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ePortfolios in craft education at the primary level: Teachers' experiences on ICT integration

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Abstract
The Finnish National Core Curriculum (NCC), which took effect at the primary school level in autumn 2016, includes ICT competence for all school grades, and encourages pupils to document their working processes in crafts. However, the literature provides evidence of the barriers faced by teachers in integrating information and communication technologies (ICT) into teaching. This paper is shaped as an autoethnography, and its purpose is to share the challenging experiences of primary school teachers involved in the integration of technology in an electronic portfolio (ePortfolio) project in craft education with 43 third-grade pupils in a Finnish primary school context. Research data – field journal notes, video recordings and interviews – were analysed qualitatively, relying on Ertmer's conceptual framework on ICT barriers (1999) and five main categories were reported, which are 'Inadequate software/hardware', 'Learner group attributes', 'Allocation of responsibility', 'Lack of resources' and 'Teacher attributes'. Based on the results, the study discusses the challenges of integrating ICT into craft education in primary level.

Keywords
ePortfolio, primary school, digitalisation, craft education, ICT barriers, multimodality

Introduction
The aim of the present study was to examine the challenging experiences of primary school teachers involved in the implementation of information and communication technologies (ICT) in craft education. Digital documentation, in the form of electronic portfolios (hereafter ePortfolios), was conducted by third graders based on their crafts artefacts. Craft education, an obligatory school subject in Finland, is an important part of Finnish basic education and has a 150-year long history in the Finnish school system (Saarinen et al., 2016). According to the Finnish National Core Curriculum (NCC) for Basic Education, the subject craft education in comprehensive school encompasses various techniques, such as sawing and crocheting, technology education, and design (NCC, 2016, p. 434). Furthermore, the craft education contributes to implementation of digital documentation, since the NCC (2016, pp. 436-437) encourages pupils to use the digital technology, and to document their working processes.

An ePortfolio at simplest is an electronic collection of authentic evidence showing one's learning journey (Barrett, 2010; Lorenzo & Ittelson, 2005). According to Nicolaidou (2013) ePortfolios show great potential in supporting students' writing performance and facilitating peer feedback. An ePortfolio can have various roles in schools, including as a storage space for documentation, an assessment tool, a peer feedback channel and a process- and development-reporting tool (Saarinen et al., 2016; Nicolaidou, 2013). The empirical research on using ePortfolios has so far focused on secondary and higher education levels, whereas ePortfolio use in primary level education is limited (Kuan-Cheng et al., 2006; Nicolaidou, 2013). Furthermore,

only a few studies have focused on usage of ePortfolios in primary level craft education. Saarinen et al., (2016) have studied pupils' experiences using ePortfolio method in primary level craft education, and Saarinen et al., (2019) concentrated on the content of the ePortfolios, likewise, in primary level craft education. More studies are needed to confirm skills and knowledge needed in ePortfolio creation at each age (Saarinen et al., 2019). Furthermore, teachers' experiences in this kind of research setting are rare.

In this autoethnographic study, I investigated an ePortfolio project for third graders (pupils aged 9–10 years), in which the pupils created digital multimodal content in the form of ePortfolios based on their crafts artefacts, using desktop and tablet computers (Apple iPads) in a classroom setting in southern Finland. Multimodal content refers to different semiotic and sensory modes, such as written, visual, spatial and auditive elements (Sefton-Green et al., 2016; Dix et al. 2004). Multiliteracies is an approach that highlights the aspect of multimodality in texts (New London Group, 1996; Cope & Kalantzis, 2009; Kress, 2003). Multiliteracy is also included in the NCC (2016) as a transversal competence, and it means the 'abilities to obtain, combine, modify, produce, present and evaluate information in different modes, contexts and situations, and by using various tools' (NCC 2016, pp. 33-34).

Digital technology is widely used in our society and, consequently, the use of ICT in teaching and learning has been one of the main goals of Finnish education policy over the past ten years (Hoikkala & Kiilakoski 2018; Tanhua-Piiroinen et al., 2019). So far, according to Hoikkala and Kiilakoski (2018), attempts to integrate ICT have had a common main challenge: integration has mainly been driven by the central administration, which neglects pedagogical aspects such as teachers' everyday schooling expertise and students' personal digital culture. ICT usage levels in Finnish schools have fallen short of the target (Hoikkala & Kiilakoski, 2018; Tanhua-Piiroinen et al., 2019; European Commission, 2013). Yet another attempt to boost integration of ICT in teaching and learning is the current Finnish National Core Curriculum (NCC) for Basic Education, which includes ICT as a transversal competence for all school subjects (NCC, 2016). Nevertheless, the ICT competence targets are expressed on a rather general level in the NCC, and no dedicated hours are given for ICT; rather, it is to be integrated into all learning (NCC, 2016). The NCC (2016) took effect at the primary school level from the 2016–2017 school year. The reality of teachers is twofold in relation to school digitalisation. On one hand, the NCC (2016) obligates extensive use of digital technology in schools. On the other hand, there are several challenges, known as ICT barriers, impeding technology integration in everyday schooling (Admiraal et al., 2017; BECTA, 2004; Hew & Brush, 2006; Ertmer, 1999).

There is evidence that teachers find it problematic to fulfil the digitalisation requirements of the NCC for various reasons. These reasons include a lack of digital resources (software-, hardware- or network-related), low quality of digital strategies in schools and a lack of support for teachers in fulfilling the requirements (Hoikkala & Kiilakoski, 2018; Tanhua-Piiroinen et al., 2019; European Commission, 2013). Similar results are presented in the literature, such as by Vanderlinde et al., (2015), who identify the individual-teacher-level variables (e.g. ICT competence and professional development) and the school-organisation-level variables (e.g. ICT leadership and school vision) in their study concerning the conditions that support or hinder ICT use in primary schools in Flanders, Belgium. Konstantinos et al. (2013), for their part, report 'a wide and acute confusion among the ICT teachers' which manifests in difficulties for the

achievement of a horizontal approach to ICT and in limited cooperation between ICT teachers and other teachers in primary schools in Greece. Yuksel et al. (2013) conclude in their longitudinal survey of Turkish primary school teachers from 2005 to 2011 that the most significant barriers to effective ICT integration are the lack of and limitations of the hardware. Thus, a fair amount of literature provides evidence of the barriers to ICT integration in educational setting in general, but there is a knowledge gap regarding empirical evidence from research looking at sector or subject specific barriers restricting the use of ICT within the youngest age groups in primary education (e.g. BECTA 2004).

Technology should be a natural part of everyday school life (Blau & Shamir-Inbal, 2017; Kirschner, 2015), which is not necessarily the case in the 'messy realities of digital technology use in 21st century school systems' (Selwyn, 2011, p. 25). These messy realities caught my attention during the third graders' ePortfolio project.

In this study, I seek to contribute to the principled understanding of primary school ICT barriers (see above Konstantinos et al., 2013; Vanderlinde et al., 2015; Yuksel et al., 2013) by exploring them in the context of craft education. By means of the rich data of an autoethnographer and authentic quotes in the findings chapter, I aim to describe in detail the problematic endeavour of my colleagues and me to integrate technology into our teaching in order to meet the requirements of educational policy. I centre my research around the following research questions: From teachers' point of view, what barriers impede technology integration in ePortfolio lessons, in primary school craft education? How do these barriers appear at the micro- and macro-levels?

Ertmer's conceptual framework for analysing ICT barriers

In this study, I use Ertmer's (1999) identification of first- and second-order barriers as a structure that guides my investigation of ICT barriers in a Finnish primary school context, in craft education. First-order barriers, considered extrinsic to instructors, as Ertmer (1999) defines them, refer to missing or inadequate resourcing, such as a lack of resources, limited time and a lack of technical support or access to appropriate training. Second-order barriers, considered intrinsic to instructors, are instead rooted in the beliefs and value systems of individuals, such as beliefs about teacher–student roles or teaching methods, established classroom practices and attitudes such as unwillingness to change.

First-order barriers are eliminated mainly by securing additional resourcing, whereas confronting second-order barriers demands challenging one's belief systems and the routines of one's practice. This conceptual framework of Ertmer has influenced numerous researchers and has been used in analysing why instructors fail to integrate technology into instruction at various levels of education (Admiraal et al., 2017; BECTA, 2004; Hew & Brush, 2006; Yuksel et al., 2013).

Context for the research

School context

The research was carried out in two separate third-grade classrooms in a suburban comprehensive school, Owl School, in southern Finland, in the 2016–2017 school year. In this year, Owl School was attended by approximately 800 pupils, ranging from pre-school to ninth

grade. Basic education in Finland is non-selective, and every pupil is allocated a place in a nearby school. Finland has low levels of stratification in its education system, which means that no class enjoys more advantages than any other (OECD, 2012). Written permission for data collection was sought from both the city municipality and the school principals.

Teacher participants

As a researcher, class teacher and crafts teacher, I started a multimodal ePortfolio project with my own class and asked two other third-grade class teachers, Lisa and Tina (pseudonyms used for teacher participants), to join the project with their classes. Additionally, I invited all the teachers teaching crafts to Lisa's and Tina's pupils to join the learning project and received the consent of every teacher involved for participation in the study. Lisa wanted to commit to ePortfolio creation with her pupils, whereas Tina and crafts teachers Sally, Mary, Cathy and Vicky wanted to join tentatively, without strict obligations to produce anything additional with the pupils. Thus, Lisa, with almost 30 years of teaching experience, became the key informant for my study, alongside me, with my five years of teaching experience. I worked in close cooperation with Lisa throughout the entire project and offered her help and guidance at different phases, often in the form of simultaneous teaching. The other teachers mentioned above made small contributions towards the project goals, such as using 1–2 lessons for documentation activities with their pupils, but their contribution was non-committal. Nevertheless, Tina, Cathy and Sally provided me with useful opinions and ideas throughout the school year in collegial discussions. Most of the research data and findings are based on my observations as a researcher-teacher, but Lisa's contribution has been remarkable.

Pupil participants

The pupil participants of the study were 43 third-grade pupils, aged 9–10 years, of two intact classes (my class and Lisa's class) in a primary school. My class consisted of 11 boys and 12 girls, and Lisa's of 12 boys and 8 girls. The aims of the study were explained to all pupils and their parents, and both the pupils and their parents were asked for a written permission to conduct the study. Both classes had used iPads at school several times during the 2014–2015 and 2015–2016 school years, mainly for maths and (Finnish) language-related learning games. Lisa and I had not used desktop computers with our pupils before the 2016–2017 school year.

Digital learning environment

The first fifty iPads introduced in Owl School during the 2014–2015 school year. Since then, digitalisation at the school has progressed, and at the beginning of the 2016–2017 school year, every teacher had a laptop, and there were over 100 iPads available for the pupils. There was a need to choose a digital learning environment for Owl School, as Finnish municipalities had launched a service called 'Edustore' for digital learning content acquisition and downloads, and an environment supporting the Edustore service was required. This was when Peda.net came along.

Owl School began using Peda.net's school network, an online service for pedagogic purposes, at the beginning of the 2016–2017 school year. The Peda.net service, coordinated by the Finnish Institute for Educational Research at the University of Jyväskylä, contributes to ICT usage in education by offering its members online tools to be utilised as schools' homepages and virtual learning environments. The service consists of organisational sites and personal profile spaces.

We teachers, in cooperation with Owl School principals, decided that Peda.net was to be used with primary school pupils. We were allowed to choose between Peda.net and another digital environment, Moodle. Peda.net, based on a short introductory training session, seemed easy to use and it operated on various types of end-devices, such as desktops, tablets and phones. The non-profit organisation behind the product, as well as the fact that the tool is widely being used in Finnish municipalities at different levels of education, also influenced our decision. As stated by Selwyn (2011, p. 33), digital technology in schools often just comes in: decisions are made by nonteachers, often as a part of national school technology policies, and the needs of teachers and pupils are not necessarily considered. In Owl School, even though the teachers participated in selecting the tool, there was not much choice. It was not possible to organise proper testing of the tool or benchmarking of the available systems since there was neither the time nor the competence available to carry this out.

ePortfolio project in crafts at Owl School

My intention was to construct an ePortfolio project for third graders which would include experimental learning and the integration of ICT in craft education. I also wanted to reflect on the requirements of the NCC, which places a strong focus on ICT competence and multiliteracies (NCC, 2016). I planned a project in which two classes of third graders, including my own, would familiarise themselves with Peda.net and learn to use ePortfolios as a process- and development-reporting tool in craft education.

In digital documentation of their crafts artefacts the pupils produced multimodal texts (Sefton-Green et al. 2016; Dix et al. 2004) in Peda.net combining visual photos and written texts. Figure 1 and Figure 2 present examples of two third grade pupil's ePortfolios. The pupils have designed and produced a potholder and a tuned coat hanger and explain the work processes in their ePortfolios. The text samples are translated from Finnish to English.

First, I used the sewing machine to overlock the edges of two denim pieces with zigzag. Second step was decorating one of the denim pieces with different stiches. Third step was attaching the terry lining with pins and sewing it. The easiest step was decorating the potholder. The hardest thing was overlocking the denim pieces.

Figure 1. Example of third grade pupil's photo and text in her ePortfolio.

First, I planned, what I wanted to do. After that, I was able to choose between an old and a new coat hanger. I chose an old hanger. I started to felt wool. I made two felt balls. After that, I stained the coat hanger. I got an idea! I wanted to produce tyres. It took quite a while to finish the product.

Figure 2. Example of third grade pupil's photo and text in his ePortfolio.

Finnish municipalities and schools take independent care of the pedagogic goal-setting related to ICT learning and teaching. I had to define and set goals for the digital documentation of the work processes, taking pupils' ages and skill levels into account. The following goals acted as a starting point for the ePortfolio creation.

> *Gain a basic understanding of Peda.net service and ePortfolios.*
> *Gain basic desktop and tablet computer skills (log in/log out, navigating, text-writing and editing).*
> *Learn the process of ePortfolio creation, and rules for process reporting (take a photo, save the photo on Peda.net, add a caption and write textual content).*
> *Learn together and develop collaboration skills.*

(1)

I used the results of a pre-questionnaire on pupils' prior ICT experiences in planning the actual project. Both desktop and tablet computers (Apple iPads) were used in the ePortfolio creation.

Methodology and research design

The study followed an autoethnographic approach in the context of ethnographic fieldwork and writing. The approach was used in contexts familiar to me and included participant observation (Angrosino, 2012; Atkinson & Hammersley, 1994; Van Maanen, 1995), due to the fact that I, in the role of teacher and researcher, was involved as a member of the social setting under examination. I use a fictive name of the school and pseudonyms to protect the anonymity of the participants. The study was based on a data-producing process over a period of eight months in the 2016–2017 school year. The study can be regarded as a case study, a form of qualitative descriptive research, looking at a limited selection of participants (see for example Becker et al. 2012). Thus, no general conclusions can be drawn based on this study.

Various methodological strategies of autoethnography have been developed, and autoethnography is surrounded by polarised methodological debates. Approaches range from evocative self-exposure, with little abstraction or connection to theory, to analytical and realist description, with little focus on personal perspective (Holman Jones et al., 2013; Stahlke Wall, 2016). My intention was to conduct a study that lies between the evocative and the analytic approaches, also called 'moderate autoethnography' by Stahlke Wall (2016). Stahlke Wall (2016, p. 8) suggests that 'a moderate autoethnography would […] combine the power of the personal perspective with the value of analysis and theory, so that understanding is advanced in ways it might never have otherwise been'. In this study, my personal experience of ICT

barriers is connected with the broader social context in themes that I explain and elaborate in detail, both systematically and analytically, based on Ertmer's (1999) conceptual framework.

Data producing

Observation is at the core of ethnographic fieldwork, as recorded in field notes. I began producing data in September 2016 by taking field notes about the first phases of the ePortfolio project, which involved informing the pupils, parents and other teachers, setting up the learning environment and accompanying the pupils to the computer lab. While teaching and observing our lessons and having discussions with other teachers, I paid special attention to occurrences which could be interpreted as obstacles to the use of ICT in class, as well as to interactions that touched ICT barriers. Field notes and the research journal were kept for eight months, until the end of the project in May 2017. The validity of the research data was strengthened by supplementing the research journal data with audio-visual recordings using a digital camcorder. I recorded my own class, both in the computer lab (4 lessons) and in our own classroom (2 lessons) during the ePortfolio project. In addition to discussion with the teachers throughout the school year, I interviewed Lisa and Tina with a voice recorder at the end of the project in order to study their opinions on the project. Transcribing the complete record was conducted by me rather than by external transcribers.

Data analysis

As the ePortfolio project evolved, I began analysing my field notes and video recordings. The ongoing analysis of my raw data guided me towards questions and topics which I wanted to discuss with Lisa and other teachers to obtain participant perspectives on the events and processes. I conducted a qualitative thematic analysis on the data by following the six steps prescribed by Braun and Clarke (2006): 1) Familiarising with data, 2) Generating initial codes, 3) Searching for themes, 4) Reviewing themes, 5) Defining and naming themes, and 6) Producing the report. Thematic analysis is described as 'a method for identifying, analysing and reporting patterns (themes) within data' (Braun & Clarke 2006, p. 79). I used the Atlas.ti program, a computer program that can be utilised in qualitative data analysis (see for example Fielding 2001), in conducting the thematic analysis steps 2-5. The steps were not conducted in a rigid sequence, but in a recursive or cyclical way.

In data analysis, I focused on the findings which reflected barriers impeding ICT integration in the ePortfolio project. I used the conceptual framework of Ertmer (1999) as a tool for positioning intrinsic or extrinsic factors as possible causes of ICT barriers. The ICT barriers were examined at micro-level in the classroom context (cf. Jerolmack & Khan, 2017). The starting point of the study was the micro-level in the form of interactions and occurrences recorded in the field notes, research journal and digital recordings. In thematic analysis, these micro-level interactions and occurrences were grouped to form the themes, that is, the five main categories of the ICT barriers, that are considered the macro-level barriers in this study.

Every micro-level barrier was thus labelled an internal or external ICT barrier based on Ertmer's framework. I subsequently grouped the micro-level barriers, i.e. classroom occurrences or teacher opinions, into tentative macro-level categories. I compared every newly identified micro-level barrier to the existing macro-level categories and either added it into that category, created a new tentative category or recoded an already existing category to account for its

micro-level barriers as the properties and definitions of that particular category developed further. I continued data analysis until the tentative categories were saturated, additional data fit into the existing categorisation and no more recoding of micro-level occurrences or macro-level categories of barriers was needed. In other words, the trustworthiness of the data analysis method was strengthened by reaching theoretical saturation before defining the final macro-level categories.

Self-reflexivity

I played the multi-faceted role of researcher, informant, teacher, ICT mentor and author. My role amongst other teachers was that of a colleague rather than an outsider. However, there were certain aspects in doing fieldwork in my own practice I had to be aware of. I needed to pay special attention to the fact that I, firstly, did not try to control everything excessively but rather let things happen, and secondly, took notes on the developments from the viewpoint of a researcher, without neglecting details already familiar to me. In autoethnography, the author's voice is de facto heard, but in my research, both formal and informal discussions with teachers under investigation enabled me to develop a shared social identity with my colleagues, and the findings of the study, to a certain extent, developed into collective findings. I intertwined my experiences with the views of other teachers in order to indicate the sharing of experience among multiple subjects (Chang, 2008; Ellis et al., 2011).

Findings: external and internal barriers

In the following, my intention is to illustrate the main themes which the qualitative analysis of my research data revealed. As a result of the analysis, I identified five main categories of ICT barriers in our ePortfolio project, macro-level barriers which are summarised in Table 1 and are handled separately and presented with supporting quotes in the text. The first four categories represent external barriers, which may generally be eliminated by securing sufficient resourcing (Ertmer 1999). The fifth category, teacher attributes, has to do mainly with teachers' beliefs and attitudes and represents deeply internal barriers (cf. Ertmer, 1999). I use quotes that I recorded during the ePortfolio project to demonstrate how macro-level barriers manifest at the micro-level in classroom action. The quotes emerge from the self-reflexive field journal and from the transcripts of the video and audio recordings. It is always mentioned whose voice is being heard in the quotes.

Table 1. ICT barriers classification based on qualitative data analysis.

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 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 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 in teachers' ICT skills	E1Ex1 Impossible to even start the project without tutor/teacher help due to technical challenges related to Peda.net service
	E2 Teachers' attitudes	E2Ex1 Extra effort was required from the teacher

Inadequate software/hardware

According to Yuksel et al. (2013), lack of hardware and limitations of the hardware are the most significant barriers to effective ICT integration in the primary school context. However, barriers related to inadequate software are more numerous in my data than hardware-related barriers. This reflects the unsuitability of the Peda.net service for our specific needs related to craft documentation with young pupils. The Peda.net service features various user interface elements and components which can be used when creating and disseminating digital content such as pages, text modules and image modules. There was no ready ePortfolio structure available from the service, so I had to design and construct one to be used by the pupils. Setting up the system, creating ePortfolio templates in the personal spaces of the pupils and adjusting the settings accordingly was laborious and time-consuming, as is visible in the following quote

from the field journal.

> *From the beginning of September, I have been creating portfolio pages in pupils' personal spaces and changed the default settings so that I, as a teacher, am able to view every portfolio. I had to collect every pupil's username and password for this operation. It would make sense to let older pupils follow the procedure themselves, but for third graders the procedure is simply too complicated.*
> *(Field journal, 26.9.2016)*

Thus, the initial phase of the project took longer than expected, and I had to provide a great deal of support for Lisa and Tina in technical matters, as they were setting up the ePortfolio system for their classes. My class saved the first photos of their crafts artefacts on Peda.net in mid-October, Lisa's class at the end of January and Tina's class only at the end of March. The implications of the inappropriate software became apparent during the first months of the project in the form of, among other things, overtime work (lines 1–3) and Tina's demotivation (lines 6–8).

> *L1 We have been working for several weeks with Lisa (mainly during breaks and after school*
> *L2 days) in order to get the Peda.net user accounts finalised and portfolio blanks created in pupils'*
> *L3 personal space and linked to Lisa's personal space. […] Cathy and I (another ICT mentor*
> *L4 teacher in our school) organised three one-and-a-half-hour Peda.net workshops for teachers in*
> *L5 December. Lisa was able to join these workshops for a couple of hours, and we were finally*
> *L6 able to finish the preparatory activities for Lisa's class. Tina felt that the procedure should be*
> *L7 handled by crafts teachers, not by her. Cathy and I promised to provide support for Tina. She*
> *L8 managed to create portfolio pages for ten pupils today.*
> *(Field journal 15.12.2016)*

Taking photos of crafts artefacts with the iPads was simple, but the procedure for navigating Peda.net, creating and naming a new page for the photo in the pupil's ePortfolio and saving the photo there required over 20 clicks. I wrote a step-by-step guide to be used when adding new content in the ePortfolio. Despite the instructions, the pupils needed an adult to help with the procedure. This complexity of the tool was a surprise to me. It became clear that for our specific needs, Peda.net was not optimal. Proper testing or a pilot round would have revealed this fundamental problem of the tool for our purposes. The extra adults played an important role in the success in our project, as is visible in the following quote.

> *Lisa's class started crafts photographing the day before yesterday. Crafts lessons are so hectic that without extra adults, there is little opportunity to take the photos and save them in Peda.net. Alex, a student in vocational ICT programming getting acquainted with working life in Owl School, took one pupil at a time out of the classroom to take a photo of their crafts artefact to save the photo in Peda.net.*
> *(Field journal 1.2.2017)*

Using Peda.net on desktop computers required multiple logins by the pupils. The pupils had to log in to the desktop computer, to the school network and finally to the actual Peda.net service. There were separate usernames and passwords to be used for these separate login procedures. Login-related problems, depending on the perspective, are categorised in Table 1 under 'Inadequate software/hardware' (desktop procedure), under 'Learner group attributes' (young

pupils with inabilities) or under 'Allocation of responsibility' (parents created overly complicated user accounts).

We also encountered unpredictable ICT-related issues, not related to Peda.net, during the ePortfolio project. Such occurrences require immediate actions from the teachers, and re-planning is often needed. One time, when the Owl School network went down, for instance, we had to cancel the crafts photographing with Lisa's pupils.

Learner group attributes

Digital technology use in schools often manifests as a more compromised reality than expected. Selwyn (2011, p. 25) refers to the 'messy realities of digital technology use in 21st century school systems' and argues (Selwyn 2011, p. 58) that the use is 'less extensive and sophisticated than it could be'. Based on the pre-questionnaires on the pupils' prior ICT experiences, every pupil had previously used both a tablet computer and a desktop computer, mainly for playing games and watching YouTube videos, but in our project, the skills needed were different. When young pupils are involved, clearly defined sub-goals for the pupils are needed in order to meet the requirements of truly integrating ICT into pedagogy. As stated earlier, the NCC (2016) does not define such goals. Large class sizes and heterogeneity in relation to pupil ICT skills may become a barrier for the teacher if the teacher does not have the tools, or even the confidence, to handle the complex situation. 'Learner group attributes' is a macro-level barrier which is not taken into account in the ICT literature, and I consider it primary-school-specific.

Most of the pupils did not remember their usernames or passwords, even at the end of the project. I documented pupils' login credentials on papers which I gave them every time they were supposed to work on their ePortfolios, and I collected the papers when the lesson was over. Logging into the desktop computers was laborious, due to the multiple logins explained in the previous chapter. The following quote is one of the most significant in the study in relation to the messy realities of primary school digitalisation. It shows us concretely the starting point of digitalisation with young pupils. There were lessons when some of the pupils had to log out immediately after logging in, as the lesson was already over.

> *Login to the computers by pupils took an eternity, even though there were only ten pupils in the computer lab with me. It took about 20 minutes in total for the login procedure, which consisted of logging into the Owl School network and logging in to the Peda.net service. The pupils did not recognise the typos they made when typing their usernames and passwords (for example, extra spaces or missing letters), and there were pupils who were simply not able to type a long username at all. (Field journal 18.1.2017)*

The logout procedure was also difficult. In the late phases of the project, there were still pupils who simply pressed the power button of the computer to log out. Switching to edit mode and saving the created content were also difficult procedures to remember. Text-input-related problems occurred frequently. All in all, virtual keyboard usage was more familiar to, and easier for, the pupils than desktop keyboard usage, such as for entering special characters. Skill heterogeneity among pupils was a fact, as is visible in the two following quotes. In the first example, Ann has already written her text, whereas some of the pupils are not even able to

switch to the edit mode (lines 4–6). In the second example, Lisa described skills varied among pupils (lines 7–11).

> *L1 Teacher: Let's check those difficult signs now. It is quite easy to enter the @ sign with a tablet*
> *L2 computer, because it is available in the virtual keyboard. You don't need to enter it as a key*
> *L3 combination like with the desktop computer.*
> *L4 Ann: My text is ready. (Ann gives her iPad to the teacher).*
> *L5 Teacher: (Teacher goes to the back of the class. There are still pupils that are not able to switch*
> *L6 to the edit mode.) Just press here in order to activate the edit mode.*
> *(Video recording in our own classroom, iPads being used 10.5.2017)*

> *L7 Lisa: The skills of the children varied a lot. Some were able to do things, everything was easy*
> *L8 for them, and they progressed smoothly in writing ePortfolio descriptions. Then there were*
> *L9 pupils who couldn't get anything done and needed an adult to sit next to them for almost the*
> *L10 entire lesson. But overall, this phase of the project went pretty well, because we were allowed*
> *L11 to conduct simultaneous teaching, and we were monitoring the computer lab together.*
> *(Lisa and Tina's interview 24.5.2017)*

All in all, the lessons in the computer lab were chaotic. The pupils were often impatient and walked about as they asked for help from the teachers or other pupils.

Allocation of responsibility

The macro-level barrier 'Allocation of responsibility' can be considered both primary-school-specific and crafts-specific. Previously, Konstantinos et al. (2013) have considered the lack of cooperation between ICT teachers and teachers of other school subjects at the primary school level as a barrier. In this study, this aspect is seen more broadly, as the cooperation happened between class teachers and crafts teachers, as well as school assistants and parents.

There are two hours of crafts teaching per week in the third graders' curriculum (NCC, 2016). Often, the class teacher does not act as a crafts teacher, and another teacher takes care of the crafts lessons. According to my experiences, creating ePortfolios is not easy if the class teacher and the crafts teacher are not the same person. First, there is no flexibility in teaching hours from the crafts teacher's point of view. Second, the crafts teacher may not be willing to waste too much of the weekly two-hour quota for documentation activities. If the class teacher acts as a crafts teacher for his or her class, there is more flexibility, because the teacher may quite easily rearrange the weekly timetable. The macro-level barrier 'Lack of resources' is thus connected to the macro-level barrier 'Allocation of responsibility', as limited time has an impact on the crafts teachers' willingness to cooperate and take responsibility in digital documentation. In our ePortfolio project, I tried to organise an extra adult, such as a school assistant, to take care of the photographing of the crafts artefacts with the pupils. If that was not possible, we brought the ready crafts artefacts into our own classroom, and I helped the pupils to take the photos during breaks. Lack of time to conduct the documentation was a problem from crafts teachers' point of view as is visible in the following two quotes.

> *Cathy, one of the crafts teachers, said that she was not able to handle the crafts photographing with the pupils during crafts lessons, as she was mainly alone with the pupils. I went to help her, as I had no lessons when she had crafts lessons. I took*

one pupil at a time out of the classroom to take a photo of their crafts artefact to save the photo in Peda.net.
(Field journal 15.2.2017)

I asked Sally, one of the crafts teachers, whether she had an idea, how she could handle the crafts photographing and ePortfolio writing with the pupils. She said that there is not enough time and that she cannot do that with the pupils during crafts lessons. We decided that I take the ready crafts artefacts with me and organise the photographing and writing when I have time. According to Sally it is really strange that no extra hours are allocated to crafts teaching even though there is now the requirement to do digital documentation with the pupils.
(Field journal 22.2.2017)

The fact that the parents needed to give their permission by creating the Peda.net user accounts for their children heavily affected our project's schedule. The parents were instructed in the process, but when dozens of parents are involved, there are sure to be problems and misunderstandings. There were delays by some parents in providing the user accounts for the pupils (lines 5–6). Lisa, Tina and I had to send friendly reminders to the parents to finish this task. Some parents wanted us teachers to create the user accounts for their children (Lines 1–2). Additionally, some of the usernames and passwords created by the parents were far too complicated for a third grader to type in.

L1 Finally, every pupil in my class has a Peda.net username and password. I handled the two
L2 missing accounts myself, as the families asked me to do so. This procedure is totally fine, as
L3 stated in the Peda.net user account instructions. Additionally, there were two usernames that
L4 did not work, even though the parents had informed me that they had followed the instructions.
L5 I called the parents and found out that the problem was that the parents had not clicked the
L6 activating link sent to their email addresses.
(Field journal 31.10.2016)

Lack of resources

In the literature, ICT barriers related to a lack of resources refer mainly to lack of technology, lack of access to available technology, lack of technical support and lack of time (BECTA 2004; Hew & Brush, 2006; Yuksel et al., 2013). According to Hew and Brush (2006), resource barriers are the most frequently mentioned technology barriers in the literature. In this study, the lack of technology manifested in the fact that there was only one computer lab, with 25 computers, in Owl School for 800 pupils in the school year 2016–2017, and there were no laptops for pupils available yet. On the other hand, tablet computers (i.e. iPads) were more readily available. Additionally, the computer lab reservation tool was unreliable, and it was often difficult to find a free slot in the reservation calendar.

Lisa: There were all the practical issues that did not work, like reserving computer lab slots by means of the reservation tool. There were double reservations, even though you thought you managed to reserve some time for your class. Once we were in the lab with a group of upper-comprehensive school pupils at the same time (laughs). In my opinion, there should be more computers available for the small pupils.

(Lisa and Tina's interview 24.5.2017)

The lack of pupil ICT skills (see also 'Learner group attributes') and lack of school assistants or extra adults impeded educational technology integration in this study. Going with 20–25 young pupils into the computer lab at the same time is laborious. An extra adult is needed to get things done. For example, Cathy and Sally, crafts teachers, said that they were not able to handle the crafts photographing or ePortfolio writing with the pupils during crafts lessons, as they were mainly alone with the pupils (see the quotes in section 'Allocation of responsibility').

Teacher attributes

The study of Yuksel et al. (2013) conducted in Turkey shows that young teachers' self-confidence in terms of ICT skills is stronger than self-confidence of teachers with more years of teaching experience. It was not possible to verify this in my autoethnographic study. In this study, internal barriers were rare and all belong to the same macro-level category 'Teacher attributes'. My role as an ICT mentor was emphasised during the project and certainly affected the fact that the external findings are emphasised. This can be explained by the insider-research nature of my study. I, as an ICT mentor teacher, am confident in my own ICT skills and have a great deal of experience with pedagogic software usage. I gave support to other teachers in technical matters during the project. Internal barriers in this study emerge from the interview and discussion data. Both Lisa and Tina reflected on their insufficient knowledge of the Peda.net service and highlighted the fact that the researcher–teacher's support, especially in the early phases of the project, was crucial. The following two quotes stem from the interview I organised with Lisa and Tina at the end of the project. Lisa and Tina point out the importance of professional teacher development possibilities in gaining comprehensive knowledge of ICT tools and resources. Both regard their ICT skills as insufficient to start a project such as this by themselves, without any support.

> *Lisa: The Peda.net school network was totally new to me, and I found it a bit difficult and complicated in the beginning. I think the expertise and support provided by the researcher–teacher was important. The first phases of the project were laborious, but the support provided was so meaningful that we were able to start the project and the pupils got excited to do it.*
>
> *Tina: I agree with Lisa that the support by the researcher–teacher was crucial. Without it, I would not have been able to get started in the project. Also crucial was the Peda.net hands-on training for teachers. But a lot of extra time was needed, and I had the feeling that more training at the very least would be needed to gain knowledge in ICT skills.*
> *(Lisa and Tina's interview 24.5.2017)*

Conclusion and discussion

In this autoethnographic study I have combined the aspects of ICT and craft education at primary level. The study aimed in share the challenging experiences of teachers involved in the implementation of technology in primary craft education as the pupils were to document their crafts processes in ePortfolios. ePortfolio has shown to be a workable method in craft

education (Saarinen et al. 2016), and it fulfils the curriculum requirements of digital documentation in crafts in basic education (NCC, 2016). However, mainly due to the inappropriate tool, the findings of this study revealed the messy realities of digital technology use in a Finnish primary school craft education, which were categorised and analysed by means of qualitative thematic analysis (Braun & Clarke, 2006) and Ertmer's (1999) conceptual framework on 'first- and second-order ICT barriers'. As a result, I have reported five main categories of barriers to ICT integration, which are 'Inadequate software/hardware', 'Learner group attributes', 'Allocation of responsibility', 'Lack of resources' and 'Teacher attributes'. These findings concerning digital documentation in crafts align with the generic primary school ICT barrier literature (e.g. Konstantinos et al.' 2013; Vanderlinde et al., 2015; Yuksel et al., 2013). However, the generic literature does not take into account the young pupils' lack of ICT skills or the role of parents and other adults in the learning processes, which, based on my findings, are fundamental at primary level, as shown in the present ePortfolio project in crafts documentation. In this study, these two aspects are included in primary-school-specific macro-level barriers that I call 'Learner group attributes' and 'Allocation of responsibility'. Furthermore, the macro-level barriers 'Allocation of responsibility' and 'Lack of resources' are firmly connected to the school subject crafts due to inflexibility in teaching hours, when class teacher does not act as a crafts teacher, and due to limited time available in the crafts curriculum to conduct digital documentation. When ePortfolios are introduced, some of the barriers reported in this study may arise regardless of school subject, some are more specifically related to craft education, but it is to be noted that as a whole, the findings of this study have arisen from the context of craft and technology education in Finnish primary level. Thus, the findings reflect the aspects of that particular school reality with its objectives, contents and structures. Furthermore, since the study is based on a limited selection of participants, no general conclusions can be drawn.

In terms of the NCC (2016), the documentation of one's own work processes in craft education is connected not only to ICT but also to multiliteracies as a transversal competence (NCC 2016; Saarinen et al., 2016). In the present ePortfolio project the pupils were to, for instance, take photos of their crafts artefacts and to describe the making of them, which required multimodal textual skills. Thus, ePortfolios as a form of documenting crafts processes support not only the understanding of design and crafts processes but also the development of these transversal skills as a part of craft education. However, as this study shows, the lack of ICT skills of young pupils and the role of parents and extra adults should be more specifically taken into account when planning the ePortfolio lessons in order to get the full potential of the ePortfolio method as an educational tool. This is connected not only to lack of time but also to teachers' possibilities and willingness to organise their teaching concerning crafts documentation. Based on the results, the learning of very basic ICT skills, such as logging into the school network and the Peda.net service, took a lot of time and less attention was paid on further formulation of ePortfolio content itself.

The notion in the literature that teachers' agency in influencing technology adoption in schools is often limited (Selwyn, 2011) applies to our experience. It became evident that the Peda.net environment was not optimal for our specific ePortfolio needs with young pupils. In our project, neither the teachers nor the school administrators had the technical expertise or understanding of the digital tool used. It is to be noted that this does not mean that the tool would not work

for other purposes. Thus, in planning ePorfolio lessons in crafts, it is essential that the teachers involved have understanding of the digital tools, and agency in choosing the appropriate digital tools.

The Finnish NCC (2016) obligates extensive use of digital technology in schools. However, this study revealed a contradiction between this policy and the reality teachers face in schools. It remains largely open in *what* and *how* to integrate technology, as the pedagogic goals are defined on a very general level. On one hand, the NCC (2016) offers high levels of autonomy to Finnish teachers in ICT integration, which can be regarded as a positive point. On the other hand, the fact that technology goals remain vague can easily lead to inequity among pupils, as the implementation may vary considerably between Finnish municipalities, schools and teachers.

The autoethnographic nature of my study made it possible to include details based on lived experiences, which deepened the understanding of the ICT barriers at primary level. Ertmer's framework (Ertmer, 1999) worked as a profoundly useful tool in classifying ICT barriers encountered throughout the study. However, it should be noticed that the classification is always dependent on researcher's interpretation and that some of the categories in the findings of this study overlap.

To my knowledge, this is the first study providing empirical evidence on barriers restricting the use of ICT within the youngest age groups in primary craft education. It shows the challenges in incorporating the aspects of transversal skills such as ICT and multiliteracies (NCC, 2016) into subject specific craft education. However, by outlining the basic ICT learning goals in detail and by providing the teacher agency in adopting ICT tools, it is possible to support the planning of future ePortfolio projects in craft education. Future research should continue exploring the use of ePortfolio as method by taking into account various ICT tools in different age groups in craft education.

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