, different aspects related to technical support, reliability or convenience of access to technology are mentioned as unresolved issues. Even in those countries with high levels of technology provision, such as England or the Netherlands, these issues are seen as problematic. On the one hand, there is the whole set of problems related with the consistency between what a newly appointed teacher is going to find in a regular school and the provision of technology available at teacher training institutions. A second important aspect is related to the reliability and convenience of use; for instance, the provision of *wifi* access might not work equally well in all the premises or it might be difficult to get some particular device inside the classroom (*e.g.* Sweden, Norway). More profoundly, though, functional issues seem to arise: what kind of support is available? How easy is to get that support?

At the institutional level, however, the most important barrier in most countries is the lack of a consistent institutional policy backed by appropriate leadership. There is clear evidence that there is a wide divergence in the degree to which institutions have been able to successfully develop pedagogical models where technology plays an important role for all student teachers. In all of these cases what appears to make a difference is a clear vision embodied in a well-designed policy which is advocated by strong leadership and good communication and collaboration between all members of the training team. Most teacher training institutions have technology plans, strategies and policies, but in many cases they are hardly known by the main stakeholders. This clearly indicates the low priority attached, up until now, to these policies. Furthermore, although ICT is presented as a transversal topic

(which should be integrated in each subject by teacher trainers), the reality highlighted by empirical data is quite different. ICT is still perceived by trainers as something additional which needs time. On the one hand, teacher trainers do not have the competences to integrate ICT in their training in pedagogical way. On the other hand, some training institutions do not have the possibility to monitor how ICT is used by trainers during the courses.

In addition to these barriers, there are three policy issues that do not seem to be well addressed so far: To begin with, for a number of perfectly understandable contextual and policy reasons, some governments have been focusing far more on in-service, rather than initial, teacher training. While in the short run this may have been a good choice, in the long run initial teacher training has been ill-served and rarely subject to national scrutiny. In addition, teacher training institutions and programmes are quite often part of the university sector. This is a major improvement in comparison to the previous situation when teacher training was part of secondary education. The inclusion in the university sector has turned out to be problematic in the countries that have not developed competence standards for qualifying to be a teacher: teacher training institutions and programmes may have evolved without regularly engaging in a dialogue with the public authorities responsible for providing education. The issue of technology use can be seen in this respect just as an indication of the inherent difficulties of this dialogue.

Although many of the participating countries have undergone major curriculum reforms recently so as to incorporate not only digital competencies but, more broadly, the wider set of 21st century skills, there is sometimes a mismatch between curricular reforms and what is going on in initial teacher training. Government requirements regarding curriculum reform implementation have not always been complemented by dialogue and collaboration with teacher training institutions – although there are of course exceptions to this, *e.g.* Finland. Contextual pressure (in the form of official government inspection of ITT institutions) as shown in the English context, may be a key factor as well.

Teacher competencies are not always well defined, and even when they are it is often the case that they do not endorse a clear vision of what teaching and learning in a knowledge society should be and the supporting role that technology has to play. For instance, some countries have introduced different systems of measuring teacher digital competencies, be that on a compulsory basis (United Kingdom [England]) or voluntarily (Denmark), but the efficiency of these measures seems to be under scrutiny.

5 DRIVERS, ENABLERS AND SUCCESS FACTORS

These factors will also be discussed at three levels: i) personal, referring to individual teachers, trainers, school leaders, etc. ii) institutional (schools, teacher training colleges) and iii) policy. However, it is important to point out from the outset that these three levels interact and feed into and back to each other, making it sometimes difficult to establish a clear distinction between them and to place particular factors in one of them.

5.1 Local level

Effective collaboration with other colleagues in the development of new ideas and good practice was one enabling factor mentioned by a few countries**.** Collaboration may take place within the same institution or across institutions, both within and outside the country. With respect to international collaborations or networks EU projects facilitating exchanges amongst trainers from different European institutions can act as enablers. There was some evidence to suggest that subject based collaboration was particularly helpful, given the strong subject orientation of trainers and teachers in terms of 'communities of practice', and the fact that ICT use varies significantly across subjects in terms of which programs and applications are of most relevance to teachers and trainers

Individual trainers and mentors often mentioned more time and, sometimes, training as necessary factors that would enable them to further develop further competencies in this area (*e.g.* Sweden, Norway). The issue of providing adequate incentives to trainers to work in this area is, however, an important one; these may take the form of the provision of funding to support particular ICT initiatives such as that provided by the United Kingdom's Teacher Development Agency, funding dedicated time for teachers and trainers to explore and develop particular ICT agendas; or even public recognition of work and achievements in the area such as the annual awards provided by a Finnish University.

5.2 Institutional level

One initiative mentioned by Sweden and Norway was the creation of dedicated ICT units within teacher training colleges with the responsibility to provide support in ICT-related matters to all subject-based trainers or departments. In a more or less similar way, some colleges in the United Kingdom (England) have a designated individual within the course team who is responsible for the strategic development of ICT. These individuals ensure that the role of ICT is encouraged and fully considered in all subjects and that good practice is shared among colleagues.

A necessary factor is the existence of reliable and efficient ICT support units that trainers can rely on for technical problems, in addition to the availability of reliable and flexible equipment. Flexibility of equipment was considered as key, particularly in the case of the United Kingdom (England), where the increase in availability of laptops, data projectors and wireless connections in classrooms has transformed trainers and student teachers' use of ICT in the last few years, as it meant that they could easily access and use equipment and applications in a spontaneous way during their teaching, something that is difficult to achieve when equipment is located, for example, in special ICT suites.

5.3 Policy level

The existence of strong ICT national policies and strategies at national level have definitely acted as drivers in some cases, such as the in United Kingdom (England), where belief in the role of new technologies in education and considerable investment in the area has certainly been a driver. It is important, however, when developing national policies, to ensure that stakeholders at all levels are involved, particularly in countries with long traditions of stakeholder involvement and negotiation, such as the Nordic countries. Developing such policies in a bottom-up way has the advantage of rendering them more credible among stakeholders that are ultimately responsible for implementing them in practice.

Providing more latitude or autonomy to individual schools, in terms of allowing them to pursue the ICT agendas which they considered to be most propitious for their students and their institutions, has also been found to act as an enabling factor.

From a policy perspective what this means is providing incentives for development that are not too prescriptive so that individual trainers, for example, can use them according to their needs and interests. An example of such an initiative was the development grants awarded by the Teacher Development Agency in the United Kingdom, which provided funding to trainers for development in the area of ICT without specifying the exact content of this.

The integration of teacher training institutions in the Higher Education sector in Finland meant the fostering of research and innovation culture. This had a positive impact on the development of new tools and resources for using in teaching and teacher training as it encouraged staff, such as teacher trainers, to become more active in research in the field.

6 CONCLUSION AND KEY MESSAGES

To conclude we summarise the key messages to emerge from the preliminary analysis of the empirical data.

The emerging profile of student teachers in most countries is not that different from that of their peers in other areas of higher education when it comes to technology access, competence and confidence. In most countries, student teachers are expected to use technology such as Learning Management Systems (LMS) in support of their administrative and learning requirements. However, many find the amount of training and experience they receive on pedagogical uses of technology in the classroom insufficient.

Teacher trainers also appear to have a good level of ICT skills and there is practically universal access to appropriate equipment and software in most countries, albeit with some reservations regarding the reliability of some equipment. The main issue raised by teacher trainers was the lack of time to fully explore the pedagogic potential of ICT applications.

Mentors of student teachers in some countries expressed concerns about information overload, excessive bureaucracy and a plethora of externally imposed initiatives in education which limited the time available to explore and develop ICT work.

Lack of time appears as the most important obstacle at the personal level, but can be interpreted in different ways. At the institutional level, technical support, reliability and convenience of access count, but the most important obstacle stems from the lack of consistent institutional policies. At the policy level, curriculum reforms need to be backed with fresh approaches to teacher competencies.

At the personal and institutional levels, effective collaboration with other colleagues for developing new ideas and exchanging good practice was one enabling factor mentioned by a few countries. Another factor is the existence of reliable and efficient ICT support units, in addition to the availability of reliable and flexible equipment.

At the policy level, it is important that teachers and trainers are provided with incentives for development that are flexible and not too prescriptive. The existence of strong ICT national policies and strategies has been an important driver in some cases, particularly when developed in a bottom-up way. It is also important to ensure policy coherence regarding ICT, in areas such as curriculum development, teacher competences and assessment frameworks and practices.

REFERENCES

[1] Aust, Ronald, Newberry, Brian, O'Brien, Joseph, & Thomas, Jennifer. (2005). Learning Generation: Fostering Innovation with Tomorrow‘s Teachers and Technology. Journal of Technology and Teacher Education, 13(2), 167–195.

[2] Baron, Georges-Louis, & Bruillard, Eric. (2003). Les technologies de l'information et de la communication en éducation aux USA: Eléments d'analyse sur la diffusion d'innovations technologiques. Revue Française de Pédagogie (145), 37–49.

[3] Baumberger, Bernard, Perrin, Nicolas, Betrix, Dominique, & Martin, Daniel. (2008). Intégration et utilisation des TIC par les formateurs d‘eseignants. In B. Charlier & P.-F. Coen (Eds.), Formation des enseignants et intégration des TIC: Faire le bilan pour comprendre (Vol. 7, pp. 73–86). Neuchâtel: CDHEP.

[4] Bétrancourt, Mireille. (2007). Pour des usages des TIC au service de l‘apprentissage. In G. Puimatto (Ed.), Les dossiers de l'ingénierie éducative (Juillet ed., pp. 73–92). Paris: SCÈRÈN–CNDP.

[5] Clifford, Patricia, Friesen, Sharon, & Lock, Jennifer. (2004). Coming to teaching in the 21st century: A research study conducted by the Galileo Educational Network. Retrieved 5 May, 2008, from http://www.galileo.org/research/publications/ctt.pdf

[6] Daele, Amaury, & Lusalusa, Simon. (2003a). Les apprentissages vécus par les étudiants. In C. Bernadette & D. Peraya (Eds.), Technologie et innovation en pédagogie : dispositifs innovants de formation pour l’enseignement supérieur (pp. 163–176). Paris: De Boeck.

[7] Daele, Amaury, & Lusalusa, Simon. (2003b). Quels nouveaux rôles pour les formateurs d‘enseignants? In C. Bernadette & D. Peraya (Eds.), Technologie et innovation en pédagogie : dispositifs innovants de formation pour l’enseignement supérieur (pp. 141–148). Paris: De Boeck.

[8] Davis, Elisabeth A., Petish, Debra, & Smithey, Julie. (2006). Challenges new science teachers face. Review of Educational Research, 76(4), 607–651.

[9] Dawson, Kara, & Fitchman Dana, Nancy. (2007). When curriculum-based, technology-enhanced field experiences and teacher inquiry coalesce: An opportunity for conceptual change? British Journal of Educational Technology, 38(4), 656–667.

[10] Enochson & Rizza, 2009, ICT in initial teacher training: research review. OECD. EDU Working paper n38. From http://www.oecd.org/dataoecd/30/54/44104618.pdf EDU/WKP(2009)17.

[11] Haydn, Terry A., & Barton, Roy. (2007). Common needs and different agendas: how trainee teachers make progress in their ability to use ICT in subject teaching: Some lessons from the UK. Computer & Education, 49, 1018–1036.

[12] Judge, Sharon, & O'Bannon, Blanche. (2007). Integrating technology into field-based experiences: A model that fosters change. Computers in Human Behavior, 23, 286–302.

[13] Judge, Sharon, & O'Bannon, Blanche. (2008). Faculty integration of technology in teacher preparation: outcomes of a development model. Technology, Pedagogy and Education 17(1), 17–28.

[14] Karsenti, Thierry. (2005). Les TIC et les futurs enseignants: Les facteurs qui influencent leur utilisation. In D. Biron, M. Cividini & J.-F. Desbiens (Eds.), La formation enseignants au temps des réformes (pp. 263–280). Sherbrook: èditions du CRP.

[15] Karsenti, Thierry, Raby, Carole, & Villeneuve, Stéphane. (2008). Quelles compétences technopédagogiques pour les futurs enseignants du Québec? In B. Charlier & P.-F. Coen (Eds.), Formation des enseignants et intégration des TIC: Faire le bilan pour comprendre (Vol. 7, pp. 117–136). Neuchâtel: CDHEP.

[16] Kirschner, Paul, & Davis, Niki (2003). Pedagogic benchmarks for information and communications technology in teacher education. Technology, Pedagogy and Education, 12(1), 125–147.

[17] Larose, François, Lenoir, Yves, Karsenti, Thierry, & Grenon, Vincent (2002). Les facteurs sous-jacents au transfert des compétences informatiques construites par les futurs maîtres du primaire sur le plan de l'intervention éducative. Revue des sciences de l'éducation, 28(2), 265–287

[18] Lavonen, Jari, Lattu, Matti, Juuti, Kalle, & Meisalo, Veijo. (2006). Strategy-based development of teacher educators'ICT competence through a co-operative staff development project. European Journal of Teacher Education 29(2), 241–265.

[19] Moursund, David, & Bielenfeldt, Talbot. (1999). Will new teachers be prepared to teach in a digital age: A national survey on information technology in teacher education. Eugene, OR: International Society for Technology in Education.

[20] Mutton, Trevor, Mills, Gary, & McNicholl, Jane. (2006). Mentor skills in a new context: Working with trainee teachers to develop the use of information and communications technology in their subject teaching. Technology, Pedagogy and Education, 15(3), 337–352.

[21] Pierson, Melissa E., & Cozart, Alysa. (2005). Case studies of future teachers: Learning to teach with technology. Journal of Computing in Teacher Education, 21(2), 59–63.

[22] Rizza, (forthcoming). ICT and Initial Teacher Training – National Policies. OECD Working Paper.

[23] Sardone, Nancy B., & Devlin-Scherer, Roberta. (2008). Teacher candidates' views of a multi-user virtual environment. Technology, Pedagogy and Education, 17(1), 41–51.

[24] Strudler, Neal, Archambault, Leanna, Bendixen, Lisa, Anderson, Don, & Weiss, Rita. (2003). Project THREAD: Technology Helping Restructure Educational Access and Delivery. Educational Technology Research and Development, 51(1), 39–54.

[25] Strudler, Neal, & Grove, Karen. (2003). Integrating technology into teacher candidates'field experiences: A two-pronged approach. Journal of Computing in Teacher Education, 19(2), 33–38.

[26] Tan, Ashley, del Valle, Rodrigo, & Pereira, Maura. (2004). Required educational technology course in NCATE accredited preservice teacher programs. Paper presented at the IST Conference.

[27] Twidle, John, Sorensen, Peter, Childs, Ann, Godwin, Janet, & Dussart, Molly. (2006). Issues, challenges and needs of student science teachers in using the Internet as a tool for teaching. Technology, Pedagogy and Education, 15(2), 207–221.

[28] Vannatta, Rachel A., & Fordham, Nancy. (2004). Teacher dispositions as predictors of classroom technology use. Journal of Research on Technology in Education, 36(3), 253–271.

[29] Whittier, David, & Lara, Sonia. (2006). Preparing Tomorrows Teachers to use Technology (PT3) at Boston University through faculty development: Assessment of three years of the project. Technology, Pedagogy and Education 15(3), 321–335.