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Digitally competent schools: teacher expectations when introducing digital competence in Finnish basic education

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Abstract

The increased exposure to technology raises a need for understanding how the digital world works, just as we learn about the physical world. As a result, countries all over the world are renewing their school curricula in order to include digital competence, computer science or other similar content. In this paper, we provide insight into what teachers see as crucial aspects when implementing a new curricula introducing digital competence as a transversal element. We have analysed 86 Finnish teachers' descriptions of digitally competent schools and digitally competent personnel, in order to identify a list of prerequisites that can be helpful to school leaders who are to drive the change at their local schools.

Keywords: digital competence, basic education, teacher expectations, schools as learning organisations, curriculum changes

Introduction

The increased exposure to technology raises a need for understanding how the digital world works, just as we learn about the physical world. Consequently, during recent years, we have witnessed an active discussion surrounding the role of programming and computer science (CS) for everyone (e.g. Informatics Europe and ACM Europe, 2015). As a result, an increasing number of countries have introduced or are in the process of introducing CS or elements thereof in their school curriculum. For instance in Europe, the majority of countries (17 out of 21) taking part in a survey conducted by the European Schoolnet in 2015 reported doing so (Balanskat & Engelhardt, 2015).

The way in which this is accomplished varies. Some countries focus on K-12 as a whole, whereas others primarily address either K-9 or grades 10-12. Some countries have introduced CS as a subject of its own, such as the introduction of the subject *Computing* in England (English Department for Education, 2013) while others have decided to integrate CS content with other subjects, by for instance making programming an interdisciplinary element throughout the curriculum. The latter is the case, for instance, in Finland (Opetushallitus, 2014) and Sweden (Skolverket, 2017). While some countries have a clear focus on programming or CS, Finland and Sweden introduce the term *digital competence*.

In this paper, we provide insight into what prerequisites and needs teachers experience when implementing a new curricula introducing digital competence as a transversal element. We start with a brief presentation of the theoretical foundation for our study: *schools as learning organisations* (OECD, 2016) and the *TPACK* framework (Mishra & Koehler, 2006). Next, we discuss digital competence in the Finnish curriculum and relate the term and the content areas to both CS and the general digital competence framework *DigComp* presented by the European Commission (Ferrari, 2013). After describing the study and its methodology, we present the results, which are then discussed in light of our theoretical framework. We end the paper with some recommendations.

Theoretical framework

Curricula changes and rapid technological progress affect schools and faculty in several ways. We frame our study of teachers' view of a digitally competent school around two aspects in particular: implementing change in schools and teachers' knowledge.

Schools as learning organisations

The rapid pace of change in our society means new challenges for educational institutions, and thereby teachers, who are to prepare children and youth for an uncertain future (OECD, 2016). As a consequence researchers, educators and policy makers argue that schools should be reconceptualised as "learning organisations" (Coppieters, 2005; Fauske & Raybould, 2005; OECD, 2016; Stoll & Kools, 2017). In the words of Senge (1990) a learning organisation is "continually expanding its capacity to create its future". Coppieters (2005) argues that schools need to be seen as complex dynamic systems, which change constantly and move between stable and more chaotic situations. Such a system and its evolution cannot be predicted, but viewing a school as a learning organisation makes it easier to cope with change.

There are several lists characterising a learning organisation. One of these is the one presented by the OECD (2016) suggesting that such a school

- develops and shares a vision centred on the learning of all students,
- creates and supports continuous professional learning for all staff,
- promotes team learning and collaboration among all staff,
- establishes a culture of inquiry, innovation and exploration,
- embeds systems for collecting and exchanging knowledge and learning,
- learns with and from the external environment and larger learning system, and
- models and grows learning leadership.

Another concept, closely related to the notion of schools as learning organisations, is professional learning communities (Thompson, Gregg & Niska, 2004). The aim of such communities is to develop a collaborative work culture among teachers. Vescio et al (2008) discuss the model presented by Newmann et al (1996) suggesting five essential criteria of a professional learning community:

- having shared values and norms,
- having a clear and consistent focus on student learning,
- engaging in a reflective dialogue leading to continuous discussions among teachers on "curriculum, instruction and students development" (p. 182),
- making teaching public, and
- focusing on collaboration.

The essence of these criteria shares many similarities with the OECD list above. In their review of research on the impact of this type of learning communities, Vescio et al (2008) found that they have a positive impact on both teaching practices and student achievement. Another review, conducted by Stoll and Kools (2017), indicated that there seems to be general agreement that seeing schools as learning organisations is necessary in order to deal with the current pace of development. Stoll and Kools also found that schools as learning organisations are closely connected to the external environment, use inquiry, problem solving and experimentation as change drivers, and emphasise individual, team and organisational learning. Finally, Stoll and Kools' review revealed that faculty's beliefs, values and norms and the strategies and structures available for supporting this kind of learning are key in order for the school to function as a learning organisation.

TPACK

Shulman (1987) introduced the concept of pedagogical content knowledge (PCK), as a means of conceptualising what knowledge is involved in good teaching. As information technology (IT) became an increasingly integral part of teachers' everyday practice, Mishra and Koehler (2006) built on Shulman's idea and introduced TPACK (technological, pedagogical and content knowledge) as a corresponding framework for conceptualising the types of knowledge involved in successful teaching with technology.

Where PCK integrates pedagogical and domain knowledge into an understanding for ways of teaching a given topic, TPACK adds technological knowledge to the mix as a crucial component for integrating technology in teaching practices (Voogt & McKenney, 2017). The framework hence acknowledges that in order to use technology efficiently in the classroom, a blend of knowledge is needed. Depending on how these types of knowledge are combined, seven types of knowledge can be derived, as illustrated in Figure 1.

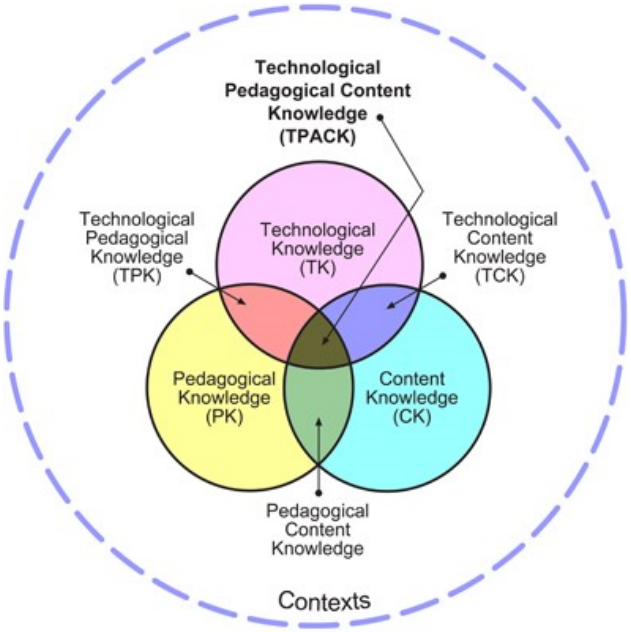

Figure 1: The TPACK framework

Researchers (e.g., Harris and Hofer, 2011; Jimoviannis, 2010) have argued for the need to relate TPACK to different subjects and domains. In their systematic literature review of TPACK, Voogt et al (2013), however, found that hardly any

of the 55 journal articles reviewed studied TPACK from a domain specific perspective. They also found that TPACK is closely related to teachers' beliefs about pedagogy and technology. In a more recent review, Willermark (2018) found that the TPACK framework is utilized in a variety of ways in order to identify teachers' knowledge. She also noted that there is a need for a clearer and joint operationalization of TPACK.

History of technology in Finnish basic education

The role of CS and IT in the Finnish national curriculum has varied over the years, placing focus on different areas, ranging from using technology as a tool to learning how the computer works and how to use it to create programs. CS, or what was then called Automated Data Processing (ADP), was mentioned in the national curriculum for upper secondary school (grades 10-12) for the first time already in 1972 (Kavander & Salakoski, 2004).

It was, however, not until computers became a more common part of ordinary people's lives in the 1980s that an active discussion on the need for teaching everyone about technology was initiated (Toivonen & Jarnila, 1981). In basic education (grades 1-9, starting at age 7) CS – or computer technology, "tietotekniikka" – was introduced as an elective subject in grades 8-9 in the curriculum from 1985. This meant that all municipalities had to offer the subject, although students did not have to select it as part of their studies. The curriculum specified four courses in this elective subject: basics of computer technology, computer applications, computer creativity (music and graphics) and programming (Koppa, 2010).

In the 1990s, CS lost its status as a subject of its own, as the curriculum from 1994 specified that computers and IT should be integrated in the teaching of other subjects. This led to a larger focus on using computers and applications as tools, rather than understanding the technology, its benefits and challenges. Schools still had the right to organise elective courses in CS, and they were given free hands to decide on the content themselves. This led to the course offerings at schools throughout the country varying to a high extent – some schools did not arrange any course in CS at all, while others offered they students specialised CS courses (Koppa, 2010).

In December 2014, a new national curriculum for comprehensive education (grades 1-9) was accepted after a two year long process, now again including a larger emphasis on CS and aspects of understanding technology in addition to merely using it. This is accomplished through the introduction of digital competence (Opetushallitus, 2014). Time wise, the development of the new policy documents, coincided with the global discussion on the need for CS at schools among parents, industries and society as a whole. The new curricula came into force in schools throughout the country starting in August 2016. We will return to the new curriculum below.

Digital competence

The Finnish curriculum introduces the concept digital competence, which is one of many terms used in the debate on how to integrate CS in basic education. In a review of digital competence in educational settings, Pettersson (2017) found that digital competence should not be viewed in isolation, but instead be "regarded as an organizational task, influenced and driven by several contextual factors embedded within and across a wider school organization" (p. 1).

Digital competence is also used in a more general discussion on skills and attitudes needed for everyone living in our current and future society.

In 2013, the European Union published the first framework named *DigComp* (Ferrari, 2013), presenting the skills needed for all citizens to thrive in an increasingly digitalized society. The second version of this framework was presented in 2016 (Riinakari et al, 2016), covering five main competence areas including all in all 21 specific competences (Figure 2):

Competence area	Competence
Information and data literacy	1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
Communication and collaboration	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
Digital content creation	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licenses 3.4 Programming
Safety	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment
Problem solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps

Figure 2: The EU digital competence framework (DigComp)

In 2017, the framework was once again updated, this time to also include eight proficiency levels for each of the 21 competences, as well as examples of use of these competences in learning and employment (Carretero et al., 2017). The competence level ranges from foundation to highly specialised, where the lowest levels involve basic knowledge and skills, which might involve guidance from others, and the highest levels involve being able to work independently, guide others and propose new solutions and alternative models within the given area. All in all, this framework provides a structure allowing individuals to understand what it means to be digitally competent and how to assess and develop the competences involved. The framework has been used for assessment and development purposes, for instance, in an effort to create a self-efficacy tool for teachers (Nordén, Mannila & Pears, 2017) and libraries (Andersdotter et al, 2017).

Educators do not only need these competencies at a personal level, but also for guiding the next generation in becoming digitally competent. It is hence crucial, that they are "equipped with the digital competence all citizens need to be able to actively participate in a digital society" (Redecker & Punie, 2017, p.15). In addition, teachers need educator-specific digital competences in order to use technology in their teaching. These competences are captured in another framework published by the European Commission, *DigCompEdu*, which specifies the digital competence needed for educators. The proposal is framed around six areas focusing on different aspects of an educator's activities (p. 16):

- *Professional Engagement:* using digital technology for communication, collaboration and professional development.
- *Digital Resources:* sourcing, creating and sharing digital resources.
- *Teaching and Learning:* Managing and orchestrating the use of digital technologies in teaching and learning.
- *Assessment:* Using digital technologies and strategies to enhance assessment.
- *Empowering Learners:* Using digital technologies to enhance inclusion, personalisation and learners' active engagement.

- *Facilitating Learners' Digital Competence:* Enabling learners to creatively and responsibly use digital technologies for information, communication, content creation, wellbeing and problem solving.

Finally, the EU commission (Kampylis et al, 2015) has also published a framework describing digitally competent organizations, *DigCompOrg*, focusing on seven main themes: 1) leadership and governance practices, 2) teaching and learning practices, 3) professional development, 4) assessment practices, 5) content and curricula, 6) collaboration and networking, and 7) infrastructure. This is closely related to the concept of digitally competent schools, as used here and previously mentioned in the literature by for instance Ottestad (2010).

Curriculum changes in Finland

In this section, we discuss the introduction of digital competence in the Finnish curriculum (grades 1-9). In addition, we address teacher training and the need for professional development.

Digital competence and the Finnish curriculum

The Finnish new curriculum includes many new aspects. One of the largest changes is the introduction of the so-called *transversal competence* as a trait throughout all age levels and subjects (Opetushallitus, 2014). This competence is seen as a collection of seven competence areas, which all include knowledge and skills, values, attitudes and ambition: 1) thinking and learning to learn, 2) cultural competence, interaction and expression, 3) caring for oneself and everyday life skills, 4) multi-literacy, 5) digital competence, 6) workplace skills and entrepreneurship and 7) participation, influence and building a sustainable future. These competence areas are closely related to frameworks such as the key competences for life-long learning presented by the European Union[1] and the 21st century skills, presented by, for instance P21[2].

Each of the competence areas is described both in the general part of the curriculum as well as separately for each subject and grade level. When reviewing the seven competence areas in the Finnish curriculum, most of the competences presented in the EU DigComp framework are covered – not only in the specific fifth area (digital competence), but throughout all seven areas. For instance, areas 1-4 and 6-7 include the following:

- *Thinking and learning to learn:* collaboration, finding information, problem solving
- *Cultural competence, interaction and expression:* communication
- *Caring for oneself and everyday life skills:* safety, responsible use of technology, ethical questions
- *Multi-literacy:* collecting, combining, editing, producing and evaluating information, critical thinking
- *Workplace skills and entrepreneurship:* work life changes due to technology and globalisation
- *Participation, influence and building a sustainable future:* societal engagement, collaboration, impact of media, environmental issues

The fifth area "digital competence", naturally, covers most aspects. In the general part, the curriculum specifies that students should develop their digital competence in the following four main areas (Opetushallitus, 2014, p. 23, freely translated from Finnish): they

- learn to understand central concepts and principles for how digital tools are used and how they work. They are given the opportunity to develop their digital competence in practice while creating their own artifacts.
- are guided in using digital tools in a responsible, ergonomic and safe manner.
- learn to use digital tools for looking up information as well as in exploratory and creative work.
- get experience and training in using digital tools for communicating and building networks.

In addition, students "get familiar with how to apply and use different digital tools for various purposes and see their significance in everyday life, in communication between people and as a means to influence. […] Students learn to evaluate the impact of IT from a sustainability perspective and to become responsible consumers. Students experience international communication using technology and become aware of the importance, opportunities and risks involved in a global world" (Opetushallitus, 2014, p. 23, freely translated from Finnish).

One part of digital competence has received particular attention in the debate, both at national and international level, namely programming. In Finland, programming is explicitly mentioned in two subjects: mathematics (grades 1-9) and crafts (grades 3-9). In mathematics, focus is on learning to use programming to solve problems and implement ideas. In crafts, programming is used together with technology such as robots, micro controllers and other components to add a new dimension to the types of artefacts that can be created. This is well in line with the ideas of the maker culture. In addition, programming can be included in all other subjects as part of the cross-curricular digital competence. It is, however, important to note that digital competence is much more than programming alone.

Teacher training and professional development

Curricula revisions naturally raise a need for teacher training efforts. When adding a completely new area, such as digital competence, the need is quite large. While most teachers are used to using technology to some extent, most of them lack previous background in programming, algorithms and data as well as questions related to privacy, ethics and safety arising from the increased digitalization. The introduction of digital competence in the curriculum hence calls for large training efforts in order for all teachers to have the skills and confidence needed to teach the new content (Thompson et al, 2013).

In England, the new subject Computing was introduced in 2014 (English Department for Education, 2013), and despite large companies supporting the change, for instance by offering training and community efforts, over half of the teachers (60%) still felt that they were not ready to teach the new curriculum in fall 2014 (YouGov, 2015). After teaching the new curriculum, teachers reported on five most common challenges: their own subject knowledge, students' lack of understanding the new content, technical problems, meeting different ability levels, and students willingness/ability to solve problems (Sentance & Csizmadia, 2017).

Most Finnish schools are publicly funded, and the teacher profession is regulated having the required qualifications defined by law (Ministry of Education and Culture, 2016). To become a teacher in Finland a master's degree is needed, and teacher training programmes are offered by universities throughout the country.

The Ministry of Education and Culture finances professional development for in-service teachers through the Finnish National Agency for Education

(Opetushallitus in Finnish), as municipalities and organisations can apply for funding for arranging courses, workshops and other training initiatives both face-to-face and online. In addition, the Finnish government has initiated the "New comprehensive education" programme (http://minedu.fi/en/new-comprehensive-education), focusing on new pedagogy, learning environments and digital learning. As part of this program each Finnish school (grades 1-9) will get a tutor teacher to embrace new pedagogical approaches and promote digitalisation in teaching.

If again reviewing digital competence from the DigComp perspective, some competence areas have received more attention in the professional development context than others. In recent years, there has been a clear focus on programming, digital creation and pedagogical use of digital tools. In the same way as programming has been the focus in the general school debate, it has also been subject to a quite active training scene. Apart from government funded courses and support, other actors, such as the IT industry, have also taken a role in providing teachers training in programming.

Study and methodology

The purpose of this study was to bring light on teachers' views on the prerequisites for implementing the curriculum changes. The research question is hence the following:

RQ: What prerequisites and needs do teachers in grades 1-9 consider important when introducing digital competence as a transversal trait in the curriculum?

In order to address this question we have collected data during a professional development effort in 2016/2017. We have organised state funded professional development for Swedish speaking teachers in Finland in digital competence starting in 2013. Some of the initiatives have been face-to-face, while others have taken place online. Some have been half-day introductory workshops, while others have lasted several days. For this study, we have analysed data collected during an online course focusing on digital competence and programming. The course did not require any previous experience of the topics at hand.

The data origin from a course assignment, which dealt with the notion of a *digitally competent school* and *digitally competent personnel*. Teachers were asked to describe how they perceived these concepts using their own words. All data were collected online using an open survey tool during two instances of the online course (spring 2016: 59 participants and spring 2017: 27 participants). All in all, the data reported below are based on responses from 86 teachers, totalling 172 responses (two assignments per teacher).

The analysis was done according to the principles of content analysis (Cohen et al, 2007). The basic idea of content analysis is to take textual material and analyse, reduce and summarise it according to predefined or emergent themes. We analysed teachers' responses to the two assignments one-by-one with the research question in mind, extracting all topics found together with excerpts that exemplified the topic. The topics and excerpts were collected into a spreadsheet. When all 172 responses had been analysed, we reviewed the spreadsheet and combined topics into larger themes. This phase resulted in 11 themes, which are presented below. Each theme is exemplified by excerpts from teachers' responses, freely translated from Swedish.

Results

The content analysis of teachers' views of a digitally competent school revealed seven themes. First, a digitally competent school ***has sufficient resources***. Some of the resources are related to technology (equipment and technical support), whereas others are related to teachers' possibilities to learn and develop their digital competence (time and professional development).

> The school invests in the digital equipment needed.
>
> That there are enough computers, tablets… and that the network and other equipment work.
>
> Easy and quick technical support when problems arise.
>
> Time for planning and professional development.

While buying technology and bringing it into the classroom is rather easy (provided that the economy allows for such purchases), it is not as straightforward to find good ways of using it. In order for a school to be digitally competent, the respondents hence noted that digital tools and new content need to be ***integrated*** in the school's activities.

> Technology is a natural part of teaching and is used for pedagogical purposes, not just for the sake of using it.
>
> Digital competence is part of all activities at school.
>
> The use of digital tools should be seen as self-evident, both by students, teachers, headmasters and parents.

As digital competence was added to the Finnish curriculum as a cross curricular theme, it cannot be seen as the duty of only a selected few. The respondents noted that digital competence is ***everybody's responsibility***.

> For the school to be digitally competent, everyone needs to be involved, not only a couple of enthusiasts who are responsible for developing the competence level.

Teachers also noted that the school of today needs ways, processes and structures to keep up with the societal change. Hence, in a fast changing world, a digitally competent school should be engaged in ***continuous development***.

> The school's aim is to constantly develop and take in new ideas, keep up-to-date and follow-up.
>
> There needs to be a mechanism for retaining what has been done before and ensuring that everything is compatible with the following step, so that nothing is lost.

Faculty naturally plays a crucial role in implementing the curriculum in practice, as they are the ones to meet the students in their classrooms. The respondents emphasised the importance of the school's ***organisation*** serving as an enabler in this context, facilitating and supporting teachers' work.

> The school structure, organisation and culture facilitate optimal usage of digital tools.
>
> Flexibility, which allows for innovative and collaborative cross curricular work with different approaches and methods (both analogue and digital) across age levels.

In order for the organisation to be able so serve as such an enabler, the respondents acknowledged the need for a ***strategy and plan***.

> A clear strategy for the entire school, which is annually updated. This also includes a strategy for professional development.
>
> The school has a clear vision, a concrete action plan and priorities in the budget.
>
> The school needs to be aware that a strategy needs to be updatable and changeable if it turns out to not be optimal.
>
> There is a plan for when and how the students are supported in developing their digital competence. It is important that this is planned so that students are equally digitally competent.

While the view of what the digitalisation means in educational contexts has varied over the years, the current definition of digital competence in the Finnish curriculum is quite broad. Consequently some teachers reacted on the current focus on programming in the general debate and emphasised the need for a digitally competent school to view ***digital competence as a versatile area***.

> All focus should not be put on programming, but it is at least as important to use and understand digital tools, discuss social media and programs that students can benefit from in their working life.
>
> The school teaches social digital competence, for instance, being critical, reflecting on one's behaviour and how we meet each other online, the meaning of publishing information and photos online, etc.

When analysing teachers' views on what they see as digitally competent personnel, we found three main themes. Some respondents noted that a digitally competent personnel is the foundation for a digitally competent school: *"How can a school be digitally competent, if the teachers are not?*" Hence, ***teacher knowledge and attitudes*** was one of the other main themes.

> Teachers need basic knowledge in programming in order to teach it.
>
> The personnel, i.e. teachers, needs to know how to use computers, apps and programs. In addition, the personnel needs to be motivated to learn mode in this field and also be given the opportunity and resource s need for doing so.
>
> Teachers feel secure in their role as a teacher with basic knowledge in the digital.
>
> Teachers have an open mind to try new opportunities from the digital world in their teaching.
>
> Teachers need to dare to try and make mistakes, as well as be open to what students' already know.
>
> Teachers are role model for students and show them how to use digital tools in a natural way.

The respondents also discussed the need for teachers to know how to use computers, tools and applications. Here ***pedagogical use and value*** were seen as crucial aspects.

> Teachers can decide when to use different tools and what value they bring.
>
> Teachers do not differentiate between analogue and digital but choose and suggest methods based on optimal teaching.

Finally, the respondents emphasised the need for teachers to work together and learn from each other. ***Collaboration*** was thus mentioned by most teachers in one way or another.

> Regular pedagogical discussions on why and how different methods can be used for optimally supporting students' learning.

> Teachers inspire each other and share tips and knowledge.
>
> Continuous professional development together. Collegial learning.
>
> Teachers network and join Facebook groups on the subject.
>
> Teacher work interdisciplinary and use the broad experience of the collegium.

The role of ***good digital leadership*** was a recurring theme mentioned by almost all teachers. This was said to be of crucial importance in the development of both a digitally competent school and digitally competent personnel. In the participants' own words good digital leadership is characterized by a leader who

> …motivates the teachers to use IT.
>
> …shows the way. Has a positive attitude, shows interest and tries new tools and is a good role model.
>
> …has a vision, direction and priorities.
>
> …makes sure the resources needed are available, both soft- and hardware as well as knowledge in the form of professional development.
>
> …is an active leader who encourages teachers to take time to increase their knowledge in programming.
>
> …needs to encourage all colleagues, regardless of what they teach, to create a positive attitude towards programming at school.
>
> …trusts the teachers, gives support and prioritises the development of digital competence at the school.
>
> …involves the teachers and lets them participate in the digital development.
>
> …listens, supports, inspires and encourages, lets teachers and students experiment.
>
> …makes sure the digital curriculum is followed based on goals, equipment and implementation.

Discussion

To summarize, the following eleven themes emerged during the analysis of teachers' views of a digitally competent school and a digitally competent personnel. Below, we have structured them based on our theoretical point of view, that is, seen through the lens of schools as learning organisations and teachers' knowledge according to the TPACK framework:

Schools as learning organisations

- Integrated digital competence
- Digital competence as everybody's responsibility
- Continuous development
- Enabling organisation
- Strategy and plan
- Collaboration
- Supportive leadership

Teachers' knowledge

- Teacher knowledge and attitudes
- Pedagogical use of digital tools
- Digital competence as a versatile area

Other

- Sufficient resources (technology, time, support)

All themes but one could be mapped to either theoretical framework. This theme, the need for sufficient equipment and technological support was, nevertheless an expected finding. Although many areas of digital competence can be covered through unplugged activities (see e.g. Computer Science Unplugged[3]), computing devices are seen as a natural requirement that has to be fulfilled in order to engage in a discussion on digital competence or digitally competent schools. The lack of computing devices can hence be seen as a problematic threshold when implementing the new curriculum. In addition, where there is sufficient equipment, teachers need to be able to get almost instantaneous support when faced with, for instance, crashing computers, lagging networks or cumbersome software interfaces.

Teachers clearly see a digitally competent school as a learning organisation: an organisation that makes change possible (enabling organisation), is constantly looking for ways to improve (continuous development), has a sense of direction (strategy and plan), supports team learning (collaboration) and grows a learning leadership (supportive leadership). It also supports all staff (everybody's responsibility) and has a shared vision for what digital competence entails in general (integrated digital competence).

When it comes to teachers' knowledge, the respondents mentioned both factual knowledge and attitudes. They also emphasised the need for pedagogical use of digital tools, that is, technological and pedagogical content knowledge (TPACK). In addition, the respondents discussed digital competence as a versatile area. As noted above, digital competence was not introduced as its own subject area in the Finnish curriculum, but rather as a transversal trait. Since the traditional way of thinking of digitalisation in a classroom setting has been from an IT perspective (computers, applications, networks), it is quite natural to first and foremost think of digital competence as being part of technological (TK) or technological pedagogical (TPK) knowledge. While digital competence, as written in the Finnish curriculum and as proposed in EU's DigComp framework, also introduces new content to be learned, only focusing on digital competence from a technological point of view is no longer enough. Digital competence should hence now also be considered part of content knowledge (CK).

The results presented in this article point out the need for time, resources, training and support when implementing the curriculum in Finnish schools. As the situation is the same in many other countries, which are going through similar processes of change, these results most likely also apply to those countries as well. For instance, the need for collaboration and team learning has been reported in England as well, where teachers reported that colleagues were the main source for support and guidance (YouGov, 2015).

The professional development courses discussed in this article were organised a couple of months before or after the new curriculum came into force in Finland. The participants were self-selecting and most of the teachers participating reported being interested in digital competence. Hence it seems reasonable to assume that we mainly reached teachers with a positive attitude towards digital competence as part of the curriculum, i.e. the early adopters or early majority. The bigger challenge is how to reach the teachers who for some reason still have not taken any step towards preparing for the new curriculum.

Based on the eleven themes that emerged from our study, we suggest the following checklist for school leaders who are in the process of integrating digital competence in their schools and practices.

- Make sure all faculty and learners have sufficient technological resources.

- Provide all faculty with time, resources and professional development in order to develop their technical, pedagogical and content knowledge (as well as the combination of these).
- Support the integration of digital competence throughout the curriculum.
- Make sure all faculty is involved in teaching digital competence.
- Support team-learning, collaboration and the sharing of ideas.
- Avoid the temptation of seeing the introduction of digital competence as a one-shot activity, but rather as a continuous process.
- Make sure the organisation is flexible enough to facilitate change and cross-curricular work.
- Create a shared vision/strategy, which is aligned with an explicit plan for how to work towards that vision.
- Be a good role model.

Many questions related to teacher preparation and the integration of digital competence as a cross-curricular trait still remain open. As many countries are going through similar change, we believe that schools as learning organisations, or in this context, digitally competent schools, have much to learn from other schools, teachers and practices both nationally and internationally.

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