*Nordisk tidsskrift for pedagogikk og kritikk*
Volume 8 | 2022 | pp. 287–297

**Invited article**

# Making the "digital leap" in Finnish schools

Reijo Kupiainen[1,2]
[1]*Norwegian University of Science and Technology, Norway;* [2]*Tampere University, Finland*

**ABSTRACT**
In 2015, the Finnish Ministry of Education and Culture launched a digitalisation project called the "digital leap." The objective of this project was to help schools quickly modernise their information and communication technology (ICT) infrastructure and pedagogy. Finnish schools have had many digitalisation projects, but the use of ICT in teaching and learning has been relatively small scale compared with other Nordic countries. Finnish teachers have autonomy for pedagogical decisions and have even abstained from top-down governing and "dumping" digital technology to schools. This article examines the challenges of school digitalisation in Finland, obstacles the teachers face in the use of ICT in education, and some perspectives on the teachers' possibility to participate in the digitalisation process. This article is based on research done in Educating for Future Literacies Research Group (EduLit) at Tampere University. The research indicates that teachers' professional capital plays an important role in the digitalisation process.

**Keywords:** *ICT in education; digitalisation; school; teacher; Finland*

## Introduction

Finland has long been known as a high-tech nation. According to Eurostat (2021), 96% of Finnish households had internet access in 2020. The smartphone penetration rate in the same year was 98% (Clausnitzer, 2021). Compared to the high usage of digital technology and the internet, it may be surprising that digitalisation has been relatively slow in Finland in education and at schools. Finnish schools are highly digitally equipped and connected (European Commission, 2019), but at the same time, students do not use the internet or computers at school as much as students do in other Nordic countries. In Finland, the percentage of students who use the internet for learning purposes at least once a week in secondary schools is 72, whereas in Denmark, which is the top country in Europe, the percentage is 99 (European Commission, 2019). In upper secondary school the percentage in Finland is 84,

Correspondence: Reijo Kupiainen, e-mail: reijo.kpiainen@tuni.fi



*Citation: Kupiainen, R. (2022). Making the "digital leap" in Finnish schools. Nordisk tidsskrift for pedagogikk og kritikk, Special issue: Digitalisering av utdannings- og oppvekstspraksiser, 8, 287–297. http://dx.doi.org/10.23865/ntpk.v8.4068*

whereas in Norway it is 96, in Denmark and Sweden 97, and in Island 100 (European Commission, 2019).

When it comes to the use of computers at school for learning, differences are even bigger: 44% of students in secondary school and 69% of students in upper secondary school use computers (desktop/laptop/notebook) for learning purposes at least once a week (European Commission, 2019). In Denmark, which is again in the top in Europe, the percentage is 91 and 95, respectively (European Commission, 2019). Also, teachers' intensity to use information and communication technology (ICT) in the classroom is low, second-lowest among secondary school teachers among 21 participant countries and slightly lower than the EU average among teachers in upper secondary school (European Commission, 2019).

The Finnish education policy has noticed this challenge, and in 2015, the Ministry of Education and Culture called for a "digital leap" to be taken in Finnish comprehensive schools. The digital leap was supposed to mean that schools should quickly modernise their ICT infrastructure and pedagogy. The government also allocated funding to educational improvements during the years 2016–2020 (Lavonen & Salmela-Aro, 2022). The fund was used to increase teachers' and students' digital skills, to develop teachers' pre-service education and digital tutor teacher models, and to support special education and the use of ICT (Lavonen & Salmela-Aro, 2022).

The digital leap was part of school reform to digitalise schools, that means to develop ICT use in teaching and learning, and it was not the first one. There have been six official national-level digital education and ICT strategies during the last 35 years, as well as hundreds of different, usually short-period, development projects (Lavonen & Salmela-Aro, 2022).

According to public opinion, schools need to change at the same time as society is changing. However, efforts have focused on technology more than pedagogy. Reforms and development programmes have not had a connection to traditional Finnish education, well-being, or citizenship (Hoikkala & Kiilakoski, 2018). Technological infrastructure in schools is usually planned by non-teachers and introduced top-down as part of national educational policies, and has not met the needs of local schools and teachers.

This article focuses on the challenges and problems of digitalisation in education in Finnish schools, the major barriers to the use of digital technology at schools, and how teachers participate in planning the use of digital technology at schools. The article is based on research done in Educating for Future Literacies Research Group (EduLit), especially my ethnography in lower secondary school (Kupiainen, 2013), our research about a Digital Book Project (Kupiainen et al., 2016), and Törmälä's study focusing on teachers' experiences of ICT integration at schools (Törmälä, 2021).

## Distance education and COVID-19

The government expected a digital leap, and it really happened during the COVID-19 pandemic and school shutdown, but not in the way that was expected. In Finland,

many secondary schools moved to the distance education mode in 2020 for several months. At the time of writing this article, research on the impacts of this move has been still going on, as well as the pandemic, but some studies have already shown that the move did not happen without problems, especially when it comes to educational equality (Vainikainen et al., 2020).

Finland has been a country known for its low school segregation, but according to the research by Vainikainen et al. (2020), school-level variation was considerably larger in the period of distance education. In fact, Vainikainen et al. (2020) use the term "distance learning" instead of "distance education." These terms are sometimes used synonymously (Guri-Rosenblit, 2005) as well as the terms "remote education," "remote teaching," and "remote learning." There are also many other terms that refer to learning via ICT, such as "web-based learning," "virtual classroom," "online instruction," "computer-based learning," etc. (Guri-Rosenblit, 2005). The variety of concepts is confusing. Distance education is by a definition not necessarily organised via ICT only, but during the COVID-19 pandemic it has been done so, for example by using video conferencing platforms, such as Zoom, WhatsApp, or other instant messenger services. In this context, "distance education" and "distance learning" refer to studying remotely via the internet. Teachers and learners are connected remotely online. Terms can also vary depending on whether the perspective is teaching or learning. Instead of the concept distance learning, I use the concept distance education in this article because it is more commonly used in academic research and refers here to the way how schools organised teaching during the COVID-19 pandemic.

According to the study by Vainikainen et al. (2020), the level of structure and dialogue between teachers and learners varied by school during the first months of pandemic, particularly at the level of lower secondary education. Vainikainen et al. (2020) explained the differences between schools by teachers' varying digital competences and the availability of devices and resources. Lavonen and Salmela-Aro (2022) also reported challenges with equity of learners during the pandemic.

Perhaps the most worrying finding at the individual level in the research by Vainikainen et al. (2020) was that a fifth of pupils spent only an hour or less on learning daily. Distance education determines the actual distance and dialogue between learners and teachers, and the greater the distance, the more learner autonomy is required (Moore, 2013; Vainikainen et al., 2020). Therefore, distance education requires a good and balanced structure and dialogue suitable for learners and the content of learning. It seems that this balance varies between schools, and at some level, pupils have been left alone.

The COVID-19 pandemic forced schools, teachers, and pupils to the mode of distance education, but not all schools and teachers were prepared enough for a new kind of situation, where teaching was organised via internet. In Finland, teachers have governing autonomy, which is a feature of Finnish education policies that give teachers autonomy for pedagogical decisions and the possibility to abstain from direct and centralised interventions (Saari et al., 2014). Teachers also often resist

centralised demands (Saari & Säntti, 2018). Digitalisation and technology are not the priority for teachers, but ICT can be used in teaching when the content (curriculum), pedagogy, and proper technology are simultaneously disposed to find the best possible solutions for teaching and learning (Kupiainen et al., 2016). In the situation of school shutdown, teachers did not have any other choice than to turn the teaching to the digital mode. Some were better prepared for that than others.

## Digitalisation and teachers' professional capital

Overall, the digitalisation process of schools in Finland has been led from top to down and funded by short-period government-sponsored projects (Hoikkala & Kiilakoski, 2018). This kind of action is international, and critics have long pointed out that "dumping" digital technology in schools does not meet the needs of local schools and teachers (Selwyn, 2011b). The situation is frustrating for many teachers. When I did an ethnography at secondary school in 2009–2010 in Finland, one of the teachers at the research school described the situation at the school in the following way:

> I had five or six years ago clear plans for what we need for media education. For example, that we should get more devices every year so that it does not take all our money in one year, for example one or two laptops per year so that we could get eight laptops in both visual arts classrooms. But the practice is different, we got one laptop for a teacher in one year and that was all. Next year we didn't get anything, and we were forgotten. Then we should do new plans and again other new plans. It makes me cynical, why we had to do new plans for nothing? (Interview with the visual arts teacher, male) (Kupiainen, 2013, p. 37)

The teacher added that for two years, he studied a certain computer software for video and image editing but never received that software in the school. Suddenly, based solely on the decision of the school administration and without consulting the teachers, they got new technology and software, but it was different from the one the teacher studied. ICT has been inserted into school cultures and practices rather than integrated with those (Selwyn, 2011b).

The teacher said that he had turned cynical. Top-down dumping of digital technology into schools does not increase confidence and activate teachers. The European ICT in Education report (European Commission, 2019) showed that almost 50% of primary and secondary school teachers are less digitally active, less confident, and less supported. The same report confirms that almost 40% are highly digitally active, confident, and supported.

Integrating ICT with school practices requires more co-operation with school administration and teachers. In one of our research projects, we studied the Mobile Learning and Digital Books in Primary Education project (known as the "Digital Book Project", 2014–2016), funded by the Finnish National Agency for Education. In the Digital Book Project, six primary schools in a mid-sized city in western Finland

collaboratively designed a new learning environment for primary education based on digital technologies, especially iPads and Windows 8 tablets. One to two teachers and their respective classes from each of these six schools participated in this project.

Despite the name, the Digital Book Project was not concerned with simply replacing print books with digital books; its attempt was to change classroom practices and create new ones where mobile technologies were used to offer many possibilities, for example, apps, cameras, and audio recording software to enable students to work on multimedia and digital content production projects.

One of the main challenges was to implement the new *National Core Curriculum for Basic Education* (NCC) (NCC, 2016) in classroom practices as well. NCC was launched in 2014 and implemented in grades 1–6 in 2016. NCC has some new features, for example, seven transversal competences including multiliteracy and ICT competence. Other five transversal competences in NCC are (1) thinking and learning to learn, (2) cultural competence, interaction and self-expression, (3) taking care of oneself and managing daily life, (4) working life competences and entrepreneurship, and (5) participation, involvement and building a sustainable future (NCC, 2016). Transversal competences can be seen as one version of so-called 21st century competences. They are (1) transversal (i.e. not directly linked to school subjects but relevant in broader fields), (2) multidimensional (i.e. consists of knowledge, skills, values, attitudes and will), and (3) associated with higher order skills that help to cope complex problems (Voogt & Roblin, 2012).

Multiliteracy in the NCC means "the competence to interpret, produce and make a value judgement across variety of texts" (NCC, p. 22). The concept of text is understood in a broad way as written, spoken, printed, audiovisual or digital format. NCC is a normative document that now demands that, for example, ICT competence is an inevitable part of classroom practices as an "object and tool for learning" (Kupiainen et al., 2016, p. 23). The Digital Book Project was an attempt to think about how to best do this. Integrating teachers to think this in co-operation with the school administration in an early phase was quite unexceptional.

Our research indicated that teachers gained much through collaborating and sharing ideas with each other instead of relying on top-down dumbing of digital technology to schools or working solitarily to try solving all technological and pedagogical problems (Kupiainen et al., 2016). We conclude our research as follows:

> In this study, teachers described their enthusiasm, motivation, and self-efficacy and collective efficacy for integrating technology in the classroom. This, in turn, reflects well on an approach to teachers' professional development that is grounded in collaborative decision making, knowledge sharing, and planning. (Kupiainen et al., 2016, p. 127)

The teachers who participated in the Digital Book Project collectively demonstrated active agency with a diverse and deep knowledge of the possibilities of the NCC, also in the realm of digital technologies and ICT competence, and were able to apply

their understanding of NCC to different contexts. This requires that teachers have strong professional capital. A teacher's professional capital is a concept introduced by Hargreaves and Fullan (2012). For them professional capital is a combination of human, social, and decisional capital in the teaching profession (Hargreaves & Fullan, 2012). It is about collective responsibility and commitment that teachers develop with colleagues constantly in relation to students so that they can achieve their best.

It is possible only if teachers get strong support from their colleagues, principals, and other professionals at the school. Developing professional capital for the digitalisation of schools is a collective process involving sustained professional collaboration.

In fact, based on our survey of teaching multiliteracy at primary schools (Kulju et al., 2020), 77% of class teachers (N = 590) say they use ICT willingly, 86% try new teaching methods willingly, 91% co-operate with other teachers, and 81% get support from other teachers and principals. This indicates that support and co-operation with other teachers seems to be at a rather good level in primary schools as well as the use of ICT. However, 8% of teachers say that they do not use ICT willingly, and 15% do neither disagree nor agree with the statement "I use ICT willingly."

## ICT barriers at school

Based on the research by Vainikainen et al. (2020), one reason for school-level variation during the school shutdown "may be explained by teachers' varying digital competences and the availability of devices and resources" (p. 26). In fact, some studies have shown that schools and teachers may have many different barriers in integrating ICT into teaching. The European ICT in Education survey grouped obstacles into three major sets: equipment-related obstacles, pedagogy-related obstacles, and attitude-related obstacles (European Commission, 2019).

Obstacles and barriers to using ICT in lessons are examined in EduLit as well. A member of our research group, Virva Törmälä, has identified in her case study (Törmälä, 2021) five main categories of ICT barriers in primary school (Table 1).

The research by Törmälä (2021) (Table 1) gives an interesting overview to the technology-supported learning at school at the primary level: pupils have difficulties signing in to the schools' network and learning environment, digital learning environment is difficult to use and not designed for the use of children, school network does not allow too many pupils to connect at the same time, and learning situation is chaotic due to many technical challenges, lack of skills, and lack of time. Technology creates a new layer to the school and needs continuous updating, security, and support for teachers as well as pupils.

In my ethnography, I observed the same kinds of challenges (Kupiainen, 2013). In particular, time was a scarce resource at school. The usual 45-minute period of school teaching is an extremely short time for almost anything other than listening to the teacher. One of the teachers in the research school referred to time as one of the main obstacles to using ICT at school:

*Table 1.* Classification of ICT barriers based on qualitative data analysis (adapted from Törmälä, 2021, pp. 35–36)

| **Classification category (macro-level barrier)** | **Definition (sub-category of macro-level barrier)** | **Examples (How macro-level barriers manifest at micro-level? Ex = Example)** |
|---|---|---|
| A) Inadequate software/ hardware | A1 Poor usability of Peda.net for ePortfolio purposes | A1Ex1 Saving a photo and adding some text required more than 20 steps in the user interface of Peda.net |
| | | A1Ex2 Logic and user interface components of Peda.net were not optimal for ePortfolios |
| | A2 Complicated login procedure with desktop computers | A2Ex1 Multiple logins and several usernames and passwords were needed |
| | | A3Ex1 Some pupils' user accounts in the school network were locked |
| | A3 Unpredictable occurrences | A3Ex2 Access to broadband or wireless network was unstable |
| B) Learner group attributes | B1 Young pupils' lacking abilities in ICT skills | B1Ex1 Computer login/logout difficulties appeared (see also A2 above) |
| | | B1Ex2 Text input problems occurred |
| | | B1Ex3 Accidental deletion of content by pupils happened |
| | | B1Ex4 Extra preparatory work for the teacher was needed due to pupils' lack of skills |
| | B2 Large class size and heterogeneous group of pupils | B2Ex1 Chaotic learning situation |
| | | B2Ex2 Providing a sufficient level of support was not possible |
| C) Allocation of responsibility | C1 Often class teacher does not act as a crafts teacher | C1Ex1 Multidisciplinary approach was difficult because there was no flexibility in teaching hours |
| | C2 Parents' role in enabling learning environment usage | C2Ex1 Delays by parents in creating user accounts affected project schedules |
| | | C2Ex2 Usernames and passwords created by parents were too complicated |
| | | C2Ex3 Some user accounts created by parents did not work |
| D) Lack of resources | D1 Lack of time available in the curriculum | D1Ex1 Crafts teachers' unwillingness to do ePortfolios with pupils due to lack of time |
| | | D1Ex2 Documentation had to be organised partly beyond crafts teaching hours |
| | | D1Ex3 Project progress was slow |
| | D2 Lack of education assistants | D2Ex1 = B2Ex1 |
| | | D2Ex2 = B2Ex2 |
| | D3 Lack of equipment | D3Ex1 Computer lab was rarely available |
| E) Teacher attributes | E1 Lack of teachers' ICT skills | E1Ex1 Impossible to even start the project without tutor's/teacher's help due to technical challenges related to Peda.net service |
| | E2 Teachers' attitudes | E2Ex1 Extra effort was required from the teacher |

> We have in our classroom one computer, and every student should upload a photo to the school's network. It takes five minutes per student. We have 24 students. You can count how much time it takes. (Interview with a visual arts teacher, male). (Kupiainen, 2013, p. 38)

Another obstacle I observed in my study (Kupiainen, 2013) was the need for continuous updating of devices and software. For example, the schools had a display in the hallway. It was designed for students' digital project presentations, but there was nobody at the school who could update the software needed for presentations. Teachers also had other problems with updating computer software because they did not have administrator permissions.

Continuous obstacles and barriers have a tendency to discourage teachers, as mentioned above. In their review of experiences of school shutdown during the COVID-19 pandemic in Finland, Lavonen and Salmela-Aro (2022) also write that the more digital challenges teachers experienced when they needed to shift to remote teaching, the more likely they did feel burn out and vice versa: the more digital skills they had, the more they engaged in teaching. Different technological and other obstacles, as well as a variety of teachers' digital skills, set teachers in diverse positions.

## Conclusion: Avoiding technological determinism

Lehtonen (2022), also a member of EduLit, has studied manipulatives (i.e. technical non-digital hands-on learning tools) and ICT in mathematics education. She created a framework that takes into account content, pedagogy, practice, and technology in classroom teaching in a way that the "design concepts were not driven by technologies but instead by what technologies could offer to help students learn equation-solving problems" (p. 105) in mathematics. In her framework, technology—non-digital and digital—is a servant; it is not used for its own sake. Educational reforms tend to try to solve problems through technology, even though problems are not technological in nature (Selwyn, 2011a). Six official national-level digital education ICT strategies during the last 35 years in Finland, as mentioned above, indicate that ICT has been seen as a technical fix to the problems. This kind of thinking easily leads to the technological determinism that technology is seen as an autonomous force that causes a change for better learning results. Technological determinism leaves little room for teachers to really integrate technology with classroom practices but leaves them in the position of responding to technological requirements by making the best use they can with the technology (Selwyn, 2011a). This may frustrate teachers, make them cynical, and even affect burnout, as Lavonen and Salmela-Aro (2022) mentioned.

Top-down dumbed technology does not fix the problems of education. If technology is worth using, it needs to have some value other than technological. As Lehtonen (2022) writes, content, pedagogy, and practice come first.

Technology is not independent; neither is technological knowledge. As reported by Törmälä (2021), the use of technology in an educational context is not easily predictable. As an example, the time needed for a project where digital tools were used was longer than expected due to the setting up of the digital system, creating ePortfolio templates, adjusting the settings accordingly, and supporting pupils: "Digital technology use in schools often manifests as a more compromised reality than expected" (Törmälä, 2021, p. 38). ICT can produce uneven results in the classroom (Selwyn, 2011b).

Even the concept of technology is highly problematic in the discourse of ICT in education. In fact, the concept of technology is broad as such. Schools are full of technology, starting from school buildings, air conditioning, heating systems, furniture, textbooks, paper, pens, computers, the internet, and so on. For some reason, in the common discourse of ICT, the extension of the concept of technology has narrowed radically and indicates only ICT. It is not a problem when the concept is defined, and we know that there are other technologies as well. But it will become problematic if we start to think that only ICT belongs to the extension of the concept of technology. The discourse of ICT as technology also tends to narrow the understanding of technology as material artefacts and devices.

Physical artefacts belong to the technology, but there are other elements as well, such as human activities that take place in conjunction with these artefacts and human knowledge that belongs to these activities (Selwyn, 2011a). Selwyn (2011a) gives an example of these elements in the case of textbook as technology: textbooks are artefacts with some specific attributes involving their useability, portability, durability, etc. If we look at the activities and practices of using textbooks in education, some other features come to the fore. For example, reading textbooks needs specific skills and understanding of the text. This brings to the discussion the extension of concept text. What belongs to the text? Does it include, for example, images and graphs? The use of text and style of text also produce social inequality: Children who have more cultural and social capital and early print knowledge are more prepared to read academic texts than children who have not had so much contact with the diversity and richness of print texts (Luke, 2018). The practice of using textbooks in education can also imply specific modes of teaching and learning that are different from those in the case of other technologies. The work of the New London Group (1996; Cope & Kalantzis, 2009; Kalantzis & Cope, 2012) focusing on multiliteracies gives a good example of how text and text-based education raise many questions, for example, about power, pedagogy, society, and literacy. Text and textbooks used as a technology of education are linked to a range of issues other than learning only.

The idea of digitalisation in Finnish education was to encourage Finnish teachers to use ICT in education, but the basis was on technological artefacts and ICT infrastructure. Instead of just dumping more devices to the schools, the starting point should be a joint discussion with teachers about "*what* education is, *why* education is provided and *how* education is carried out" (Selwyn, 2011a, p. 28). There are

examples where this joint discussion has offered teachers the possibility to use their professional capital to integrate ICT into the classroom (Kupiainen et al., 2016). However, we do not know how common these joint discussions have been. In principle, teachers have opportunities to participate in planning school curricula that are based on NCC.

However, times are changing. If top-down projects have been common in the digitalisation of schools, and if the priority has been to build technological infrastructure for schools, at least researchers have started to look at ICT in education from a more diverse perspective. Teachers who have the possibility to do research in their own classroom bring their valuable voice to the discussion as well. Their perspective could be holistic and observe ICT in education in relation not only to pedagogy but also to social issues. For example, in her PhD dissertation, a class teacher, Mari Muinonen, studied pupils' use of digital technology in learning about pupils' sense of community, belonging to the classroom, and emotions in digital content creation (Muinonen, 2022). Digital technology needs to be seen as part of many complicated issues concerning education, teaching, learning, and social life. This is a good direction in seeing educational technology in relation to social interaction and asking how ICT produces and enhances social relations in learning.

## Author biography

**Reijo Kupiainen** is an adjunct professor in media education at the Norwegian University of Science and Technology and a university lecturer at Tampere University. He has studied media literacy and media and information and communication technology usage within schools.

## References

Clausnitzer, J. (2021). *Mobile phone usage in Finland – Statistics and facts*. Statista. https://www.statista.com/topics/7760/mobile-phone-usage-in-finland/#dossierKeyfigures

Cope, B., & Kalantzis, M. (2009). "Multiliteracies": New literacies, new learning. *Pedagogies: An International Journal*, *4*(3), 164–195. https://doi.org/10.1080/15544800903076044

European Commission. (2019). *2nd survey of schools: ICT in education. Objective 1: Benchmark progress in ICT in schools. Final report.* Publications Office in the European Union. https://data.europa.eu/euodp/data/storage/f/2019-03-19T084831/FinalreportObjective1-BenchmarkprogressinICTinschools.pdf

Eurostat. (2021, May 5). *Share of households with internet access in Finland from 2007 to 2020 [Graph]*. Statista. https://www.statista.com/statistics/377766/household-internet-access-in-finland/

Guri-Rosenblit, S. (2005). "Distance education" and "e-learning": Not the same thing. *Higher Education*, *49*(4), 467–493. https://doi.org/10.1007/s10734-004-0040-0

Hargreaves, A., & Fullan, M. (2012). *Professional capital: Transforming teaching in every school.* Teachers College Press.

Hoikkala, T., & Kiilakoski, T. (2018). Digitalisaation pedagogiikka ja jatkuvan oppimisen ristiriita [The pedagogy of digitalization and the contradiction of continuous learning]. In *Koulutuksen Digiloikka – Miten Onnistuimme Suomalaisten Osaamisen Päivittämisessä?* [*The digital leap of education. How did we succeed in the updating of Finns' Know-How*] (pp. 12–53). Industrial Employees TP. http://www.tpry.fi/media/aineistot/ajankohtainen-materiaali/fin_01_tp_digiloikka_digital.pdf

Kalantzis, M., & Cope, B. (2012). *Literacies.* Cambridge University Press.

Kulju, P., Kupiainen, R., & Pienimäki, M. (2020). *Raportti opettajien käsityksistä monilukutaidosta 2019* [*Report of class teachers' conceptions of multiliteracy 2019*]. Publications of National Audiovisual Institute 2/2020. https://uudetlukutaidot.fi/wp-content/uploads/2021/03/UudetLukutaidot-opettajien-kasityksia-medialukutaidosta-2019-Kulju-Kupiainen-Pienimaki.pdf

Kupiainen, R. (2013). *Media and digital literacies in secondary school*. Peter Lang.

Kupiainen, R., Leinonen, H., Mäkinen, M., & Wiseman, A. (2016). A digital book project with primary education teachers in Finland. In M. Knobel & J. Kalman (Eds.), *New literacies and teacher learning: Professional development and the digital turn* (pp. 109–129). Peter Lang.

Lavonen, J., & Salmela-Aro, K. (2022). Experiences of moving quickly to distance teaching and learning at all levels of education in Finland. In F. M. Reimers (Ed.), *Primary and secondary education during Covid-19* (pp. 105–123). Springer. https://doi.org/10.1007/978-3-030-81500-4

Lehtonen, D. (2022). *"Now I get it!": Developing a real-world design solution for understanding equation-solving concepts* [Doctoral dissertation, Tampere University, Faculty of Education and Culture]. https://urn.fi/URN:ISBN:978-952-03-2250-2

Luke, A. (2018). *Critical literacy, schooling and social justice. The selected works of Allan Luke.* Routledge.

Moore, M. G. (2013). The theory of transactional distance. In M. G. Moore (Ed.), *The handbook of distance education* (3rd ed., pp. 66–85). Routledge.

Muinonen, M. (2022). *Alakoululaisten tunteet ja niihin liittyvä toiminta yhteisöllisissä digitaalisissa sisällöntuotannon projekteissa* [*Primary school pupil's emotions and action related emotions during digital content creation project*] [Doctoral dissertation, University of Helsinki, Faculty of Educational Sciences]. http://hdl.handle.net/10138/337801

NCC. (2016). *National core curriculum for basic education 2014* (Publications 2016:5). Finnish National Board of Education.

Saari, A., Salmela, S., & Vilkkilä, J. (2014). Governing autonomy: Subjectivity, freedom, and truth in Finnish curriculum discourse. In W. Pinar (Ed.), *Handbook of international research in curriculum* (2nd ed., pp. 183–200). Taylor & Francis.

Saari, A., & Säntti, J. (2018). The rhetoric of the "digital leap" in Finnish educational policy documents. *European Educational Research Journal*, *17*(3), 442–457. https://doi.org/10.1177/1474904117721373

Selwyn, N. (2011a). *Education and technology. Key issues and debates.* Continuum.

Selwyn, N. (2011b). *Schools and schooling in the digital age.* Routledge.

The New London Group. (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review*, *66*(1), 60–92. http://newarcproject.pbworks.com/f/Pedagogy+of+Multiliteracies_New+London+Group.pdf

Törmälä, V. (2021). ePortfolios in craft education at the primary level. *Design and Technology Education: An International Journal*, *26*(2), 28–45. https://ojs.lboro.ac.uk/DATE/article/view/2918

Vainikainen, M.-P., Oinas, S., Ahtiainen, R., Rimpelä, A., Lindfors, P., Lintuvuori, M., Hienonen, N., Heikkonen, L., Asikainen, M., Lindgren, E., & Hotulainen, R. (2020). School-level variation in distance learning practices during the COVID-19 pandemic in Finland. Pre-print. https://www.researchreal.fi/wp-content/uploads/2021/01/2020-09-21-Distance_learning_practices_SUBMISSION.pdf

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, *44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938