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Digital competence at the beginning of upper secondary school: Identifying factors explaining digital inclusion

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ABSTRACT

During the last decade, information and communication technology has been given an increasingly large importance in our society. There seems to be a consensus regarding the necessity of supporting and developing school-based digital competence. In order to sustain digital inclusion, schools need to identify digital deficiencies and digital achievements. The concept of digital competence is scrutinized and discussed. This paper presents a research study including 4087 students from 24 upper secondary schools. The aim of the study was to scrutinize factors predicting students' digital competence, here operationalised as Digital judgements, To acquire and process digital information and To produce digital information. Analysis revealed substantial variation in digital competence between schools and within schools. The conditions at home, i.e. language integration and cultural capital, together with mastery orientation and academic aspirations did predict digital competence, and explained a substantial share of the total variation in digital competence. There are differences in what students mastered with ICT, and therefore, the students have various requirements. Further, the students attend heterogenic schools facing different kinds of challenges. Hopefully, the schools and teachers are willing to use the results from the test, and moreover, the test results can contribute to needs-based interventions and follow-ups.

1. Introduction

Today's school leaders, teachers, and students face an increasingly complex and challenging school environment (Ainley, Enger, & Searle, 2008; Erstad, 2008). Information and communication technology (ICT) has become an indispensable part of both the workplace and our own leisure activities (CERI & OECD, 2010). Therefore, many countries, e.g., Australia, Belgium, Hong Kong, Japan, Korea, Norway, and the US, are concerned with how ICT may impact schools and education (Cha et al., 2011; Zhong, 2011). Worldwide, plans, strategies, and programs are being developed to take action and deal with digital competence in schools (Ainley et al., 2008; Balanskat & Gertsch, 2010; Law, 2008).

According to Calvani, Fini, Ranieri, and Picci (2012), an assessment tool can provide the schools with the opportunity to analyse the students' digital competence and to plan teaching based on the students' needs. Current studies indicate diversity in students' digital competence (Calvani et al., 2012; Erstad, 2010; Krumsvik, Ludvigsen, & Urke, 2011; OECD, 2011). Since 2008, a Norwegian municipality has tested students' digital competence when entering upper secondary school. This makes it possible to scrutinize what students entering upper secondary school are able to achieve and to examine differences in digital competence between schools, classes, and individuals. Is there a digital divide between the students? The aim of this study is to explore digital competence in upper secondary schools, and to examine the factors that influence students' digital competence when entering upper secondary.

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2. Perspectives

2.1. Defining digital competence

Many concepts, e.g., digital competence (Calvani et al., 2012; Erstad, 2008), digital literacy (Alkali & Amichai-Hamburger, 2004; Aviram & Eshet-Alkalay, 2006; Erstad, 2008; Eshet-Alkalay, 2004; Gentikow, 2007; Mioduser, Nachmias, & Forkosh-Baruch, 2008), media literacy (Erstad, 2010), ICT literacy (Ainley et al., 2008; Katz & Macklin, 2007), 21st century skills (Common Core, 2009), digital skills (Zhong, 2011), computer skills (CERI & OECD, 2010) and Internet skills (van Deursen & van Dijk, 2009; Kuhlmeier & Hemker, 2007), are used to identify and analyse what students should be able to achieve with digital tools and technology (Ala-Mutka, 2011). According to Krumsvik (2008) and Calvani et al. (2012), the terms digital competence and digital literacy are often used as synonyms. It seems that the concepts, to a greater or lesser extent, overlap one another. However, there are differences. A concept such as digital skills focuses on dealing with the technical conditions, whereas digital competence and literacy are broader terms that emphasise what kind of skills, understandings, and critical reflections students are able to use. When analysing and discussing the terminology, the concepts seem to have gradually shifted focus from the simple use of digital tools, often linked to concepts such as digital skills, to broader terms, including the students' digital competence and literacy (Ala-Mutka, 2011; Calvani et al., 2012).

The concept of digital competence has been used in different contexts. Firstly, it has been used in policies related to development, innovation, and education (Ala-Mutka, Punie, & Redecker, 2008; Balanskat & Gertsch, 2010; European Commission, 2002). Secondly, it is a convenient term used by teachers and school leaders to understand what students should be able to do in school (Law, 2008). Thirdly, digital competence is a concept that has been explored and discussed in research articles (Calvani et al., 2012; Erstad, 2008). According to Ala-Mutka (2011), the research literature points to the different variants of the concepts and refers to various dimensions of digital competence that are necessary in different contexts. Students' mastery of basic tools and computer programs is only a first step towards the development of advanced knowledge, skills, and attitudes (Ala-Mutka, 2011). The development of digital competence is considered a continuum from instrumental skills into productive and strategic personal competence and cognitive skills (Calvani et al., 2012). Therefore, digital competence includes students' ability to use technology in order to consume and access information. Moreover, digital competence also includes how students make use of technology to process, acquire, and evaluate gathered information. Finally, digital competence means that students' can produce and communicate information with digital tools or media.

2.2. Aspects and categories of digital competence

When one tries to map a concept such as digital competence, it is important to provide descriptions that make it possible to specify the terms as precisely as possible in order to ensure a substantial overlap between the theoretical concept and the empirical description. In an effort to operationalize digital competence and literacy, several separate aspects and categories of it have been formulated.

There seem to be at least two main directions for operationalization. One direction is focused directly on the applications of technology, whereas the other direction concerns placing digital competence into new sub-areas of competencies and literacies.

The Educational Testing Service (ETS) (2001), the International Society for Technology in Education (ISTE) (1998, 2007) and the European Commission (EC) (2006) are examples of the first direction, with a focus on the applications of technology. In 2001, the Educational Testing Service (ETS) highlighted five aspects of digital competence. These were the ability to access, manage, integrate, evaluate, and create information. Later, they added communication and definition as two additional aspects of digital competence (Katz & Macklin, 2007). ISTE (2007) developed the National Educational Standards (NETS-S), and they distinguished between 1) creativity and innovation, 2) communication and collaboration, 3) research and information fluency, 4) critical thinking, problem solving, and decision making, 5) digital citizenship and 6) technology operations and concepts. According to the EC (2006), digital competence involves basic ICT skills, together with confident and critical use of ICT. This is a broaden approach involving skills, knowledge and attitudes for participation and learning with ICT in society (Ala-Mutka et al., 2008).

Calvani et al. (2012) and Eshet-Alkalay (2004) provide examples of the ways in which one can explain the concept of digital competence through new forms and sub-areas. According to Eshet-Alkalay (2004), visual literacy, reproduction literacy, branching literacy, information literacy, and socio-emotional literacy are five important aspects of digital literacy. The Korean Ministry of Education, Science, and Technology (MEST) developed standards for ICT competence, which were described as "technology environment competence, information knowledge competence, and society culture competence" (Cha et al., 2011, p. 992), whereas Calvani et al. (2012) distinguished digital competence into three categories with sub-domains: ICT knowledge, higher-order cognitive skills, and ethical knowledge.

2.3. Description of digital competency aims

In 2004, the Norwegian Ministry of Education and Research decided to emphasize reading, writing, mathematics, the ability to express oneself orally, and the ability to use ICT (Ministry of Education, 2004, 2006). This reform was a comprehensive shift in the emphasis on digital competence in policy (Erstad, 2006; Krumsvik, 2008), and the curriculum reform was among the first in the world to define the use of ICT as one of the essential elements in student knowledge promotion across disciplines (Søby & Egeberg, 2010).

The national curriculum consists of many digital competence aims at different levels in primary and secondary schools. Below, some examples of competence aims from secondary schools are translated (The Norwegian Directorate for Education and Training, 2006). First, there are two examples of competence aims from the subject of Norwegian. Students must use A) various media sources and aesthetic expression in their own Norwegian texts and interdisciplinary texts and B) *word processing tools for archiving and cataloguing their own work*. Second, in social science, there is a request that students be able *to read, interpret, and use paper and digital maps as well as to use scale and character maps*. Third, one competence aims in science states that students must use tools for exploration, measurement, visualization, simulation, registration, documentation, and the publication of experiments as well as for field work. Fourth, a request in mathematics is that students be able to conduct surveys and use databases to search for and analyse statistical data and display the source criticism.