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PEER REVIEWED ARTICLE

Notion in Motion: Teachers' Digital Competence

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ABSTRACT

The aim of this article is to shed critical light on the prevailing understanding of digital competence in schools and teacher education. There seems to be an emphasis on how to practice teaching with ICT throughout the Norwegian educational system. This article discusses and elaborates on the current approach, and argues for understanding digital competence from a broader perspective, by suggesting a framework for the notion of digital competence for teachers. This approach stresses teaching of, about, and with ICT.

Keywords

digital competence, teacher training, teaching, ict

INTRODUCTION

In public debate the teacher's supposed limited digital skills and practices are often debated (Engen, Giæver, & Bjarnø, 2008; Ernes, 2008; Haugsbakk, 2010). Frequently the teachers are the ones targeted when schools do not meet the expectations of national standards or international measures (Convery, 2009).

Teacher digital competence is a relative term with respect to time and context. The current Norwegian curriculum is an essential part of this context and outlines what competence is considered relevant for the teacher. The Norwegian school is, via the national curriculum (the Knowledge Promotion), obliged to develop the digital skills that students need for educational and social life. This is described in general terms in the introductory part of the national curriculum, which states that school should develop broad competences for the students,


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including learning strategies, social competencies, and motivation for learning student participation (Ministry of Education Research and Church Affairs, 2004). More specifically, the national curriculum defines the school's approach to and the actual use of digital tools, as well as the social and ethical challenges technology brings about. It thus indirectly advises what kinds of competence the teachers must have in order to facilitate student learning and fulfil the intentions of the curriculum.

The current national curriculum focuses on digital skills to be integrated in school to support subject learning. In order to fulfil these requirements, digital competence among teachers is essential. Several researchers have defined teachers' digital competence (Krumsvik, 2009; Mishra & Koehler, 2006b; Sabaliauskas, Bukantaitė, & Pukelis, 2006). Although, there is no unified understanding of what this encompasses, most researchers focus on teachers' competence in using digital tools to support student learning (i.e. teaching with ICT). However, the digital competence that the Knowledge Promotion asks for is more complex. There are competence areas in the Norwegian national curriculum that aims at developing general digital competence among students, such as becoming a digital citizen. We therefore argue that there is a need for critical reflection on the prevailing understanding of digital competence. Consequently, this article will discuss the notion of digital competence in general, and further argue for defining teachers' digital competence in a broad perspective. This will be done by suggesting a framework for the notion of digital competence for teachers, which includes three aspects: teaching *of* ICT; teaching *about* ICT; as well as teaching *with* ICT. Teaching *of* ICT concerns training in digital tools and technology use, teaching *about* ICT is to teach about technology itself as well as the impact on society, and teaching *with* ICT is about arranging for student learning with digital tools.

THE NOTION OF DIGITAL COMPETENCE

The notion of digital competence can be related to the concept of digital literacy, which is i.e. discussed by Tyner (1998). "Literacy" is basically the English word for the ability to read, but is currently used in an expanded and societal context (Buckingham, 2006). Even though it is not directly synonymous with the notion of literacy, the notion of competence is used in a similar way in a Norwegian context. In combination with the term "digital", both literacy and competence have gradually been extended to cover different areas. Tyner (1998) for example distinguishes between "tool literacy" and "literacy of representation". Tool literacy, also referred to as computer, network, and technology skills, compounds the instrumental aspects of the technology, i.e. skills in using various digital tools. Literacy of representation includes how technology can be understood in our time, and how to use digital tools in a broader context. Tyner's distinction has been important for the evolving understanding of the concept of digital competence.

Based on media studies, Buckingham (2006) also proposes an understanding of digital literacy as encompassing more than purely instrumental skills. He argues that the ability to evaluate and use information critically, but also to understand the role of technology and technological development in a social, political, and economic perspective are essential parts of digital competence.

van Dijk (2013) brings the aspects of power and inequality into the discussion. He divides digital skills into six categories. The first two are medium related, namely operational skills required for operating a digital medium, and formal skills required for handling the formal structures, such as browsing the Internet. The next four categories are content related skills: information skills, like searching and evaluating information, communication skills, strategic skills for achieving professional and personal goals, and content creation skills.

In the Norwegian context, there are several proposed definitions of digital literacy and competence. “Digital *bildung*” was proposed in 2003 as an alternative concept in a problem paper (Søby, 2003). The notion of digital *bildung* is presented as a vision, which involves providing the learners with: “an opportunity to use ICT confidently and innovatively so as to develop the skills, knowledge and expertise they need to achieve personal goals and to be interactive participants in a global information society” (p. 5) [our translation].

In his discussion, Søby, in line with Buckingham, notes that the notion of skill is too narrow, arguing that the German term of “*bildung*” includes a “comprehensive understanding of how children and young people learn and develop their identity” (Søby, 2003, p. 8) [our translation]. This can be seen as related to both Tyner’s and Buckingham’s arguments for including the critical understanding of technology in a societal setting with the definition of digital literacy.

In 2004, an official Norwegian definition was proposed in a White Paper, which is here translated by Erstad (2006, p. 417):

Digital literacy is the sum of simple ICT skills, like being able to read, write and calculate, and more advanced skills that makes creative and critical use of digital tools and media possible. ICT skills consist of being able to use software, to search, locate, transform and control information from different digital sources, while the critical and creative ability also imply an ability to evaluate, use sources of information critically, interpret and analyse digital genres and media forms. In total digital literacy can be seen as a very complex competence (Ministry of Education and Research, 2004, p. 48).

Inspired by this, Erstad presents a general definition: digital literacy comprises the “skills, knowledge and attitudes in using digital media, as to be able to master the challenges in learning society” (Erstad, 2006, p. 417). A comparable approach to the concept is found in Bjarnø, Giæver, Johannesen and Øgrim (2009): “Digital competence involves the ability to use digital tools and have

an adequate understanding of the technology and thereby be able to work in and influence society” (p. 16) [our translation]. Both definitions include the skill-oriented aspects of the technology, yet emphasising understanding of the technology in a broader sense, which includes knowledge about and attitudes towards the use of technology in the society.

Further, Erstad (2010) argues for operationalizing the concept of digital literacy in what he proposes as basic components of the concept. These are basic skills in using computers and software to download and upload different types of information, knowing how to search for information, being able to navigate within, classify, integrate and evaluate various types of information, communicating and expressing oneself through different mediational means, using digital tools for collaboration, and finally, being able to create and design complex digital material.

This somewhat historical review of the notion of digital competence illustrates a motion towards a broad, holistic definition, emphasizing the role of ICT in learning. Within this, the elements of technical skills, such as tool literacy (Tyner, 1998) and instrumental skills (Buckingham, 2006) constitute a foundation. Any definition of digital competence must include basic skills in using digital tools. Moreover, both Erstad (2010) and van Dijk (2013) present digital competence as including creative abilities, presupposing students to have experiences in using technology to produce knowledge, thus learning with technology. Finally, digital competence should include a critical understanding of the societal use of technology and the formation of young people (Buckingham, 2006; Sjøby, 2003). Accordingly, the notion of digital competence can be understood as composed of three elements of *using, producing, and bildung*. This threefold perspective of digital competence will be the basis of the discussions in this article.

DIGITAL COMPETENCE IN THE NORWEGIAN NATIONAL CURRICULUM AND POLICIES

Today’s children are growing up in a digital reality that is quite different from what adults experienced in childhood, yet we do not know what reality they will face in the 21st century. This is one of many challenges for education. Prensky (2012) makes an issue of the fact that the school system is not designed to meet the rapid technological changes. He describes the generation who during their whole life have been surrounded by computers, digital games, music players, camera recorders and mobile phones as digital natives. Previous generations are described as digital immigrants. In our opinion such a divide is not necessarily a question of generation or age, but can as well be an issue of gender, social class, education, cultural background, and the like. Nevertheless, it is interesting to dwell on what challenges different frameworks for understanding the role of technology can bring about for education, in particular the differences between the competences gained in schools and in

leisure time and what kind of expertise students might bring into school (Erstad & Sefton-Green, 2013). We know from the Norwegian national survey of media habits (Medietilsynet, 2012) that children and young people have access to digital media outside of school, and that much of their social life is engaged in gaming and social networking. Consequently, or so the arguments goes, students' every-day digital literacy forms a foundation that schools should build upon and develop further. Basically this is a question of student learning and arranging for schools to be "up to date" and relevant. However, even if many students have achieved a certain level of digital skill through out-of-school use, these skills are often fragmented and not relevant for schooling (Bjarnø et al., 2009). In addition, there is a major disparity among the individual students (Østerud & Schwebs, 2009).

"Learning to use technologies" and *"using technologies to learn"* are terms that were utilized in the instructions for use of digital tools in Norwegian schools in the late 90's (Ministry of Education Research and Church Affairs, 1995; Statssekretærutvalget for IT, 1996). These terms indicate two different approaches to using digital tools. On the one hand, digital tools should be used to support learning in subject-areas; on the other hand, students should learn how to use digital tools and learn about the technology so that they could use such digital tools in a productive way. A similar division can also be found in international literature in terms of "education for ICT" vs. "ICT for education", most often with the argument that there is a need for a shift from the first toward the latter (Unwin, 2005).

In the White Paper "Culture for Learning" (Ministry of Education and Research, 2004), five basic skills were introduced as the backbone of the Knowledge Promotion. The introduction of the "ability to use digital tools" as one of the five basic skills, brought the concept of digital competence to the same level of aims as reading, writing, numeracy, and spoken language in the Norwegian schools. According to the Knowledge Promotion text, the use of digital tools must be an integral part of all subject-area learning. Consequently, the use of digital tools becomes more binding than in previous national curricula. Prior to this, the terms, which were used to describe digital tools in schooling had been influenced by words like "may" and "should", rather than "must". Nevertheless, the choice of the phrase "ability to use" emphasizes the instrumental aspects of digital competence, and thus other aspects, including the understanding of and attitudes towards technology, seem to be less emphasized.

The very idea of the Knowledge Promotion, that digital skills are included as a basic skill, may be utilized to fulfil the ideal of *using technologies to learn*. Beck and Øgrim (2009) argue from a technology perspective that there are three areas where students need to know about technology. Firstly, students must be confident users of technology. Second, they must develop an understanding of how the technology works. Finally, students must gain knowledge about the role of technology in society, so that they have the potential to influ-

ence it. In a sense, these arguments elaborate on the term *learning to use technologies*.

A framework for basic skills was developed as a part of the revision of the National Curriculum for Knowledge Promotion in 2012. In this, digital skills were defined as follows:

Digital skills involve being able to use digital tools, media and resources efficiently and responsibly, to solve practical tasks, find and process information, design digital products and communicate content. Digital skills also include developing digital judgment by acquiring knowledge and good strategies for the use of the Internet (Norwegian Directorate for Education and Training, 2012).

At the same time, the term “ability to use digital tools” is changed to “digital skills”, thereby focusing more on attitudes, understanding and communication, and to a lesser extent on the software and digital equipment. Yet, the term ‘skills’ is quite narrow, and can be said to cover only what Tyner (1998) calls ‘tool literacy’, Buckingham (2006) calls instrumental ‘skills’ and van Dijk (2013) calls ‘medium related skills’. On the other hand, digital skills are described in the framework as “learning to use digital tools, media and resources and learning to make use of them to acquire subject-related knowledge and express one’s own competence” (Norwegian Directorate for Education and Training, 2012), which illustrates a broad understanding of the notion of skills that corresponds to the twofold distinction from the 90’s (learning to use/using to learn). In this new framework for basic skills, the term digital judgment has been given increased attention. The framework includes topics such as source awareness, privacy, copyright, and netiquette which are typically non-instrumental, but still essentials of digital competence (Norwegian Directorate for Education and Training, 2012). Digital judgement as a subject area builds upon the importance of critical reflection on the use of technology. This can be related to the term *bildung*, as discussed by Sjøby (2003).

The new definition of digital skills, given by The Norwegian Directorate for Education and Training (2012), embraces the historical lines outlined in the discussion above, concurrently using contemporary concepts. In our opinion, it might seem like they have finally succeeded in formulating a definition, which is timely enough to embrace the contemporary perception of digital competence, yet robust enough to embrace the future digital age.

To summarize, the Norwegian national policy documents address three aspects of digital competence in the school system. The first is learning to use technology, which is strongly related to the use aspects of digital competence proposed earlier in this article. The second is using technology for learning and has become the most important one in the Knowledge Promotion. This aspect may be related to the previously proposed productive aspects of digital competence. The third is highlighted in the framework for basic skills, where

aspects of critical reflection on the use of technology are included. Accordingly, the notion of digital competence, within the national policy documents, can be understood as composed of *learning to use*, *using to learn*, and *critical reflection*.

THE TEACHERS' DIGITAL COMPETENCE

The landscape described above is where teachers act. They must meet the expectations set out in the national curriculum and facilitate the development of digital competence among students. This requires digitally competent teachers; teachers with digital confidence and with a digital repertoire that can form a basis for making educated choices about when and how technology should be integrated into the educational practice.

Each subject presented in the national curriculum is described in terms of basic skills relevant to that particular subject. For most subjects, skills in the use of digital tools and critical reflections are described. The curriculum is based on the idea of freedom of methods for teaching; yet, some methods and technological solutions are mentioned explicitly, for example, the use of spreadsheets for presenting data graphically. However, in general, teachers should be trained to choose, assess, and implement the technology that works with the teaching and learning in action. In sum, the Knowledge Promotion sets high demands on the teachers' ability to convert their digital competence into teaching in terms of the practical integration of digital tools in subject areas. On the other hand, digital competence is not explicitly defined in the National Curriculum Regulations for Teacher Education (Ministry of Education and Research, 2010). Conversely, it is incorporated in learning outcomes for each of the subject areas of the teacher training programme.

According to Wasson and Hansen (2014), Norwegian teachers are among the most digitally competent as compared to colleagues from other countries. They use ICT for a variety of tasks. Yet, there are issues to address, such as management of technology rich classrooms (Giæver, Johannesen, & Øgrim, 2013) and the role of teacher education in the training of pre-service teachers (Gudmundsdottir, Loftsgarden, & Ottestad, 2014).

Mishra and Koehler (2006a, 2006b) present the notion of technological, pedagogical, and content knowledge (the TPACK model) to describe the compound skills required for a teacher to integrate digital tools for learning in a productive way. The model is one way of describing the skills a teacher should possess in order to realize the aims of integrating digital literacy into the learning processes. According to this model, the teacher needs technological knowledge, as well as knowledge about content and pedagogy. In addition, they need the compound knowledge of issues raised from the intersections between technology, pedagogy, and content (in this model named TPACK). The main focus in the TPACK model is how to use integrated technology as a means for learning other

subject areas. However, the discussion in this article aims at illuminating the contextual and holistic nature of digital competence among teachers, namely all parts of the technology dimension, not only the knowledge that is illustrated in the intersections with content knowledge and pedagogical knowledge.

Using both the definition and the operationalization of digital literacy from Erstad as a stepping-stone, Krumsvik aims to define teacher competence in his discussion of digital competence (Krumsvik, 2014, 2007). In addition to basic skills, tools, expertise, and digital *bildung*, he presents and discusses teacher learning strategies and their ability to assess the relevance of ICT in a pedagogical setting as important competences. We strongly support this wide and compound understanding of teachers' digital competence, and will further elaborate on this.

Koschmann (1995) suggests three different approaches to what he describes as the training of computer literacy; learning *with* computers, learning *through* computers, and learning *about* computers. In the following, we will elaborate on these approaches in order to address teacher competence, and relate Koschmann's learning approaches to teaching approaches. The notion of *learning with computers*, or using computer programs as means for learning, is described as the most powerful one. However the notion of *learning through computers*, which encompasses on-line tutorials, simulations, and computer-assisted instructions, is separated from the notion of learning with computers. We will argue that technology development, in general, and changes in use patterns imposed by the Internet, make this distinction less relevant for describing the contemporary use of learning technology. Rather, the two approaches bring to mind what was previously described as using technology to learn.

Koschmann's way of describing *learning about computers* includes "the straightforward means of addressing the need for computer literacy" (p. 819). We argue that the notion of learning about ICT has become much more complex since Koschmann published this, and that a more contemporary understanding should include both basic knowledge about the technology itself, as well as *bildung* aspects like digital judgment and the role of ICT in society.

Salomon and Perkins (2005) discuss how technology effects the human intellect, and in particular, the effects of performance *with*, *of*, and *through* the use of technology. By effects with technology, they understand the technology as a partner and look for amplified performance when using technology, for instance, with improved spelling. The effects of technology are explained as effects that persist, even when technology is not at hand, exemplified by the idea of writing to read (Trageton, 2004). Effects through technology are seen as long-term effects and organizational changes; for instance, how the use of cars has changed the communication system, or how scientific inquiry is fulfilled today. There is no clear vision of teacher competence in these terms. However, Salomon and Perkins' notion of performance *with* technology is presented as having an immediate or short-term effect, while performance *of* and *through* has long term effects. Yet, all effects are to be carefully considered when trying to understand digital competence among teachers.

Unwin (2005) argues that there is a need to shift from *education for ICT* to the use of *ICT for education*. He states that teachers require a deep understanding of how the benefits of ICT may be used in teaching, rather than ICT-skills. He argues that the teaching of ICT-skills, or learning to use technology, should be reduced, at the expense of using technology for learning. In a contemporary context, these arguments can be seen as a response to the lack of technology integration in the teaching and learning process. However, we argue that as a result these kinds of critiques, as implemented in Knowledge Promotion, might have contributed to a motion away from the idea about the basic training of technology use as a necessary foundation for using technology for learning.

Buckingham (2006) presents a critical notion of digital literacy, including a conceptual framework of elements for mapping the field. According to Buckingham (pp. 267, 268), a literate person must understand how the language works, be able to evaluate the material encountered, know who is communicating with whom, and understand their audience. From a media literacy perspective he hereby emphasizes the need for critical reflection as an important part of digital competence. We argue that such awareness is to be nurtured in all aspects of the students' digital competence, and as such, be an essential part of a teacher's competence.

As mentioned above, Beck and Øgrim (2009) present three areas of required student competence: use competence, technology competence, and competence with computers in society. Use competence can of course be attained, however, in order for the students to internalize their knowledge the technology must be practiced by employing technology for learning. Finally, they argue that competence with computers in society is only achieved by being taught about information and communication technology (ICT). However, they do not include the needed teacher competence in their discussion. From our perspective, use competence, technology competence, and competence with computers in society must be taught explicitly; therefore requiring specific digital competence for teachers.

Teaching of, with and about ICT

Based on the discussion presented above, we propose that a teacher's digital competence is threefold: *teaching of, with, and about ICT*.

The teaching of ICT means to plan and facilitate the students, gradually increasing their digital competence through systematic training. This may involve hands-on training in keyboard use and programs, such as word processing and spreadsheets, the development of good search strategies and to know how to act according to source awareness, copyright, privacy and netiquette. This corresponds with Koshmann's approach to "learning about computers". In teacher education, as well as in the schools, this is a low priority area.

Teaching with ICT means using technology as a tool in other disciplines to achieve added value in learning. This area is emphasized by many (Buckingham, 2006; Koschmann, 1995; Salomon & Perkins, 2005; Unwin, 2005). The purpose is primarily to increase learning outcomes through variation in content and teaching methods, but also to contribute to the students' digital literacy by exposing them to the exemplary, diverse, and effective use of various technologies. It involves using technology carefully and systematically in the teaching of all subject areas at most times. This corresponds with Koschmann's two approaches of "learning with" and "learning through" computers. Teaching with ICT may appear to be the main focus in primary and secondary schools, as well as in teacher education. Teaching with ICT is crucial for pupils and students to become familiar and up-to-date with relevant technology for learning. However, this kind of technology use does not necessarily develop the holistic digital competence as described in the curriculum and national policies.

Teaching about ICT includes technology history and the dialectical relationship between technology and society - issues that are addressed by Sjøby (2003) and Buckingham (2006). It includes the investigation of technology development and its social and cultural significance, as well as assignments for engaging students in participating in democratic development in digital media (Beck & Øgrim, 2009). These issues are to be addressed within all teaching activities, and should build upon the digital judgment that (hopefully) is developed as a part of *teaching of ICT* and *teaching with ICT*.

DIGITAL COMPETENCE, CURRICULUM AND TEACHER COMPETENCE

As a result of the strong focus on integration in certain subject areas, many primary and secondary schools in Norway have closed down specialized computer labs and reduced the systematic training in digital tools (Engen, Giæver, & Øgrim, 2009). This implies a risk of blurring the responsibility for the students' digital literacy as a compound subject area – not only a skill for learning. This is supported by research stating that ICT is weak in teacher education (Tømte, Kårstein, & Olsen, 2013). Mobile technologies such as laptops and tablets are procured for teaching subject areas with ICT in technology rich classrooms. Digital competence as an independent discipline seems to have disappeared on the way from the definition in the White Paper (Ministry of Education and Research, 2004), through the curriculum, and into practice in the classroom. As long as the focus is solely on digital competence as integrated in subject areas, a specific kind of technological infrastructure is needed, namely that of the mobile technologies at hand. Based on the arguments given above, we ask whether the know-how dimension of digital competence has been so blurred that it has been a taken-for-granted competence area, although it is within the mandate of the curriculum.

We have presented different aspects of digital competence, and in all aspects more elements can be found. The notion of digital competence can be divided into use aspects, as represented by Erstad's operationalization; aspects of production, as represented by Tyner's tool literacy; and the comprehensive idea of *bildung* as represented by Søyby. When discussing digital competence in the context of the national curriculum, the use of ICT in learning can be divided into the use of technology for learning, learning to use technology, and critical reflection. Learning to use technology corresponds with the use of general definitions, while the use of technology for learning can be regarded as production. Critical and conscious reflection of technology-use can certainly be related to the term *bildung*. We argue that the two sets of understanding of digital competence given from general definitions, and the national curriculum and policies, constitute a stepping-stone for understanding the teacher competences that are needed. Of course, there is more to these categories than what has been somehow superficially presented and related here. Still, we believe that the relationships, as illustrated in the table below, can serve as a means for overviewing the holistic picture and illustrating the arguments for a threefold understanding of teachers' digital competence.

General definitions	Curriculum and policies	Teacher competences
Using	Learning to use technology	Teaching of ICT
Producing	Using technology to learn	Teaching with ICT
Bildung	Critical reflection	Teaching about ICT

In the third column, the digital competences for teachers and teacher trainers are presented, and categorized as teaching of, with and about ICT. The teaching of ICT is related to the use aspects of digital competence and with the idea of learning to use technology. Teaching with ICT is related to the production of digital competence and the pedagogical idea of using technology for learning. Teaching about ICT is related to the *bildung* aspects of digital competence and the idea of the critical evaluation of technology from the national curriculum.

FINAL REMARKS

During the last two decades, an emphasis on learning with technology has strongly influenced the understanding of digital competence. In this article, we have presented the motional nature of the notion of digital competence, with a particular focus on teachers' digital competence. Based on general definitions of digital competence and national policy documents, we present a threefold view of digital competence as a basis for mapping out the contextual and holistic view of teacher competence in ICT. As a result, we propose an augmented comprehension of teachers' digital competence as the knowledge needed to perform *teaching of ICT* and *teaching about ICT* as well as *teaching with ICT*.

Furthermore, we argue that this enriched understanding of teachers' digital competence should have consequences for teacher education programmes. We propose that further research should be carried out to determine in what ways teacher training can arrange for pre-service teachers to be trained in all aspects of digital competence, and consequently be able to conduct the teaching of, with, and about ICT.

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