A National ICT Competency Framework for Student Teachers

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Abstract: As emerging technologies provide access to the new resources in society, teachers’ roles need to transform to cater to individual students’ learning preferences. As a result, adequate ICT training for student teachers should provide technology rich experiences throughout the whole program. The Ministry of Education, Culture and Science, and several other Dutch educational partners, have delineated an ICT Competency Framework for student teachers, which they would like to see each institution adopt as the pre-eminent agenda for improving student teachers’ ICT knowledge and skills. This National ICT Competency Framework was developed based on broad comparative research on current educational trends and practices in a global context by a workgroup and review group consisting of educational professionals and ICT experts. This paper addresses and discusses the National ICT Competency Framework consisting of four different domains (attitude, basic digital skills, digital media and information literacy, and pedagogical practice), and issues concerning its implementation.

Introduction

Technological developments have often played a crucial role in bringing about social and business changes, and most researchers and facilitators in the field of technology professionalization predict that these changes will have a major impact on how education should be transformed. In fact, there are two main reasons for changing education. One reason is that the world is changing rapidly which demands new skills and knowledge, requiring schools to prepare learners for the 21st century (Partnership for the 21st Century Skills, 2009; Bellanca & Brandt, 2010). The second reason is that by making use of new technologies, schools can provide better education based on the needs and wishes of the individual learner (Kennisnet, 2013).

Emerging technologies are changing every aspect of life: collecting information; reading and writing files; communicating; and analyzing data. All of these aspects influence education as well. In fact, reading, writing, calculating, collecting and analyzing data are aspects of what education is all about. Yet, schools are stuck using 19th century technologies and didactics. In other words, the use of new technologies and educational concepts is not sufficient at the core of the schools and they are mainly used in special courses or programs. Although, new technologies are not a panacea for educational ills, it seems clear that emerging technologies are essential to teaching in the 21st century (Kirschner & Selinger, 2003; Schols, 2012). To use these technologies adequately, teachers not only need basic information and communication technologies (ICTs) skills and knowledge but they also need to know how to use them in order to improve their students learning (Kirschner & Selinger, 2003; Zhao, 2003; Hughes, 2005).

As teacher education institutions are under more and more pressure to use ICTs to provide future teachers with the necessary knowledge and skills to prepare them for the 21st century, adequate teacher professionalization becomes a prerequisite to transform education in such a way that teachers have the technological and pedagogical knowledge and skills to use ICTs to cater to students’ individual preferences (Schols, 2012). As a result, teacher education institutions are faced with the challenge of preparing a new generation of teachers to effectively use the
new learning tools in their teaching practices. For many teacher education programs, this is a daunting task which not only requires the acquisition of new resources, expertise and careful planning but "demands rethinking education not in isolation, but considering the interplay of society, education, and learning" (Collins & Halverson, 2009, p. 129).

In order to reap the benefits of using emerging technologies in teaching and learning, it is essential that teacher education institutions assume a leadership role in the transformation of education (Schols, 2012; Miller & Ribble, 2013). However, despite the fact that there are teacher education institutions which train both today’s and tomorrow’s teachers by providing them with adequate basic ICT knowledge and skills, the attention given to the use of emerging technology and the required knowledge in teacher professionalization is not up to par and lacks a universal framework of ICT competencies and standards (Unesco, 2008). In other words, a specific ICT framework for student teachers that could be used as a national benchmark is needed. In order to design and develop a National ICT Competency Framework, which may help teacher education institutions to design and develop curricula to train student teachers in mastering new ICT knowledge and skills, a team of teacher educators and researchers joined forces. This project group discerned and analyzed national and international best practices and conducted a thorough literature review to design and develop a prescriptive National ICT Competency Framework for Student Teachers (NICFST).

Aims and Objectives of ICT Competency Framework

The compilation of the NICFST was commissioned by ADEF (General Consultative Body of Head Teachers on Educational Faculties). The aim of the ADEF ICT project group is to improve student teachers’ practice by providing them with the necessary standards and competencies that will be needed in the teaching workplace of the 21st century. Additionally, the National ICT Competency Framework enables teacher education institutions to design and develop curricula which can be used for the professional development of teachers and student teachers. Moreover, the standards and competencies in the Framework can be used as guidelines for planning technology-based activities in which future pupils achieve success in learning and communication which will prepare them to meet the challenges of today’s and tomorrow’s knowledge-based society.

According to Unesco (2008), by combining ICT skills and pedagogical knowledge with emergent educational views and concepts a rethinking of learning and profound changes in education may be brought about. More specifically, the objectives of a National ICT Competency Framework for student teachers are:

- To provide a set of competencies and standards that will enable student teachers to become technologically proficient, and which will become an integral part of their teaching and learning; thus preparing them to meet the challenges of today’s and tomorrow’s knowledge-based society.
- To provide a national set of standards and competencies that can be used by teacher education institutions to design, develop and implement innovative curricula which embed ICT knowledge and skills.
- To provide a National Framework for digital literacy that includes a progressive development of ICT knowledge and skills, skills for thinking about and using information in an accountable way, and skills needed for working responsibly and productively both as an individual as well as within groups.
- To implement and extend teachers’ technology professionalization in order to improve teacher effectiveness in delivering 21st century instruction which lays the foundation of deep and continuous learning to cater to individual learning preferences.

The ADEF ICT project group has spent the last two years to updating, improving and developing a new robust NICFST that responds to the changing demands in a global knowledge-based society. In addition to the support of experts, teacher educators, teachers, students and many others who have shaped this framework into a comprehensive, purposeful and guiding document, the project group is aware that the framework is dynamic and consists of a set of guiding standards which need to be adapted to new educational demands over time.

According to Kirschner and Selinger (2003), ICT is regarded as a set of core technologies in teachers training settings, since it "refers to the main way of organizing the learning experience" (p.10). These researchers emphasize...
the importance using emerging technologies in the classroom and off-campus settings. In the design and development of the NICFST, the project group has focused on ICT as a core technology in preparing tomorrow’s teachers to become competent at the beginning of their practitioners level, which is the competency level strived for (Kirschner & Selinger, 2003).

Framework

Competency frameworks

For a better understanding of the NICFST, a description of the underpinning concepts and frameworks is in order. The National ICT competency framework is a separate framework that supports the Generic Knowledge Base for Teacher Education which describes the generic competencies at the beginning of the practitioner level for teachers in secondary and vocational education. It is based on the general competencies of teachers set by the OnderwijSCOöPeratie (Education Cooperative, 2012), and commissioned by the Dutch government. In this document it is stated that the competency of teaching demands a broad professional base and includes competency in content knowledge, pedagogical (didactical) content knowledge and pedagogical knowledge (didactics).

Three key tasks of the teacher are described. The first key task refers to the daily activities of the teacher and comprises the processes of design and the provision of education as well as the supervision of the students. The second key task refers to the teacher as being part of a professional organization in which he and his colleagues are co-responsible for the development of education and as a result can held accountable for the provision of education. The third key task focuses on the teacher as a lifelong learner, who continuously develops and maintains teacher related knowledge and skills.

Kennisnet, a public educational organization which supports Dutch primary, secondary and vocational institutions in the effective use of ICT, developed the IT Competency Framework for teachers (2012), commissioned by the Education Cooperative, and based on the three core tasks of the teacher as described previously. Before proceeding, it is necessary to discuss the key term “competency” that is used in teacher professionalization discourses and which is related to this paper. Competency is a construct that in the literature is explained in multiple ways. Valcke (2010) integrates the different elements of these explanations:

Competencies refer to a coherent and complex set of knowledge, skills and attitudes that are expressed and developed in and through concrete actions in concrete, complex and authentic situations. (p.451)

In the NICFST, this is reflected in four themes which are further specified in core concepts and competency indicators. The four themes include the three core tasks of the framework of Kennisnet (2012), and are the same themes of the first version of the national ICT competency framework for teacher education published in 2009. This format has proved to be very useful for faculties of education, providing clear guidelines for assessing students and redesigning curricula. The competency indicators are sustainable only if connected with content and pedagogical knowledge. It is an enabling framework. A teacher who is at the beginning of the practitioner level integrates the competencies described in the four themes in his professional activities in and around the school.

The four themes of the National ICT Competency Framework for student teachers

Attitude

The successful integration of ICTs in learning, teaching and the organization of education depends on the attitude of the teacher towards technology, and his acceptance of the technology (Yuen & Ma, 2008; Ertmer & Ottenbreit-Leftwich, 2010). Of utmost importance is the mindset of the teacher who is aware that effective teaching requires a deliberate and effective use of technology in his classroom. The teacher must be aware of the fact that the uses of technology in his teaching and learning, requires not only knowledge about ICT, but also about the implications for teaching content knowledge and pedagogy. This requires the teacher to have an open and flexible mind, characterized by initiative, leadership, problem solving and self-reflection.

Attitude consists of four core concepts. The first core concept describes the teacher as a learning and innovative professional, who is able to integrate emerging technologies in teaching and learning in an independent...
and critical way. The teacher believes that the deliberate practice of ICT has a positive impact on his students’ learning and he recognizes the affordances and constraints of technology. The affordances of ICT are used to support the learning of students in ways that are not possible without using technology (Puentedura, 2003). This requires teachers to make use of the state of the art technology that can be used in the teaching of higher order thinking skills and which in turn has an effect on the process of how content knowledge, pedagogy and technology influence each other.

The second core concept relates to the teacher as a flexible and adaptive professional who can show that he is responsive to educational changes and needs related to the use of ICT in educational contexts. With the rapid developments in the fields of ICT and education, schools need reflective and enquiring teachers who see themselves engaged in a lifelong learning process.

The third core concept refers to the teacher as a professional who is able to make use of ICT in a deliberate manner in order to improve his teaching methods. Moreover, he investigates and assesses the effectiveness of ICT for the learning of his students. For this he actively connects with colleagues who find themselves in similar situations regarding the use of ICT.

Table 1: Example of theme attitude and concept the learning and innovative professional

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<tr>
<th>Core concept</th>
<th>Description core concept</th>
<th>Examples</th>
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<td>1.1 The learning and innovative professional</td>
<td>1.1.1. The teacher shows that he is a professional who is continuously learning how to use the affordances of emerging technologies for learning, instruction and the organization of education in an independent, creative and critical way.</td>
<td>-Using ICTs to keep up with, and to broaden knowledge and skills by making use of online communities, fora or special interest groups. -Being aware of ICT in their own discipline and being able to assess the possibilities in teaching and learning.</td>
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Basic digital skills

A teacher at the practitioners level has not yet obtained sufficient skills to effectively use ICT for teaching and learning. These skills are based on the digital literacy skills that apply to the entire Dutch population (Kennisnet, 2012). The basic digital skills as mentioned in the NICFST, apply to the teaching profession in secondary and vocational education in the Netherlands and are conditional so as to effectively deploy ICT in learning, teaching and the organization of education. In fact, the set of skills refers to the teachers’ ability to adequately use the specific functions of (mobile) devices and (Internet) software/applications with the purpose to implementing computer applications in a skillful way. It is important to note that subject-specific hardware and software applications, for example, software related to geography, mathematics or geographic information systems for social sciences, are not listed in this framework.

The theme of basic digital skills consists of two core concepts: hardware, and software. Examples of hardware use refer to an understanding of computer characteristics and capabilities as well as to an understanding of how to implement this knowledge in the classroom. An example of this would be the ability to connect different devices such as a laptop to a beamer, using an interactive whiteboard or setting up clickers or other student response systems. The core concept software refers to general technology skills concerning office applications, software for editing pictures, audio and video, as well as more education specific tools for example content management systems, virtual learning environments and software programs for digital assessment.

Table 2: Example theme basic digital skills / core concept software

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2.2 Software

2.2.4. The teacher shows that he can support a presentation by using software and hardware applications.
- Using student response systems such as clickers, Shakespeak and / or Socrative.
- Publishing a presentation in a virtual learning environment and / or on the Internet.

In the case of problems and failures the teacher should be able to recognize and solve those problems. However, if this is not possible, he is able to seek technical assistance since the teacher is not considered to be an IT specialist.

Digital literacy

The NICFST is created in the context of an information- and network society. Technology, specifically the development of the Internet and social media, has fundamentally changed the way in which information is used, the way in which learning takes place, and the way in which communication and collaboration takes place. As a result, special attention should be given to critical thinking skills and information literacy. The challenge is to incorporate these essential skills into teaching and learning. Learning and thinking skills are comprised of critical-thinking skills and problem solving skills which help students to use information and communicate with others in a safe and productive way. In the Netherlands, the concept of “mediawisdom” is used.

The theme digital literacy consists of three core concepts: information literacy, knowledge management and “mediawisdom”. Information literacy is concerned with knowledge and skills with regard to how to search for particular information on the Internet, as well as assessing and analyzing the collected data in order to identify solutions and / or make informed decisions.

Knowledge management, the second core concept, is concerned with the efficient organization of digital sources and using them for teaching and learning. Examples include web curation and the filtering of different information sources via Really Simple Syndication (RSS).

The third core concept, media literacy, involves the deliberate, critical and creative use of current media. In the Netherlands this concept is elaborated in a specific competency framework (Mediawijzer.net, 2012) and is often used to refer to safeguarding the students from the unsafe aspects of internet use and media communication. However, the third core concept not only refers to the safe use of media, but is typically concerned with what we read or hear through the media, which requires critical communication competencies and critical thinking skills concerning the use of the Internet and social media technology for learning purposes.

Table 3: Example theme digital literacy / core concept information literacy

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| 3.1 Information literacy | 3.1.2. The teacher shows he can assess websites on validity and authenticity and can transfer the importance of these skills to his students. | - Checking and arguing the validity of digital information sources.  
- Helping students to search the Internet for information, allowing them to assess these sources based on validity and authenticity criteria. |

Pedagogical knowledge and skills

The NICFST describes core concepts and competency indicators for the pedagogical use of technology. The term
pedagogics (in the Netherlands we use the term didactics) refers to the deliberate and appropriate use of technology for teaching and learning.

The premise is that education is about designing learning activities to solve educational dilemmas. The design problem always involves a specific learning practice within a specific context in which the use of ICT is aligned with the learning objectives, the learning process of the students and assessment of the learning process. Knowledge about ICT and how to use the technology is not sufficient for designing learning activities that support the learning of students. It requires knowledge of how technology, content and pedagogy influence each other in a unique context. Additionally, it requires a professionalization of the teachers’ pedagogical knowledge: designing, planning, implementation and evaluation of learning activities by using ICT.

The pedagogical approach, in particular, relates to the process of making the right choices regarding the type of learning practices, teaching strategies and the design of a (digital) learning environment. In the NICFST these competencies are described in the first core concept. A teacher at the practitioners level shows that he or she can design a relevant, rich and effective learning environment in which ICT is used. In addition, the teacher shows that he can control and guide the effective use of ICT processes to support and cater individual and collaborative learning.

The second core concept is concerned with the organization of technology use in the (digital) learning environment. It is about organizing the necessary equipment and tools for using technology in the classroom, as well as off-campus, such as in a virtual learning environment. Moreover, it also applies to classroom management; taking into account the size and diversity of a group of students.

The third core concept involves arranging digital learning materials. The teacher shows that he can arrange new learning materials by making use of a range of learning materials in various online depositories. In arranging learning and teaching materials he or she takes into account the characteristics of the learners, differences in the levels of interest, tempo, and learning preferences.

The fourth and fifth core concepts are concerned with the use of ICT for knowledge transfer and knowledge construction. New technologies demand new, learner-centered pedagogies, and demand the promotion of active construction of knowledge by using ICT. The teacher should therefore be able to facilitate his students’ learning by making use of technologies which facilitate synchronous and asynchronous learning between students and teachers in a meaningful way.

The last core concept in this theme is the assessment of student learning with ICT. A teacher at a practitioners level shows that he or she can monitor the learning process of the student in a transparent way via various means of digital assessment and evaluation.

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<td>4.5 Knowledge construction</td>
<td>4.5.1 The teacher is able to show the use of ICT to support active knowledge construction.</td>
<td>- Using computer simulations, serious gaming and methods like WebQuests allowing students to learn in an active, independent and collaborating manner. - Mind mapping.</td>
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Implications for Practice

This paper discussed the design and development of the NICFST that is based on broad, comparative research on educational trends and practices, while the workgroup also tried to identify ways to implement the Framework as well as to identify directions for future research and developments.

While the current set of competencies, descriptors and indicators is meant to be comprehensive, the ICT...
Competency Framework is intended to be a living, dynamic document and, therefore, needs to be reviewed and updated on a regular basis. This becomes even more pertinent as the educational context changes rapidly, since knowledge evolves and the processes of invention, innovation and diffusion of technology are vast.

The ICT Framework will therefore form the first step of a technology professional development planning process. Although more profound research must be conducted, a preliminary literature review indicates that the design, development, and implementation of ICT enriched curricula in teacher education institutions should be student centered and directed at the development of competency. The latter indicates that the full integration of the NICFST is not only in the curriculum but also in the vision of how to train the teachers of the future. The change is systemic and should be based on a well-defined planning process. In this context, UNESCO’s ICT Competency Standards for Teachers (2008) provides useful guidelines for planning technology enriched curricula within teacher education institutions. The model shown in figure 5. depicts a four-stage planning approach, providing teacher education institutions where they are and where they would like to be with regard to the integration of ICT in the curricula.

Figure 1. Four-stage planning process

A clear vision for ICT within a teacher education institution should seek to complement national and international developments in this area and can address key points such as how to further develop and integrate emerging technologies within current and new curricula, or how to improve student teachers’ ICT knowledge and skills, preparing them for the 21st century. A well-defined vision and policy for ICT is the key to engaging in the institutional improvement process, making it easier to monitor implementation processes that require adjustments.

As emerging technologies open new avenues for curriculum development, it is recommended to design a plan that meets the needs of the most important stakeholder: the student. The design of a plan should therefore place the student in the curricula based on their technology learning needs and wishes. The plan should emphasize student learning in the context of their profession and cater to individual preferences.

Key to a successful implementation process of the ICT plan is ownership by teaching staff. Moreover, the management of the teacher education institution should ensure that adequate staffing, financial resources, time and infrastructure are made available.

The evaluation of the planning and the implementation process is the final step in the four-stage planning process and provides the basis for ongoing planning, innovation and progression. While the current ICT Framework comprises a broad scope of ICT knowledge and skills for student teachers, and is intended to be a dynamic document, evaluating the planning and the implementation process is imperative. It is at this point that teacher education institution can assess how well they have met the targets based on the vision and policy for ICT. In reality, the process of evaluation requires ongoing review and reflection and should be facilitated by good monitoring procedures.

Implications for further Research and Conclusions

Emerging technologies are being introduced in educational contexts at such a rapid rate today that it is difficult for teachers to keep up. Moreover, as society and the education community realize the need to integrate ICTs in education, the need for adequate teacher professional development programs for student teachers becomes more and more essential in the transformation of education in order to cope with the challenges of the knowledge-based society.

Putting student teachers in situations in which they need to use emerging technologies based on certain ICT
standards does not automatically kickstart teacher education institutions to change their curricula. Providing student teachers with enriched learning environments is not sufficient, since it “takes two to tango”. Emerging technologies are being introduced in educational contexts at such a rapid rate that most teacher educators have difficulty keeping up. As a result, the need to provide not only student teachers with adequate technology training but also teacher educators becomes more and more apparent.

In order to meet technology professional development for teacher educators, there is a need for studies to be conducted that focus on encouraging educators to develop ICT knowledge and skills. The design of technology professional development programs for teacher educators will therefore be based on a diverse range of operational technology training models such as Mishra and Koehler’s (2006) Technological Pedagogical Content Knowledge model (TPACK) which focuses on the integration of ICT into teaching and learning. Helping teacher educators to use emerging technologies effectively in their classroom may not be an easy task, but it will be an essential step in assuring that current investments in educational technologies are realized. In fact, the challenge of integrating emerging technologies into the classroom is more human than it is technological.

References


