Digital Natives: Digitally Competent?

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Abstract: This paper reports on the results of a survey-based study designed to collect data on first-year student teachers' digital competence. The study was based on students' self-assessment and identified first-year student teachers' use and knowledge of certain digital tools and applications. The results indicate that while frequency of use correlates with students' perceived competence, this does not necessarily correlate with efficient use of digital tools.

Introduction

The Norwegian curriculum reform of 2006 included digital skills in the five basic skills that should be integrated into every subject area (the ability to read, the ability to write, numeracy, oral skills and digital skills). Consequently, being skilled in the use of computers as pedagogical tools is now an obvious prerequisite for teachers to adequately implement Information and Communication Technologies (ICT) (Hakkarainen,Muukonene, Lipponen, Ilomaki, & Rahikainen 2001). Furthermore, educational programs in Norway regard digital competence as an important knowledge area in its own right, as it allows students to effectively participate in modernised society.

A recent study of teacher education institutions in Norway (Tømte, Kårstein, & Olsen, 2013) criticises student teachers for not being adequately prepared to teach with digital tools or teach future pupils how to be digitally literate. In this study, we raise the question of whether teacher education gives students the necessary competence to educate future pupils.

The aim of this paper is to determine and discuss the levels of digital competence of students entering teacher education studies. We consider how digitally competent the students are in comparison to the aims of the Norwegian National Curriculum (2006), which requires students leaving upper secondary school to be familiar with practical topics such as advanced search strategies and applications such as spreadsheets, word processors and presentation tools, as well as more critical aspects connected to e-safety, such as privacy rights, copyrights, information evaluation and source credibility. Furthermore, we focus on the relationship between the students' perceived competence and efficient use of digital technologies.

Digital Competence

The concept of the 'digital native' is often applied to the generation born in the digital age, and relates to debates on digital skills and digital competence (Prensky, 2001; Tapscott, 1998). Many scholars have described the contrast between the digital native generation and the generations of so-called 'digital immigrants'. Digital natives are considered to be digitally literate and capable of using digital tools extensively as a result of their familiarity with digital technology and tools from an early age. According to such approaches, today's pre-service student teachers should be categorised as digital natives. It has, however, been questioned whether digital natives are in fact as digitally competent as they are assumed to be. Prensky (2011) points out that today's students are not the kind of students that teachers in existing education systems were trained to teach.

Even though the aforementioned concepts and characteristics have dominated public discourse, their utility is debatable (Erstad, 2010). It can be argued that the use of digital technology in schools has led to overgeneralisations about the digital competence of students and future teachers. Such generalisations have resulted

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in the myth that young people are more competent than they actually are. In one longitudinal study, *Monitor 2013*, the digital competence of Norwegian students was monitored over the last 10 years (Hatlevik, Egeberg, Gudmundsdottir, Loftsgarden, & Loi, 2013). It, like other studies (Horrigan, 2007), found that the digital competence of students is aimed at consumption rather than production, meaning that despite students' extensive leisure use of social media and the Internet, their use of digital resources and digital technologies in learning contexts is not particularly advanced. Crook (2102), however, adds that it is not good enough to just claim that 'digital natives' are not so 'native', because their engagement in Web 2.0 technology is quite visible. Despite this, an analysis of literature on digital natives by Bennett, Marton and Kervin concludes that the literature 'demonstrates a clear mismatch between the confidence with which claims are made and the evidence for such claims' (p. 782). Similarly, Selwyn (2008) argues that 'aside from inequalities in access and engagement, there is mounting evidence that many young peoples' actual use of digital technologies remain rather more limited in scope than the digital native rhetoric would suggest' (p. 372).

In existing research literature, various concepts have been used to define what students can do with technology at school. Some examples of different concepts include digital competence (Ferrari, 2012, 2013), internet skills (Van Deursen, 2012; Hargittai & Shafer, 2006), digital skills (Zhong, 2011), ICT skills (Clario et al., 2012), ICT literacy (Ainly et al., 2008) and digital literacy (Gui & Argentin, 2011). However, a common feature of these concepts is that they consist of a combination of an aspect of technology with a perspective on knowledge. For example, internet skills, digital skills and ICT skills all emphasise the more operational use of technology within domains such as the Internet, ICT or digital media, whereas digital competence and literacy are broader concepts that extend beyond the operational use of ICT, including problem-solving, collaboration and creativity. In this study, we make use of a broader approach to understand how students use technology in different subjects at school by employing the concept of 'digital competence'.

In our paper, digital competence is defined as 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' (Norwegian Directorate for Education and Training, 2013, p.12). Digital competence is further operationalised in subject-specific competence aims for 2nd, 4th, 7th and 10th grades. This means that the content of digital competence differs across grades, and as students get older, we find increased scope and depth in terms of expectations for usage patterns, understanding and skills. One issue that we bring up is that different roles in schools involve different needs with regard to digital competence. For example, the type of digital competence needed by a pupil at school is not the same as the digital competence needed by a teacher or a school leader. At the very least, we expect teachers to have the same level of digital competence that they are required to teach their students.

Krumsvik (2007) addresses four dimensions of digital competence: basic ICT skills, pedagogical-didactical ICT awareness, learning strategies/meta-cognition and digital literacy. Krumsvik (2007) links pedagogical-didactical ICT awareness to Shulman's pedagogical content knowledge. Mishra and Koehler's (2006) concept of TPCK (technological pedagogical content knowledge) also builds on Shulman's pedagogical content knowledge. Both Krumsvik (2007) and Mishra and Koehler (2006) point out that teachers need more than just digital skills, and that digital competence for teachers is related to both subject and content knowledge, as well as pedagogical and didactical knowledge.

In relation to Mishra and Koehler's TPCK, we raise the question of what is and should be contained within the category of technological knowledge. If we relate technological knowledge to the aims of the Norwegian national curriculum, this means that teachers need in-depth knowledge of topics such as advanced search strategies, spreadsheets, word processing and presentation tools, as well as more critical aspects connected to e-safety, such as privacy rights, copyrights, information evaluation and source credibility. In addition, however, teachers need to know when it is appropriate to use digital tools and applications, which tools to use and what the societal and personal implications of their use are. Taken together, this means that teachers must be able to draw on a wide portfolio of digital tools, have practical skills, know how to use digital tools and, perhaps most importantly, be able to impart this knowledge to their pupils and integrate it into their teaching of different subjects. In this paper, we focus on student teachers' self-reporting of their practical skills, their perceived digital competence and how they actually use digital tools and applications in selected settings.

Methodology

Sample

At the end of August 2013, we carried out an online study of first-year student teachers during their introductory programme. A total of 389 first-year student teachers were invited to participate in the study. The

students received an email with information about the study and a link that led them to a survey. A total of 284 students participated in the study. This response rate of 73% of the target group is acceptable, although we had hoped for a higher level of participation. We do not have any information about the students not willing to participate in the study.

This survey was the first phase of a longitudinal study designed to investigate student teachers' development of digital competence and their preparedness to integrate ICT into their teaching and preparation in order to fulfil the aims of the Norwegian National Curriculum (LK06). We intend to repeat the survey with the same group of students in two years.

Instruments

The student teachers were given multiple choice questions about frequency of use, perceived competence and actual competence and use patterns for different digital activities. With regard to frequency of use, the students were asked questions about how often they used text editors (e.g. Word), spreadsheets (e.g. Excel), internet search strategies, photo editing applications and social networking platforms. These responses were coded as 'frequent use' if the students reported daily or weekly use, and as 'seldom' if the students used the technology less frequently than weekly. Furthermore, the students were asked to assess their own competence, with regard to their ability to use text editors or spreadsheets, internet search engines, photo editing applications and social networking sites, choosing from the categories 'very good', 'good', 'average', 'poor', and 'very poor'. In the description and analysis of the results we have combined the categories 'very good' and 'good' to 'good' and 'very poor' and 'poor' to 'poor' in order to summarise the results.

Finally, the students answered questions that aimed to measure their actual digital competence. These answers were formed as statements on a given task, such as 'When I search for "Thor Heyerdahl" and want to omit results from Wikipedia, I…'. The students were then given three or four options such as 'I just write "Thor Heyerdahl"', 'I write "Thor Heyerdahl" -Wikipedia' or 'I write "Thor Heyerdahl without Wikipedia"'. We have chosen indicators that indicate an overall competence in the different applications. For example in text editors the use of built-in heading styles is an indicator of competence in overall use of text editors.

Results

A total of 284 students participated in the study, of which 73% were female and 27% were male. Of these students, 94% were 30 years old or younger, while 47% were from 18 to 20 years old. The number of respondents varies as this depends on whether the students answered the question.

Table 1: Students' use of digital tools and media.

How often do you:	Frequent (daily/weekly)	Seldom (less than weekly)
Carry out a search on the Internet, for example by using Google, Yahoo or Bing?	99%	1%
Engage in social networking (e.g. Facebook, Google+)	98%	2%
Use a text editor (e.g. Word, Pages)	65%	35%
Publish pictures on social networks (e.g. Facebook, Google+, blog)	35%	65%
Use a spreadsheet (e.g. Excel, Numbers)	30%	70%
Edit digital photos (e.g. Photoshop, Picasa, Gimp)	21%	79%

The majority of the students reported frequent (daily or weekly) use of internet search engines (98%), social networking sites (98%) and text editors (65%). However, only a minority of students reported frequently publishing pictures, using spreadsheets or editing digital photos. Based on these findings, we decided to further scrutinise students' perceived competence and efficiency in using the tools and media that they reported frequently using, as we assumed that the students would be more capable of assessing activities that they were familiar with. Table 2 presents information about students' perceived digital competence in carrying out three activities: internet searches, social networking and text editing.

Table 2: Students' perceived digital competence in searching on the Internet, social networking and using text editors.

How do you perceive your competence in carrying out the following activities?	Searching on the Internet (e.g. Google, Yahoo, or Bing)	Social networking (e.g. Facebook, Google+)	Using a text editor (e.g. Word, Pages)
Good	94%	63%	80%
Average	5%	24%	17%
Poor	1%	13%	3%

The findings show that most students perceived their competence in searching the Internet to be good. Eight out of ten students perceived their competence in using text editors to be good, while roughly six out of ten perceived their competence in social networking to be good.

This section addresses the results of cross-tabulations of perceived digital competence and actual digital competence or efficiency, with regard to three activities. First, table 3 presents information about the relationship between perceived digital competence in searching on the Internet and efficient search strategy.

Table 3: Students' perceived digital competence in searching on the Internet and efficient search strategies.

When I use a search engine to search for information about "Thor Heyerdahl" and want to exclude hits from Wikipedia, I…	Students' perceived digital competence		
	Good	Average	Poor
Write 'Thor Heyerdahl' in the search field.	68%	88%	50%
Write 'Thor Heyerdahl' -Wikipedia in the search field.	23%	0%	0%
Write 'Thor Heyerdahl without Wikipedia' in the search field.	9%	13%	50%
(N=284)	(266)	(16)	(2)

The findings in table 3 show that only 23% of the 266 students who perceived their level of competence to be 'very or rather good' reported using a Boolean search, which is recognised as the most efficient strategy for searching online, and is part of the competence aims for lower secondary schools. Interestingly, we find no significant correlation between perceived competence and efficiency of searching.

Table 4 presents information about the relationship between perceived digital competence in social networking and students' legal use of pictures.

Table 4: Students' perceived digital competence in social networking and their legal use of pictures.

Johanna has produced a text with several pictures. Is Johanna allowed to publish the text on the Internet without having copyright to the images?	Students' perceived digital competence		
	Good	Average	Poor
Yes, but only if she gets permission from the copyright holder.	67%	70%	71%
Yes but Johanna must apply to the Norwegian data protection authorities for permission.	3%	2%	10%
Yes, but Johanna must cite the photographer.	30%	28%	21%
(N=273)	(183)	(69)	(21)

The results indicate that while 67% of the students who perceived their competence in social networking to be 'very or rather good' were able to give the correct answer about copyrights, 71% of the students who perceived their competence to be poor and 70% of the students answering 'neither/nor' were capable of giving the correct answer. This indicates that there is no significant correlation between perceived competence and actual competence with regard to this topic.

Table 5 presents information about the relationship between perceived digital competence in using text editors and the efficient use of headings in texts.

Table 5: Students' perceived digital competence in using text editors and efficient use of headings in texts.

	Students' perceived digital competence		
When writing assignments with headings, I…	Good	Average	Poor
Highlight the text and make it bold and/or italic, and then make the text bigger.	52%	56%	67%
Use the word processor's built-in heading styles.	47%	42%	33%
Do not use headings.	1%	2%	0%
(N=283)	(229)	(48)	(6)

The findings presented in table 5 show that only 47% of the students who perceived their competence to be 'very or rather good' used heading styles in text editors, while 33% of the students who perceived their competence to be 'poor' used heading styles in word processors. There is thus no significant correlation between these variables.

Finally, table 6 presents information about the relationship between perceived digital competence in using text editors and competence in creating a table of contents in a text editor.

Table 6: Students' perceived digital competence in using text editors and efficient creation of a table of contents in a text editor.

	Students' perceived digital competence		
When I make a table of contents, I…	Good	Average	Poor
Create it manually after the text is complete and check that the page numbers are correct.	54 %	56 %	33 %
Create a table of contents based on the heading styles.	31 %	31 %	50 %
Never use a table of contents.	14 %	13 %	17 %
(N=283)	(229)	(48)	(6)

The findings presented in table 6 show that only 31% of students who perceived their competence to be 'good' use the most efficient strategy for creating a table of contents. Interestingly, 31% of the students who answered 'neither/nor' with regard to their competence in text editing also reported using the most efficient strategy for creating a table of contents. Similarly, among those considering their skills to be 'poor or very poor', a total of 50% created a table of contents based on heading styles, while 33% created a table of contents manually. We found no significant correlation between the variables.

Discussion

As mentioned in the introduction to this paper, in 2006, the ability to use ICT was embedded in the Norwegian curriculum as a key competence across all subjects, from primary school through to upper secondary,

making digital competence crucial for teachers and student teachers. Our analysis shows that there were inequalities in engagement with ICT among the students participating in this study, the majority of whom were between 18 and 29 years old. Some of these students were frequent users of and participators in digital activities, whereas others were less frequent and experienced users. The results also showed variations between activities. For example, students spent more time on social networking and online searches than on using spreadsheets and editing photos. Our findings show that on average, the students spent little time on more advanced programs and activities. Overall, the diversity in their levels of engagement supports Selwyn's (2008) findings that young people's competence with and use of technology is more limited than expected.

Student teachers' perceptions of their digital competence suggest that they are digitally competent with regard to the topics addressed in this study. However, when their perceived competence is considered in light of their answers about the efficient use of technology, there appears to be a mismatch between perceived competence and their actual levels of efficiency in using technology. In three of the four cross-tabulated tables presented in the 'results' section, only a minority of students who perceived their levels of competence to be good were able to select the most efficient strategies. The exception is that two out of three students who perceived themselves as having good levels of competence in social networking knew that they had to get permission from a copyright holder of a picture in order to publish it online.

According to Hargittai and Shafer (2006), asking someone about their perceived competence measures their perceptions and self-confidence, as well as their competence or efficiency in using technology. This has at least two implications for the measurement of digital competence. First, it indicates that it can be difficult for students to be aware of their actual levels of competence, and thereby their need for instruction and guidelines, when it comes to technology. This can lead the students to opt out of courses on topics such as using word processors or searching on the Internet because they believe themselves to have high levels of digital competence, even if they are not actually efficient or experienced users of word processors or search strategies. Second, it suggests that when researchers or educators want to examine the level of competence in a group, such as young people in general or student teachers in particular, it is important to take into account both self-reports and other measurements.

The student teachers in this study had a tendency to overrate their skills with applications that they often used, such as word processors, as shown by their reports on use. Our study suggests that while mastery of certain skills, such as image processing, correlates with frequency of use, there is no evidence of this correlation with other applications. This is in line with the findings of other studies (Goldhammer, Neumann, and Keβel, 2013; Hargittai and Shafer, 2006; Hatlevik et al., 2013).

There are two limitations to this study. First, the response rate was 73%, and we do not have information about the 27% that did not participate. Second, we used single items instead of factors to identify use patterns, perceived competence and efficient use. Using factors could provide more information about the validity and consistency of the participants' responses.

In conclusion, we find that measuring use patterns and perceived competence does not provide information about what students are actually able to achieve with technology. Furthermore, it is evident that the use of technology in itself is of limited value for our future teachers if it is not supplemented with clear pedagogical visions and learning aims that are important for the learners of the 21st century, and which focus on vital issues such as collaboration, problem solving, innovation and participation, to name but a few.

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