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A Comparison Between Digital Competence in Two Nordic Countries' National Curricula and an International Framework: Inspecting their Readiness for 21st Century Education

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Abstract

This study investigates the objectives and competence aims in the digital competence curricula of two Nordic countries for compulsory education and an international framework, DIGCOMP. The main aim of the study is to analyze the visions and main features of the Norwegian and Swedish national curricula, and inspect the extent to which they align with the DIGCOMP framework. The results show that the underlying visions and objectives of the frameworks largely converge. However, there are large discrepancies between the national curricula and DIGCOMP regarding the structure, the content covered (e.g., competence aims) and the instructional aspects. The findings and their implications for researchers, policy makers and curriculum developers are discussed.

Keywords: Curriculum analysis, Digital competence, Compulsory education, 21st century skills,

Introduction

Technological advancements and the increased availability of ICT resources affects young people in several ways, and has become an extensive part of their lives. Moreover, ICT plays a significant role in the economic, social and educational reforms, and has created changes in the teaching and learning environments. Therefore, digital competence has achieved increased attention and is regarded as a crucial competence in 21st century education (Griffin, McGaw, & Care, 2012). It is therefore important to help students master ICT and develop digital competences to successfully participate in education, work, and society (Griffin et al., 2012). Accordingly, several international initiatives have developed frameworks which outline and detail the specific knowledge, competences, attitudes and skills that students need to become sufficiently digitally literate. In line with the international drives, several Western countries have initiated curricular reforms, and formally integrated digital competence in the national curricula (Balanskat, 2009; Voogt & Pelgrum, 2005). These changes have brought into play a compulsory dimension to teaching and learning with technology, and provide the schools with guidelines on what the national government expects from them regarding ICT (Vanderlinde, van

Braak, & Hermans, 2009), making it less dependent on the willingness and individual initiatives of teachers (Aesaert, Vanderlinde, Tondeur, & van Braak, 2013). Nevertheless, the national digital competence curricula are diverse and differ in several ways. Moreover, there is no consensus about the features of such technology related curricula (Fraillon & Ainley, 2010).

This study compares the visions, aims and the content features of digital competence in the national curricula of two Nordic countries; Norway and Sweden, and the international framework; DIGCOMP (A framework for developing and understanding digital competence in Europe; Ferrari, 2013). The main aim of this study is to investigate how the international framework and the national curricula are organized and described, and the extent to which the digital competence curricula in Norway and Sweden are aligned with the international framework. Given that the national curricula guide the ICT use and integration, such knowledge seems crucial to identify whether and how the students are prepared for education in the 21st century.

Theoretical Background

Digital Competence

In the research literature, a myriad of concepts (e.g., ICT literacy, digital skills, computer literacy, ICT fluency, technological literacy, Internet skills, information literacy, media literacy) are used to describe knowledge, skills, and attitudes related to digital technology (Ala-Mutka, 2011; Law, Lee, & Yuen, 2009). Even broader concepts such as new literacies, generic skills, and 21st century skills are used to describe ICT related competences. Efforts have been made to clarify and distinguish between the concepts in order to identify similarities and differences (Lankshear & Knobel, 2008). Yet, this seems to be a challenging task, and many researchers have concluded that most of the terms are used interchangeably and largely reflect the same content (Law et al., 2009; Søby, 2013). Moreover, a comprehensive examination of the relevant concepts and their underlying meanings is out of scope for this paper. In this paper, the term digital competence is used for describing students' knowledge, skills, and attitudes related to ICT in formal education. The primary reason for this choice is the wide use of the concept internationally, and particularly in the educational systems in the European countries as the term is established in the educational policy- and decision making, and research communities. Moreover, competence in the Nordic languages is understood in a similar way as the concept of literacy in the English language, and is broader than for instance skills. Moreover, in the Nordic languages it largely reflects the German term "bildung" which means to be literate (Søby, 2003). Note that even though digital competence is the dominant term in this paper, the terms ICT literacy, ICT competence and digital literacy are used synonymously as they are closely related and connote to a large degree comparable frameworks, include converging competences, and are extensively used in educational research (Siddiq, Hatlevik, Throndsen, Olsen, & Scherer, 2016).

Definition of Digital Competence

Digital competence has been defined as "the interest, attitude, and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate, and evaluate information; construct new knowledge; and communicate with others in order to participate effectively in society" (Lennon et al., 2003, p. 8). This definition is in line with several other definitions of digital competence and ICT literacy (Educational Testing Service, 2007; Ferrari, 2013) which reflect the importance of confident and critical use

of ICT for fully participating in the knowledge society. The definition of digital competence in the frameworks and curricula is vital as it may reflect the rationales for educational technology use. For instance, Tondeur and colleagues (2007) described the four rationales underlying technology implementation as: an economic rationale, educational rationale, social rationale and the catalytic rationale. These four rationales drive national educational technology policies and are strongly related to the dominant rationales of curriculum development. Hence, the definitions used in the frameworks will be studied and analysed with regard to these rationales. Such knowledge could potentially illustrate the underlying visions and aims of the national curricula and the international frameworks, and support comparisons between them. Moreover, differences between the underlying visions and aims of the frameworks may contribute to further differences in the content (i.e., learning goals or competence aims).

Digital Competence frameworks

Like the large number of concepts reflecting ICT competences in education, there are also a great number of frameworks aimed at outlining the expected knowledge, skills and attitudes in order to become digitally competent. While some digital competence frameworks have been developed as international initiatives and collaborations (e.g., Binkley et al., 2012; Fraillon, Schulz, & Ainley, 2013), others are founded in the national curriculum context. The international frameworks tend to have broader vision and aims, and are partly novel when introduced, while the national curricula tend to be inspired by the international drives in different ways and are founded in the believe that such competences should be part of students' learning. In several studies, researchers have systematically compared international frameworks to investigate the commonalities and differences between these (Voogt & Roblin, 2012). There are also examples of comparisons between national educational technology curricula (Aesaert et al., 2013). Yet, such studies conducted comparisons on an overall level and not including the competencies within the frameworks or curricula. Moreover, there is limited access to studies which have investigated the comparability between international digital competence frameworks and the national curricula, which could potentially reveal the strengths and deficiencies of each, the alignment between them, and to what extent the national contexts prepare their students for 21st century education.

In the following section the reasons for selecting the DIGCOMP framework, and the national curricula of Norway and Sweden in this study is provided.

Criteria for selecting the international framework and the national curricula

DIGCOMP: A framework for developing and understanding digital competence in Europe

The DIGCOMP framework was selected as the key framework in this study for categorizing the competences in the remaining frameworks. DIGCOMP was initially developed by the European Commission (Ferrari, 2013), and is based on (a) a review of 15 frameworks of Digital competence; (b) a conceptual mapping (Ala-Mutka, 2011); (c) a collection and analysis of case studies (Ferrari, 2012); and (d) a delphi study including opinions of relevant stakeholders and experts (Janssen et al., 2013). Note that the main purpose of the DIGCOMP framework is to detail a conceptual understanding of digital competence for education. Nevertheless, it has been applied to empirical studies, and for instance Siddiq and colleagues (2016) proved that a slightly revised version of DIGCOMP was sufficiently profound and broad for categorizing digital competence assessments. Hence, the revised DIGCOMP (Appendix A, or for more details see Siddiq et al., 2016) is utilized in this paper as a blueprint to perform comparisons with the national curricula.

The Norwegian and Swedish national curricula

In the Norwegian national curriculum, Digital competence is described as one of the five basic key literacies (along with reading, writing, oral skills, and numeracy) to be integrated with the competence aims of the school subjects in compulsory education (i.e., grade 1 – 13) (Norwegian Directorate for Education and Training, 2012). Moreover, Norway has received much attention as being one of the first countries to integrate digital competence formally in its curriculum in 2006 (Balanskat & Gertsch, 2010), and was therefore included in this study.

On the other hand, the Swedish national curriculum was recently (March 2017) revised, and digital competence has been integrated into the Swedish national curriculum (Lgr11, 2017) for the first time. Thus, including the Norwegian and Swedish curricula might result in findings related to the time of inclusion, and the maturity of the field as digital competence (both the concept and the frameworks) have changed across time (Erstad, 2010; Martin, 2006).

The Curriculum Model

The curriculum model, which was built on the work of Goodlad, Klein, and Tye (1979) distinguishes between the intended, the implemented, and the attained curriculum (Van den Akker, 2003). This conceptual framework of the curriculum model has often been applied as the domains of analysis in studies on general education (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009), and ICT in education (Voogt & Roblin, 2012). The *intended curriculum* level represents the learning goals intended for students to achieve and how the educational system should be organized to facilitate these. This typically include the rationale and goals for learning (e.g., competence aims). Next, the *implemented curriculum*, represents what is actually taught in schools or classrooms, the characteristics of those teaching it, and how it is taught. The *attained curriculum* describes students' outcomes and characteristics, and is typically related to assessment of the intended curriculum (i.e., learning goals, competence aims) and reflects the implemented curriculum (i.e., what has been taught). As illustrated, the three representations are interconnected. Markauskaite (2006) emphasised that "in order to develop a comprehensive understanding of ICT literacy policies and practices in specific contexts, all three domains should be investigated" (p. 6). However, a detailed analysis of all three curriculum representations is out of scope for this study. Hence, while the primary focus is on the intended curriculum, the implemented and attained curriculum representations are included by investigations of whether the curricula contain or are accompanied with guidelines or requirements related to these. Hence, the conceptual framework of the curriculum model is used as guiding principles in the process of developing a framework for analysis in this study. Furthermore, the three curriculum representations align well with the three curriculum clusters or components: *visions, competence aims/features,* and *instructional aspects* derived from Madaus and Kellaghan's (1992) six curriculum components. The three curriculum clusters have proved useful in previous studies on comparisons of different national educational technology curricula curricula (Aesaert et al., 2013). Hence, to facilitate the comparative analysis these three clusters will be applied to guide the analysis in this study.

The Present Study

Given that few studies have compared the content features of national digital competence curricula and international frameworks in a systematic way, this study aims at contributing to this gap. First, the international framework; DIGCOMP (Ferrari, 2013) is described as it represents and provides information about what is emphasized by international authorities. Second, the Norwegian and Swedish national digital competence curricula will be described and analyzed, and finally compared to the DIGCOMP framework.

More specifically, the following research question is addressed:

RQ1. Which visions, competence aims and instructional aspects are described in the Norwegian and Swedish national curriculum and how do the frameworks align with the international framework?

Method

As described in previous section, the three key clusters: *visions, competence aims* and *instructional aspects* were selected based on relevant curriculum models for guiding the comparative analysis. More specifically, a qualitative analysis of the textual documents has been carried out in three consecutive phases (Wolcott, 1994). The first phase consisted of descriptive readings to establish what the key aims and purposes of each framework are, to identify the structure of the frameworks, and in particular, which features and aspects of digital competence are provided. In the second phase, one framework was selected as the key framework for carrying out the comparative analysis of the content of the remaining frameworks. The third phase consisted of comparisons between the international framework, and the Norwegian and Swedish curricula which serve as examples of operationalizations of digital competence in national educational context.

Analysis and Results

RQ1. Which visions, competence aims and instructional aspects are described in the Norwegian and Swedish national curriculum and how do the frameworks align with the international framework?

The DIGCOMP Framework
The DIGCOMP framework has defined digital competence as "the confident, critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society" (Ferrari, 2013, p. 2). DIGCOMP structures digital competence by specifying five levels - with increasing conceptual resolution. As shown in Table 1, the first level of the framework comprises six competence areas: *Information, Communication, Content Creation, Safety, Problem Solving,* and *Technical Operational Skills*. Each competence area consists of a number of competences (level 2; Table 1, e.g., 1.1 Browsing, searching, and filtering information), which are further fine-grained and descriptions of proficiency levels for each competence are outlined (level 3). The fourth level outlines examples of knowledge, skills, and attitudes applicable to each competence. The last and fifth level displays a contextual elaboration by providing examples of the applicability of the competence for different purposes (e.g., learning and employment). Please note that the levels 3 to 5 are not shown in Table 1 given the increased level of detail in each (see Ferrari, 2013 for further descriptions of the competences, and the proficiency levels in the framework).

Comparisons Among the DIGCOMP and the two National Frameworks
The revised DIGCOMP framework (Siddiq et al., 2016) with the six competence areas and the competences within each is the starting point for a brief comparison, as shown in Table 1. It is beyond the scope of this paper to provide an exhaustive comparison of the frameworks with a full review and synthesis of every detail included. The following overview's sole purpose is to provide enough detail in order to highlight the similarities and differences of specific relevance to allow for an overarching discussion of the findings in this study.

Table 1. A comparison among the revised DIGCOMP framework, and the Norwegian and Swedish digital competence curriculum.

DIGCOMP	**Norwegian curriculum**	**Swedish curriculum**
Competence areas and competences	**Categories**	**Competence aims**
1. Information 1.1 Browsing, searching, and filtering information 1.2 Evaluating information 1.3 Storing and retrieving information	**Search and process**	**Information**
2. Communication 2.1 Interacting through digital technologies 2.2 Sharing information and content 2.3 Engaging in online citizenship 2.4 Collaborating through digital technologies	**Communicate**	**Communication**
3. Content creation 3.1 Developing content 3.2 Integrating and re-elaborating 3.3 Copyright and licenses 3.4 Programming	**Produce**	**Developing content** **Programming**
4. Safety 4.1 Protecting devices 4.2 Managing and protecting personal data 4.3 Protecting health 4.4 Protecting the environment 4.5 Netiquette	**Digital judgment**	
5. Problem solving 5.1 Solving problems with use of digital technology 5.2 Collaborative problem solving 5.3 Innovating and creatively using technology 5.4 Identifying digital competence gaps		
6. Technical operational 6.1 Solving technical problems 6.2 Identifying needs and technological responses 6.3 Basic technical skills		

The Norwegian Digital Competence Curriculum

The definition of digital competence in the Norwegian curriculum includes what is understood by digital competence and emphasizes that digital skills are "a prerequisite for further learning and for active participation in working life and a society in constant change" (Norwegian Directorate for Education and Training, 2012, p. 12). Digital competence is described as a basic key literacy, and is based on the idea that the basic literacies contribute to the development of the subject competences while also being a part of them. Hence, the Norwegian national digital competence curriculum consists of a framework of digital competence, and is also described in the subject curricula (Norwegian Directorate for Education and Training, 2010). Since the digital competence described in the subjects is derived from the framework, the main unit of analysis in this study is the framework.

The Digital competence framework is outlined in a grid and consists of four categories, namely: Search and Process, Produce, Communicate, and Digital Judgment. For each of these categories, descriptions of the progression through five levels are provided, and each competence category (i.e., the cells) in the grid

formulates performance standards at that level (Appendix B). The framework continues by stating that "the requirements are general and serve as a basis and point of reference for developing subject and grade relevant competence aims" (Norwegian Directorate for Education and Training, 2012, p. 5). Moreover, it is stated in the framework that each subject curriculum group needs to "make decisions on which grids, cells, and levels are relevant for their subject as well as for different age groups of students, and formulate competence aims based on these decisions" (Norwegian Directorate for Education and Training, 2012, p. 5).

The instructional aspects (i.e., assessment, curriculum materials, transactions and processes) have not been described in the Norwegian digital competence curriculum.

Comparisons Between the Revised DIGCOMP Framework and the Norwegian Digital Competence Curriculum

A comparison between the revised DIGCOMP framework and the Norwegian Digital competence curriculum as shown in Table 1, indicates that the competence areas Information, Content Creation, and Safety in the DIGCOMP framework are to some extent covered in the Norwegian curriculum, whereas the competence areas Communication and Problem Solving are to a great extent lacking. Hence, the Norwegian framework lacks descriptors related to the more generic 21st-century skills (e.g., Communication, Collaboration, Problem Solving, Creativity; competence areas 4 and 5 in the revised DIGCOMP framework).

The largest difference between the two is that the Norwegian curriculum is less detailed, and many of the single competences in DIGCOMP are included in the level descriptions instead (see Appendix B for an overview of the Norwegian framework). For instance, the category Search and Process is described at level 1 as "can read hypertexts and simpler interactive information …," whereas the description at level 2 is "can make simple digital searches, and read and interpret information from digital sources …" and at level 3 continues by stating "can choose and use search strategies and assess information from digital sources …". Similarly, levels 4 and 5 describe further ability expectations of students at these levels. While Browsing, Searching and Filtering Information (1.1) and Evaluating Information (1.2) are formulated as two separate competences in DIGCOMP, they are regarded as levels of higher complexity under the content category Search and Process in the Norwegian curriculum. This indicates that students at higher levels of digital competence are expected to manage evaluation of information and use proper search strategies, whereas students at lower levels are not expected to be able to search for or assess information. These findings point toward the insufficient structure of the Norwegian framework, which challenges further comparisons. In particular, one categorisation level corresponding to competences in DIGCOMP is missing (see Table 1), which potentially could bridge the topical content (i.e., labelled as categories in the framework; see Appendix B) and the ability level descriptors.

Moreover, the five level descriptors in each category in the Norwegian Digital competence framework do not correspond with the grades in the Norwegian educational system (i.e., 13 years of compulsory education), and further explanations regarding this link are not provided (see Norwegian Directorate for Education and Training, 2012). It is stated in the Norwegian Digital competence framework that the ambitions specified in the framework are to be included and operationalized in the subject-specific curricula, and the task is primarily given to the subject expert groups. However, there are no explicit descriptions of what should be integrated into which subjects and during which year of schooling.

The Swedish Digital Competence Curriculum

Digital competence has only recently been integrated into the Swedish national curriculum. These changes aim at clarifying and reinforcing digital competence in the curriculum, syllabi and subject plans for elementary and secondary schools. Moreover, the governmental body states that the main purpose is to emphasize the school's mission to strengthen students' digital competence. It has been highlighted that these changes will affect the duties of principals and teachers, the role of the school library and the teaching of individual subjects.

Although, emphasis has been put on digital competence in the Swedish curriculum in general, the concept appears twice in the document, and a stand-alone section including further definitions and clarifications of how the concept should be understood is lacking. Yet, in the note regarding the revisions (Lgr11, 2017, p. 2) a short description of which sections have been revised is included. Nevertheless, in a separate commentary from the educational authorities (Skolverket, 2017), the background and conceptual understanding of digital competence has been described along with how the aspects of digital competence have been expressed. Secondly, comments on the changes made in the subject syllabi are described, and examples of how the students will be given the prerequisites to develop the various aspects of digital competence are provided. It should be noted that the Swedish curriculum lacks one distinct framework which outlines digital competence. Therefore, the two official documents: the curriculum (Lgr11, 2017) and the commentary (Skolverket, 2017) were analysed in this study as they describe the digital competences included as part of the subject aims, and the background, the overarching aims and objectives of the digital competence curriculum.

In the commentary, digital competence is described as a dynamic concept which changes across time. Moreover, a short review of different contexts describing the concept of digital competence are provided, and in particular the descriptions of digital competence in the EUs key competencies are emphasized. The Swedish definition is based on these descriptions, and outlines which competence areas it includes and its importance for "understanding the transformation digitalization entails in society including the possibilities and risks, and to participate in the development of the society" (SOU 2015:28, p. 8).

The analysis of the competence aims was conducted by locating the digital competence descriptions in the subject syllabuses and compared to the level 1, 2 and 3 descriptions in the DIGCOMP framework. Consequently, the labelling in Table 1 under the Swedish curriculum is not identified from the curriculum, yet given by the researchers as they were matched.

The instructional aspects (i.e., assessment, curriculum materials, transactions and processes) have not been described in the Swedish digital competence curriculum.

Comparisons Between the Revised DIGCOMP Framework and the Swedish Digital Competence Curriculum

The lack of a specific digital competence framework in the Swedish curriculum challenges the comparisons with the DIGCOMP framework. Yet, the descriptions related to digital competence throughout the subject syllabuses (i.e., aims) were identified and compared to the DIGCOMP framework.

In the Swedish curriculum, the competence areas Problem solving and Safety are lacking. This is also the case for the area Technical operational skills, yet this may be covered in the subject Teknik (Lgr11, 2017; Rasinen, 2003). Also, the revised curriculum has included programming as part of mathematics, in which problem solving is described as an aspect – yet, problem solving in digital environments is not described directly or in other subjects (Skolverket, 2017).

Discussion

In the following sections, the overall findings of the study will be discussed related to the structure of the frameworks and the three clusters: visions and objectives, competence aims/features, and instructional aspects.

Structure of the frameworks

The results show that the structure of the international frameworks and the Norwegian and Swedish digital competence curricula differ. While, the DIGCOMP framework is developed across levels with increasing progress and level of difficulty, this is less visible in the Norwegian curriculum, even though it contains level descriptions – yet, these do not describe levels, rather competences. The Swedish curriculum seem to lack levels in the curriculum as no pattern of increasing progression within the competence areas could be identified. This may challenge the implementation of the framework and consequently the development of students' digital competence.

Moreover, the level of detail in the descriptions of the competence aims in the two national curricula is kept superficial, which can potentially lead to a greater variation in how the curricula are interpreted by schools and teachers, and to what extent the digital competence aims are taught (Aesaert et al., 2013).

Visions and Objectives

The three frameworks emphasize the importance of digital competence for coping with the transformation entailed by technology and to participate in the society. Hence, the social rationale (Tondeur et al., 2007) is the most prominent in these frameworks. Yet, this focus is not unique as this has been highlighted in several national and international educational technology reforms (OECD, 2015). In addition, the pursuit of equity and educational reform is also recognisable in the argumentation of the importance of digital competence. Even though the economic rationale is not mentioned explicitly in the Swedish and Norwegian curricula, the focus on the social and catalytic rationales are related to the underlying economical- and educational aspects as argued by Aesaert and colleagues (2013). These results slightly expand the view that the educational and social rationales are mainly prominent in the introduction of digital competence in the school curricula (Voogt, 2008).

Because this study is mainly concentrated around which competences the three frameworks promote that the learner should attain, the focus on the visions and objectives was kept lower. Hence, comprehensive descriptions of the visions were not analysed in detail, yet the focus was kept on the definitions of digital competence. Therefore, future research may further explore the rationales underlying the curricula and the alignment between these.

Competence aims

The specific content of the DIGCOMP framework and the national curricula vary. The national curricula and DIGCOMP share the key competence areas *Information, Content-creation* and *Communication* to some extent. For instance, not all the competences described under the competence area *Communication* are covered in the Norwegian and Swedish curriculum. The national curricula cover communication briefly, and emphasizes the asynchronous communication which is typically operationalized as presenting a specific theme or topic to specific audience using suitable technology (Lgr11, 2017; Norwegian Directorate for Education and Training, 2012). Moreover, computer-supported synchronous communication, collaboration or collaborative problem solving is not mentioned in the curricula. The lack of such

competence might be challenging for students while entering work life, as collaborative problem solving among others is sees as a critical competence in the 21st century (Care, Scoular, & Griffin, 2016).
In the Swedish curriculum, the competence area *Safety* is lacking. This is surprising considering that digital technology is the preferred platform for communication between young people today, and we cannot anticipate that all young people are capable of learning how to behave appropriately and protect themselves in online environments. Moreover, recently researchers have emphasized the importance of teaching media literacy (e.g., the ability to access, analyze, evaluate, create, and act using different forms of communication) in schools for countering for instance "fake news" (Bulger & Davison, 2018). Moreover, Bulger & Davison (2018) recommend the development of curricula for addressing the need to be able to address user behavior in addition to interpretation, and the importance of assessment to monitor and measure students' competences within this competence area.

Even though, the digital competence aims in the Norwegian and Swedish curricula are cross-curricular, they are not always equally integrated into the subject-specific aims. For instance, whereas some of the goals clearly describe the digital competence and the subject content the students should acquire, others seem to pay less attention to the digital competence dimension. E.g., in the biology subject curriculum (Lgr11, 2017), the competence aim "documentation of scientific studies with text, image and other forms of expression, both with and without digital tools", is more relevant for the biology dimension than the digital competence. There are a number of such examples in both curricula, which may cause even larger variations in the teaching of digital competence. Moreover, researchers have argued that clear and univocal definitions aid the implementation of a curriculum (Virkus, 2003).

Instructional aspects

Assessment
None of the studied countries have dedicated a separate part of its digital competence curriculum to instructional aspects. In contrast, the English curriculum contains an elaborated section 'curriculum in action' which translates the competence aims into real classroom activities (Aesaert et al., 2013). Moreover, while in some countries the assessment of digital competence has been a critical part of monitoring the extent to which the students are digitally literate by performance-based tests (Siddiq et al., 2016), self-reporting (ITU monitor, 2009) or participation in international comparative studies (such as the International computer and information literacy study (ICILS); Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014) there has, to my knowledge, not been conducted a such study in Sweden. Monitoring students' digital competence is important from several perspectives. For instance, for investigating to what extent students' have developed the sufficient levels of digital competence, to evaluate and revise the curriculum, and to plan efficient interventions directed towards teachers and/or students. However, this may be put in action in the coming years as digital competence has just recently been formally included in the Swedish curriculum.

Transactions and processes
With regard to transactions and processes, the curricula of Norway and Sweden do not provide teachers with any information on how to implement the curricular goals in their classroom activities. This is consistent with the features of politically determined decentralized education systems, which is applied in both these countries. Such educational systems stress school autonomy and enables schools and teachers to organize their learning environments in their own way. This may lead to large between-school variation regarding the curriculum implementation (Resh & Benavot, 2009), and has already been

indicated for the implementation of digital competence curriculum in Norway (NOU 2014:7, 2014). An evaluation of the Norwegian national curriculum revealed that how digital competence is understood varies across schools and classrooms, and the teachers perceive it as important only for students in the beginning of primary education, instead of skills that are continuously developed as part of their subject domain learning throughout their educational training (Aasen et al., 2012). Consequently, it seems that the formal responsibility for instructing students to attain the digital competence goals falls between different actors, and this lack of a clear-cut digital competence curriculum may also affect pre-service teachers and teacher training institutions, as the framework does not clearly put forward the requirements to the teachers (Tømte, Kårstein, & Olsen, 2013).

Conclusion

The results of this study have shown that the international frameworks have a larger degree of specificity and volume compared to the two national curricula. Moreover, the national curricula lack sufficient structure and thus do not support a conceptual hierarchy with increasing specifications of the competence areas and competences across grade levels. Moreover, a lack of descriptions related to the instructional aspects (e.g., assessment, teaching procedures and materials) may affect the integration of the curriculum. In conclusion, such knowledge can provide policy makers, researchers and educators relevant information about the alignment between the national operationalization of digital competence and the international drives. Also, such knowledge can be crucial for curriculum developers, and it may well be helpful to plan relevant interventions that promote the empowerment of teachers to use ICT for learning, and to develop their students' digital competence. Finally, as stressed by Scheuermann and Pedró (2009, p. 5): "certainly, knowledge economies and societies would greatly benefit from a broader set of internationally comparable indicators. These could monitor progress in ICT uptake and unveil important information about use, ranging from issues such as frequency to purpose", the divergences uncovered in this study might bring attention to the importance of comparable indicators across digital competence frameworks and curricula.

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APPENDICES

Appendix A. The revised DIGCOMP framework (Siddiq et al., 2016)

Competence areas (Level 1)	**Competences** (Level 2)
1. Information	1.1 Browsing, searching and filtering information 1.2 Evaluating Information 1.3 Storing and retrieving information
2. Communication	2.1 Interacting through digital technologies 2.2 Sharing information and content 2.3 Engaging in online citizenship 2.4 Collaborating through digital technologies ***2.1.1 Asynchronous Communication** ***2.1.2 Synchronous Communication** ***2.4.1 Asynchronous Collaboration** ***2.4.2 Synchronous Collaboration**
3. Content-creation	3.1 Developing content 3.2 Integrating and re-elaborating 3.3 Copyright and Licenses 3.4 Programming
4. Safety	4.1 Protecting devices **4.2 Managing and protecting personal data** 4.3 Protecting health 4.4 Protecting the environment **4.5 Netiquette**
5. Problem solving	**5.1 Solving problems with use of digital technology** **5.2 Collaborative problem solving** 5.3 Innovating and creatively using technology 5.4 Identifying digital competence gaps
6. Technical operational	**6.1 Solving technical problems** **6.2 Identifying needs and technological responses** **6.3 Basic technical skills**

Note. The competences in bold letters represent the revisions of the original DIGCOMP framework. Elements marked with an asterisk (*) refer to level 3 in DIGCOMP.

Appendix B. Norwegian Directorate for Education and Training 2012—Framework for Basic Skills

Digital skills as basic skills					
Field of skills	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
Search and process	Can read hypertexts and simple interactive information. Can use picture- and icon-based navigation.	Can make simple digital searches and read and interpret information from digital sources. Can use simple digital resources and tools for information processing and learning.	Can choose and use search strategies and assess information from digital sources. Can use different digital tools and resources for information processing and learning.	Can filter, transform, and Collate information from digital sources. Can use relevant search tools and master search strategies in subject-related tasks.	Can find, organize, and update digital information. Can use advanced search strategies and sources in subject-related work.
Produce	Can write simple texts on keyboard and produce simple composite texts. Knows simple digital use of sources and copyright rules.	Can produce digital composite texts following simple formal requirements. Can make simple use of digital sources, observing copyright rules, also in re-use and further development.	Can make digital composite texts with linked content. Can understand and use digital formal requirements in one's own texts. Can refer to digital sources and apply copyright rules.	Can produce and edit complex digital texts. Can refer to and assess digital sources in relevant subject-related situations.	Can choose and use target-group-relevant digital tools and digital formal requirements. Can administer copyright rules to one's own digital products and master digital source referencing.
Communication	Can use simple digital tools and media for presentation and communication.	Can use a selection of digital tools and media for presentation and communication.	Can make varied use of different digital tools and media to convey a message both in one-to-one and group communication.	Can use digital media and tools to convey a clear and detailed message for communication and documentation.	Can choose, assess, and apply digital communication tools according to different subject-related needs.
Digital Judgment	Can follow basic rules for digital interaction. Knows basic rules for protection of personal privacy on the Internet.	Can apply basic netiquette and knows about rules for protection of personal integrity on the Internet.	Can apply netiquette and follow rules for protection of personal integrity on the Internet and in social media.	Can use the Internet and social media efficiently and appropriately.	Can reflect ethically on and assess the Internet and social media as communication And information channels.