Digitalisation in early childhood education: a domestication theoretical perspective on teachers' experiences

Sofie Lindeman[1] · Maria Svensson[2] · Ann-Britt Enochsson[3]

Abstract

The aim of this study is to increase knowledge of teachers' understanding and experiences of using, or not using, digital tools in Early Childhood Education (ECE). The study takes a domestication theoretical approach based on interviews with twelve teachers from nine ECE institutions working with play-based learning with children aged 1–5 years from four different municipalities in Sweden. The study answers the following two research questions: In what ways, and to what extent, do teachers integrate digital tools in their work? What practical, symbolic or cognitive aspects affect their work with digital tools? The teachers have integrated the digital tools to different extent. The most useful tools for working with the children are tablets and beamers, which are devices that can be used in various ways. Digital tools used for administration are domesticated to a greater extent than the tools teachers use with the children. The study further shows that important factors in the successful domestication of digital tools in ECE include digital competence, including pedagogical aspects, in combination with personal drive and professional learning and development.

Keywords Early Childhood Education (ECE) · Teachers · Domestication theory · Digital competence

✉ Ann-Britt Enochsson
ann-britt.enochsson@kau.se

[1] Bergsvägen's Preschool, Stenungsund Municipality, 4482 Stenungsund, Sweden

[2] Varekil's Preschool, Orust Municipality, 47380 Henån, Sweden

[3] Department for Educational Studies, Karlstad University, 651 88 Karlstad, Sweden

1 Introduction

Digitalisation is part of the daily lives of most people, and most countries around the world have programmes to introduce children and young people to information and communication technology (Sepúlveda, 2020). Unsurprisingly, opinions diverge on the use of digital tools among children and young people; digitalisation at societal, group and individual levels is globally and nationally an engaging topic, and the younger the children involved, the greater the debate. Some claim that digital tools for young children (aged 1–5) should not be introduced until we know more about their negative effects (American Academy of Pediatrics, 2016). Such arguments are mainly based on research showing that considerable screen time corresponds to delayed development of, for example, language and socio-emotional skills (Carson et al. 2019; Chonchaiya & Pruksananonda, 2008; Hinkley, 2014), or may lead to health issues caused by too much sedentariness (World Health Organization, 2019). This may be a reason why Early Childhood Education (hereafter ECE) is excluded from these programmes in many countries (European Commission, 2019), and some teachers are reluctant to use digital tools with the children (Palaiologou, 2016). However, many teachers find digital technology useful for educational purposes and play in addition to activities that involve movement – one does not have to exclude the other (Blum-Ross & Livingstone, 2018; Enochsson & Ribaeus, 2020; Marklund & Dunkels, 2016).

Although using digital tools and developing children's digital competence in ECE is not mandatory in most countries, digital tools are widely used among young children, and have been used in ECE for more than 20 years to different degrees, even if there is also a history of reluctance (Dezuanni & Knight, 2015). According to the same authors, the breakthrough came with the advent of iPads in 2010, which were found to suit the children better than desktop computers. This study is conducted in a Swedish context where the ECE curriculum states that "play is the foundation of development, learning and well-being" (Swedish National Agency for Education [SNAE] 2018, p. 8). In an international context, this approach is sometimes referred to as EDUCARE (Bourbour, 2020; Mertala, 2019). Pedagogical activities are organised around play rather than classes and formal teaching. More than 80% of Swedish children aged 1–5 attend ECE, which means a majority of very young children are involved. Since 2019, the development of children's digital competence and the use of digital tools are also embedded in the ECE mission. A debate on whether digital tools should be used is therefore no longer relevant – at least not in Swedish ECE. Focus should instead be on how teachers can adequately prepare children for participation in a digital society (Kjällander & Riddersporre, 2019). SNAE uses the word *adequate* to indicate that ECE have to keep pace with the rapid digital development; what is new today can be outdated tomorrow. For teachers, adequate digital competence means knowing when, how and why digital tools should be used, but also when they are *not* to be used (Kjällander & Riddersporre, 2019).

Research within the field of play-based learning by using digital tools is sparse (Edwards & Birds, 2017), and existing research has been criticised for not paying

attention to the unique pedagogical characteristics of ECE (Mertala, 2019). Without relevant knowledge, there is the risk of reducing the importance of the use of digital tools (Hernwall, 2016). Examining teachers' understandings and experiences of digital tools, but also why teachers are not always able to work according to their visions within the area, is an important first step in filling this knowledge gap. Domestication theory has proven useful to understand the dynamic between users and different kinds of technology and also focus on changes in the users' views of activities (Ytre-Arne, 2019).

Domestication here refers to the extent to which users have integrated the tools. Using this theoretical perspective as an analytical framework provides a nuanced perspective on the implementation and adoption of technology in ECE, focusing not just on digital competence and hands-on-skills, but also on the meaning teachers accord to implementation (Engen, 2019). Hence, the result will contribute to the currently sparse knowledge of the use of digital tools in the specific context of play-based learning (Edwards & Birds, 2017; Hernwall, 2016; Mertala, 2019). This approach also makes it possible to describe where in the process of domestication teachers are, and what practical, symbolic or cognitive aspects affect this development (Holmgaard Christensen, 2019). This in turn is relevant in understanding how teachers view their mission and the extent to which they fulfil it, and will contribute to creating a more nuanced picture of the use of digital tools in ECE and moving "beyond screen time", as Blum-Ross and Livingstone (2018) put it. It is also relevant for teachers working in ECE where the use of digital tools is not mandatory.

The aim of this study is to increase knowledge of teachers' understanding and experiences of using, or not using, digital tools in ECE, and in latter cases to gain understanding of obstacles that might be prevented. The following research questions are answered:

- In what ways, and to what extent, do teachers working in ECE integrate digital tools in their work?
- What practical, symbolic or cognitive aspects affect their work with digital tools?

In this study, the term *digital tools* is used for any digital technologies teachers use to fulfil their mission. These can be tablets and their apps, floor robots, interactive boards, etc., or tools used for communication with guardians. *Digital technology* or *technology* is used in a wider sense.

2 Theoretical framework

In this section, domestication theory is described as well as some empirical research using this theoretical perspective in educational settings.

Domestication theory is used to analyse how different media are introduced and integrated in society. Selwyn (2012) advocates domestication theory as one of several useful theories for studying the complexity of educational technology, and focusing on social contexts rather than on technologies as products. The word *domestication* alludes to the domestication of wild animals, which have to

be domesticated not to be threatening or challenging, but to become important and meaningful (Berker et al. 2006; Silverstone, 2006). Domestication theory can highlight changes in attitudes and use and gives us tools to reveal the dynamics between technology and users – here, teachers.

When used in analysis, domestication comprises four consecutive phases. These phases have been labelled differently by different researchers, but are basically the same. In this study, the labels used by Holmgaard Christensen (2019) are chosen: (1) *appropriation*, (2) *objectification*, (3) *incorporation* and (4) *conversion*. Unlike for example Sørensen et al. (2000), Holmgaard Christensen differentiates between incorporation, where technology is seen as a natural part of daily life, and conversion, where technology is given a deeper meaning and is seen as contributing to the identity construction of the individual, and also to individuals' relationships to their environment. While digital tools are used on a daily basis in ECE, this does not automatically lead to creating deeper meaning for children and/or teachers, and this terminology enables analysing this aspect.

2.1 Phases of domestication

First, the artefact – here the digital tool – must be acquired in one way or another to be accessible to the user. It must be given a physical and mental place. The appropriation phase also includes motivation, a reason for the acquisition and what the acquisition is expected to yield, which means that the appropriation phase starts with the user's needs (Holmgaard Christensen, 2019). Second, the artefact must be objectified and given meaning. It is important that users feel that the digital tool is practical and useful in their daily lives, and that it assumes a personal meaning to them. In this phase, the digital tool goes from just being a thing to becoming something personal. The artefact is given space and is shown to others. When this happens, it is given physical, symbolic and psychological values; these values affect its use, but also change when new technology is introduced. In this phase, it is important to look at changes over time, and how the user context changes, since it is not static (Holmgaard Christensen, 2019).

Third, the incorporation phase describes how the digital tool fits into the user's specific way of being and at the same time it can redefine these patterns. The existing context of the user plays an important role, since the user is now linked to the artefact, and has an idea of its relevance. When technology is used, there are also opinions, for example on when its use is desirable or when it should be restricted. In a family or work team, meanings and expectations must be negotiated and reconciled, which leads to changes in context and thereby meaning (Holmgaard Christensen, 2019). Fourth, in the conversion phase, the digital tool becomes an object which redefines users' relations to the world around them. The use of digital tools enriches daily communication and at the same time, the user becomes part of a communication-intense society. Technology contributes to articulating the user's identity, which is both communicated and maintained through actual use.

The domestication process is regarded as successful when technology is successfully embedded within daily routine and habits (Voujärvi et al. 2010).

2.2 Other concepts

The process of domestication includes three intertwined aspects related to human commitment to technology (Sørensen et al. 2000). The *practical* aspect concerns how technology is used, for what, and if it is used as intended. The *symbolic* aspect concerns the meaning the digital tool has for the user and how this affects the use, while the *cognitive* aspect concerns learning to use the tool.

Sometimes, the domestication process does not develop linearly through the four phases; it can also reverse. Conditions can change so that specific tools are no longer relevant, or the understanding of technology can change. This is called *reversed domestication*. Karlsen and Syvertsen (2016) claim that too little attention is paid to reversed domestication, which also can be based in resistance to the actual technology. Reversed domestication can refer to practical, symbolic as well as cognitive aspects.

A *moral economy* is the framework and values that form the basis for the decisions that people make in a certain context (Silverstone, 2006). Artefacts may be partly used for their original purpose, but can also be redefined in different terms and thus acquire new uses depending on the user's interests and values. In the ECE setting, decisions are influenced by the values and frameworks of this particular context, which makes it an example of a symbolic aspect of domestication.

An important concept in domestication theory is *triple articulation*, which refers to the fact that technologies are physical artefacts and also bearers of meaning in several interconnected senses; there is the message itself, but contextualisation also affects the meaning (Courtois et al. 2012). Here the medium *is not* the message, but rather *becomes* a message which can change in different contexts. Mobile technology is an example of how devices easily change context and become bearers of different meaning (de Reuver et al. 2016).

2.3 Previous educational research using domestication theory

Very few studies have used domestication theory in combination with education. Searches in the databases *Academic Search Elite, ERIC* and also *Google Scholar*, including searches via bibliographies in articles that seemed relevant from the last ten years, resulted in only two articles from the same research group (Engen, 2019; Engen et al. 2014). Engen and colleagues studied the domestication of iPads in primary classrooms. They concluded that teachers and students found it difficult to translate the use of a product designed for a consumer market and private use into a school context, but over the years, they saw that the teachers eventually discovered pedagogical uses. Engen et al. claim that there are many nuances in this process, and domestication theory makes it possible to study how products meant for consumers can be adopted in a school context.

Brito et al. (2018) studied children 0–8 years using smart toys in their homes. The researchers called this age group "the touch-screen generation", but they found that smart toys are still not very well domesticated in Portuguese homes. The main

reason for this seems to be the high prices, even if some guardians think the toys have pedagogical potential.

3 Research overview

The research overview gives a picture of previous research on teachers' work with digital tools in ECE and the factors affecting it. Selected studies focus on play-based learning with digital tools in ECE, and report results from four continents.

3.1 Teachers' work with digital tools in ECE

A range of digital tools are used in daily ECE activities, such as computers, digital cameras, beamers, microscopes, scanners, smartphones and tablets including different kinds of software (Abdullahi & Abdulganiyu, 2019; Nilsen, 2018), Jernes et al. (2010) also found that teachers listed a range of knowledge and competences that children acquired when using digital tools. Through activities with digital tools, children learn letters, numbers, colours and figures. They also learn hand–eye coordination, digital vocabulary, how the Internet works, and how to approach digital tools in general (Jernes et al. 2010). These competencies focus on individuals, but children further develop social skills such as collaboration, waiting their turn and showing respect to others. Teachers work actively to include the children in using the digital tools (Abdullahi & Abdulganiyu, 2019; Jernes et al. 2010; Mangen et al. 2019). Abdullahi & Abdulganiyu, 2019. from Nigeria advocate collaborative game-based learning, which increases motivation to learn and encourages the children to contribute to the group. Another collaborative activity studied in Sweden involves working with interactive whiteboards (Bourbour, 2020), where the learning processes are made visible when working on the wall. Bourbour found that the interactive whiteboard changed teaching in a way unparalleled by small-screen devices in her research.

The tablet has become an increasingly common tool in ECE, and it seems to be considered a complement to traditional activities (Nilsen, 2018), even if Dezuanni & Knight (2015) claimed networking them into ECE places is a complex process, and doing so takes time (Engen, 2019). How the tablets are used depends on who takes initiative: children prefer play, games, entertainment or just relaxing activities, while teachers initiate pedagogical activities or try to motivate the children to join teacher-led activities (Nilsen, 2018).

Tablets are also used by teachers for administration. While digital documentation appears to be a perfect form of documentation – even 'super-documentation' (Knauf, 2020) – digital communication with guardians can be more complicated (Eckeskog, 2019). The problematic issues identified in Eckeskog's Swedish study were a lack of training and resources (time and technology).

It is not the technology itself, but teachers' presence and what they do which are key to using digital tools in a meaningful way with children (Dong, 2018; Morgan et al. 2016). Present teachers, who can survey, help, encourage, praise and also

support when there are difficulties and frustration easily arises, contribute to learning (Plowman & McPake, 2013).

3.2 Teachers' views on digital tools

It has been shown that teachers' work with digital media is affected by their attitudes towards them, and that their attitudes can affect the extent to which digital tools are available or visible to the children, or what rules there are about using them (Enochsson & Ribaues, 2020). Digital competence is regarded as an aspect of democracy in several studies (see Chukwuere, 2017; Lindahl & Folkesson, 2012; Nilsen, 2018). Enochsson and Ribaeus (2020) found that different views on democracy also led to varying views on using digital tools in ECE. Teachers can also regard digital tools as a threat (Hernwall, 2016), and some have concerns about digital technology limiting the children's creativity and causing health issues (Palaiologou, 2016).

In a comparative study where guardians and teachers from Jordan gave their views on the potential of using digital technology in ECE to support children's development and learning, it was found that the teachers saw benefits to intellectual development, while guardians held more general views (Ihmeideh & Alkhawaldeh, 2017). Teachers from Northern Europe generally consider digital tools important to learning (Nilsen, 2018), not just at the present moment, but also in preparing children for their futures, including preparing them for school (Enochsson & Ribaeus, 2020; Forsling, 2021; Plowman & McPake, 2013). Adults and children can have vastly different perspectives on current digital technology; therefore, children's perspectives are very important to take into account when implementing the curriculum (Nilsen, 2018).

3.3 Prerequisites needed

In a digital age, teachers need competence to create technology-based activities, which must present high-quality learning situations (Jernes et al. 2010; Magen-Nagar & Firstater, 2019). Research has found that teachers generally have difficulties in both aspects. They need to be encouraged to participate in in-service training to help them understand the available pedagogical possibilities and how technology can contribute to ECE (Dong, 2018; Magen-Nagar & Firstater, 2019), and also to find solutions in unforeseen situations (Artemieva et al. 2020; Plowman and McPake, 2013). Despite positive views on technology, teachers in Dong's, (2018) Chinese study show a low degree of pedagogical engagement with digital technology in their pedagogical practices and also a limited consciousness about their pedagogical role. Teachers' attitudes to and knowledge of digital tools can be developed through professional training. Several researchers claim teachers need quite an advanced level of competence in combination with their own driving force to enable children to develop their digital competence (Hernwall, 2016; Magen-Nagar & Firstater, 2019; Nilsen, 2018).

Information technology can be a positive contribution to ECE (Magen-Nagar & Firstater, 2019), but ECE needs to be updated to understand what knowledge and

skills needed for the children to be able to participate fully in a digital society, both here and now and as future adults (The Swedish Internet Foundation, 2019). Knowledge of technology is important. When software comes with instructions, it is used more effectively (Morgan et al. 2016). Knowledge of different methods is also important, as is knowledge of ways of performing in the digital context as mentor, instructor and teammate (Jernes et al. 2010), while at the same time relating to policy and practical frameworks (Mertala, 2019). No clear connections between the use of digital technology and learning have been found; learning instead depends mainly on the context (Magen-Nagar & Firstater, 2019; Nilsen, 2018).

When working with digital tools, teachers in ECE are sometimes questioned by guardians (Forsling, 2019), who are often affected by media debates on the negative effects of screen time on children. Blum-Ross and Livingstone (2018) advocate extending the discourse about young children's use of digital tools beyond screen time and so that it instead concerns the ways in which children use – and can use – such tools. Edwards and Birds (2017) as well as Mertala (2019) have suggested alternative frameworks to analyse *children's* use of digital tools in play-based learning environments. They described the complexity of the field and the way in which children's use of digital tools can be seen as epistemic as well as ludic play (Edwards & Birds, 2017), and how EDUCARE is not only a matter of education and care, but also of socialisation (Mertala, 2019).

To summarise, this overview shows that teachers see the potential of using digital tools in ECE and also use them to a certain extent. However, there is a need for teachers to understand more fully how to prepare children for a digital society, and to do so in a way that is meaningful for the youngest children.

4 Material and methods

The method was semi-structured interviews and below follows a description of the research instrument, participants, ethical considerations and analysis.

4.1 Research instrument

Semi-structured interviewing is a qualitative method and the interviews were conducted to give informants the opportunity to express themselves freely in relation to the theme of the interview (Christoffersen & Johannessen, 2015). According to Christoffersen and Johannessen, the relation between interviewer and interviewee is not as crucial in a semi-structured as in an unstructured interview, and two interviewers were involved. An interview guide was drawn up and used as a basic structure and further questions could be asked when clarifications were needed. This gave us deeper insight in the topic because interviewees could share their reflections and experiences.

The interview guide is based on the practical, symbolic and cognitive aspects mentioned in the theoretical framework above (Sørensen et al. 2000) to cover what material the teachers used, their attitudes and their training. This was done to ensure

that all parts of the domestication process are covered by the questions. The questions concerned the teachers' approach to digital tools, their symbolic value and the teachers' knowledge of handling them. An initial question was on their own understandings of digital tools and digital competence. This could for example reveal that some devices were so familiar that they were not considered technology (Holmgaard Christensen, 2019). The interviewees were also asked to describe in detail how they worked with digital tools, which technology was used and how this was done. There were also questions about where they kept the devices, what benefits they saw and also problems they encountered. Probing was used to ensure everything was covered (Christoffersen & Johannessen, 2015). The questions were designed to determine where in the domestication process teachers were, and what place technology had in their daily lives (Holmgaard Christensen, 2019).

Individual interviews were conducted in a quiet room at the interviewee's workplace. To reduce stress, a 45-min appointment was made for each interview, which took 20–40 min. All interviews were audio recorded.

4.2 Participants

This is a qualitative study, not aiming to compare individuals, but to study possible ways in which teachers work with digital tools in ECE. The participants were selected to ensure variation within the group of interviewees. Twelve teachers from nine different ECE institutions in four municipalities were interviewed. Beside the national curriculum, municipalities run ECE institutions fairly independently, and the use of digital tools can differ between municipalities. It was therefore important that several municipalities were represented. Emails requesting participation were sent to several principals in the four municipalities, and ten interviewees were recruited in this manner. The principals received information about the study and also the consent forms that were to be signed by the participants. A further two teachers were contacted directly, and they received permission to participate from their respective principals. The two teachers recruited directly were previously known to the interviewers, but no close relations existed. No information which could affect the interpretation of the results is deliberately omitted, but this transparency had to be balanced with protecting the anonymity of participants. All procedures followed Swedish regulations (Swedish Research Council, 2017). The selected teachers were all women of different ages, and their work experience as teachers varied between 1 and 40 years.

4.3 Analyses

The interviews were transcribed verbatim. The transcripts only included interviewees' words and a few remarks on their manner of speaking, and therefore listening carefully to catch *how* things were said was an important part of the analysis (Holmgaard Christensen, 2019). This also helps to make visible the dynamics between the teachers and technologies (Berker et al. 2006).

At first, the analysis focused on the four main phases of domestication described above (appropriation, objectification, incorporation and conversion) to determine where in the domestication process the teachers were (Holmgaard Christensen, 2019). Domestication theory studies often aim at studying specific tools. Instead focus was on the interaction between users and technologies, an approach for which the theory also suits (Berker et al. 2006). The analyses also concerned which kind of digital tools were used and in what way, what it meant to the teachers and how this meaning affected its use. (Holmgaard Christensen, 2019). The different phases were colour-coded in the transcripts. When analysing data from the first four phases, the categories reversed domestication (Karlsen & Syvertsen, 2016), moral economy (Silverstone, 2006), and triple articulation (Courtois et al., 2012) were used. The teachers' training and/or competence within the area was considered important and was analysed as a separate category.

The initial analyses were conducted individually by two researchers, before discussing them together to find a 'negotiated consensus' (Dahlgren & Johansson, 2019) to validate the results. This procedure increases reliability (Bjereld et al. 2018); in addition, the third researcher was used to enhance inter-rater reliability (Cohen et al. 2018.).

5 Results

This study concerns understandings of digital tools in ECE, and the analysis also aims at making the teachers' overall understanding of digital technology visible. Domestication theory can be seen as a multidimensional model of the process, since it is not always linear; the process can at the same time be both temporary and reversed (Lohnes Watulak & Whitfield, 2016), as is also shown in the results. The results are presented in two parts based on the research question. Results related to the first research question (In what ways, and to what extent, have teachers working in ECE integrated digital tools in their work?) are further organised based on the four phases in the domestication theory. The other categories described above are discussed under the second research question (What practical, symbolic or cognitive aspects affect their work with digital tools?).

5.1 Integration of digital tools

5.1.1 Appropriation

Only one of the teachers can be found in the appropriation phase, has taken steps towards the objectification phase. All teachers have access to a range of digital tools, both hardware like tablets, computers, beamers, etc., and software like a Learning Management Systems (LMS), geocaching apps, and games. The interviews highlighted differences between tools used with the children and tools used by the teachers in other ways, such as an LMS. The latter tools are domesticated to a greater extent than tools used with children. Such administrative tools have been introduced

into ECE institutions from above, and their introduction has been followed by specific training.

Motivation is crucial in the appropriation phase and is important in how digital technology is domesticated. Motivation does not originate only from the teachers' own interests, but from the principal or municipality. However, teachers' motivation can increase when they understand how communication with guardians is facilitated, and thus bring meaning to technology. All staff members are given the same conditions. In combination with mandatory training, including clear demands, the process of domestication becomes easier. The importance of support is visible in one of the municipalities, where all institutions were given access to the app *Polyglutt* (a multilingual picture book). Workshops were offered, and teachers found the app very useful. These factors together ensured successful domestication, mentioned by several of the teachers, for example:

> [The children] like *Polyglutt* and there are all different languages. I think it is very good if there are children with other first languages [than Swedish], so they have the possibility to listen to their own mother tongue.

When it comes to appropriation, several of the teachers spoke about the limitation of the systems used for ordering apps. They found the process difficult and time-consuming, as emails must be sent and costs approved before buying an app. An interviewee described the process as follows:

> It is more difficult than if there had been a separate account, which you could use as you see fit. Then you need to test things and it's a bit difficult to argue for buying it by saying you *think* it's a good tool, and then you discover it's not, and you've paid 50 [Swedish] kronor.

Teachers also gave examples of a system where an app is ordered and then bought and placed on the intranet by the IT department. Before they could download it, somebody else found and downloaded it, so the whole process had to be repeated.

5.1.2 Objectification

Five of the interviewed teachers were found to be in the objectification phase. The interviews clearly showed that all the teachers were aware of the changes related to the use of digital tools in ECE, since they all commented on it. They also said that digital tools were previously more used as a babysitter, a break activity or a gaming machine, as this teacher said:

> In the beginning when we first got iPads, we had one per unit, and at this time, it was more the children's tool. Because they used it and we didn't work with it, they [the children] played games. But I thought that it became, like, if you can call it babysitter.

The teachers shared the sense that it had gradually become more important to have pedagogical aims when using technology, especially after the introduction of personal tablets for the staff: the teachers expressed it as "owning the tool". Several

of the teachers differed between positive and negative screen time, depending on the activities. They did not want the tablets to become gaming machines:

> This is the way I want digital tools to be used, they shouldn't be gaming machines, we have to change our mindset. They have to become tools you can use to show, reflect and offer [the children something].

Some of the teachers had received instructions not to say 'iPad' or *surfplatta* (Swe., literally meaning "surfing tablet"), and so associate them with games. Teachers should instead use *lärplatta* (meaning "learning tablets"), which refers to something used with a pedagogical aim. The interviewees considered norms when talking about the tablets; what may be done and what should be avoided. Only a few of the interviewed teachers showed a positive attitude towards gaming on the tablets. These teachers described different types of gaming apps, and said that the ones encouraging collaboration or intra-activity can be used pedagogically.

Different kinds of software are used for communication with guardians (e.g. LMS) and are meaningful since the teachers regarded them as fulfilling a clear purpose. They make communication easier between the institution and the children's homes, but some interviewees said that they did not know if information had reached guardians. It was easier to see when a paper had disappeared from the child's shelf. Technology does not make everything easier, as this teacher stated:

> It's nice that we don't have to print out all the papers, because there are a lot of papers. But you have to know if the parents really read, or the communication will stop and there can be problems for the children. Now, when we have stopped using papers, we have to ask the parents all the time: "Have you been able to access the communication platform?", "Do you read what's written on the platform?" so they will get used to it, so they do not miss things and so there will be no problems for the children.

Despite these problems, the teachers are generally positive to the tools. Those who were in the objectification phase had in common that the tools were already in place, they had acquired symbolic meaning, and were used as a natural part of everyday life, but several interviewees said that the tools cannot be used too much or too often; digital activities cannot take precedence over other activities. They also expressed uncertainty on the aim of the technology and their own competence.

Preparing the children for school was an aspect raised in several interviews, and it stands out as part of the objectification phase. These interviewees claimed that children benefitted from having worked with digital tools in ECE when they start school:

> Our institution is situated in an area where I guess most families have digital media at home, but some children may live in other areas where it's different and it's extremely important that there are digital tools in ECE, so those children don't lag behind when they start school.

The results also show that several teachers saw digital tools as presenting a special kind of attraction, which almost automatically interested children in on-screen activities.

Interviewees provided examples of how they would like to work with digitalisation in ECE, without having done it yet. Here this has been considered part of the objectification phase: digital technology is given value and meaning, and the understanding of technology changes. These teachers' reasoning on using the technology may be interpreted as indicating integration, but such views are not consistent through the interviews and they provided no concrete examples. Their reasons for not yet putting digitalisation in practice differed: some said that all staff members did not agree on how to use digital technology, while others identified a lack of knowledge on implementing it.

5.1.3 Incorporation

Only two of the interviewees could be said to be in the incorporation phase. These teachers have made digital tools part of everyday activities with the young children and have come further in the domestication process than those in the objectification phase, as can be seen from this example:

> Digitalisation, iPads, beamers and computers are much, much more present [nowadays]. We sit by the computer and the children sit beside us, checking what we are doing. We do things together. It is as natural as paper balls, paper and pens. It is a change and we use these tools, the grown-ups and the children. In a few years it will be a natural activity.

The app *Polyglutt* is an example of software that several teachers described as a natural part of everyday ECE activities. In combination with the beamer it has a natural place in ECE and the teachers found it meaningful. Using *Polyglutt* with the children changes the context. Whereas children used to sit in a sofa, close to a teacher reading aloud from a book, they now sit together in front of a big screen listening to the same story, also available in different languages. In this context, the tablet acquires a specific meaning as a book or library:

> There are great benefits. I think reading has been difficult in different ways. There are sometimes many children, who want to listen and also see, and you hear "I cannot see", "can you show me", "I'm too far away", "she's sitting too close to me", etc. Now, there's room for everybody, lying on mattresses and blankets and seeing the book on the wall.

The teacher above describes how the working situation has improved with the help of this app and a beamer.

5.1.4 Conversion

Four of the interviewed teachers were found to be in conversion phase. In this phase, technology has been domesticated: it is not just part of everyday life, but also part of

one's identity. In this study of teachers' understandings of digitalisation, their implementation of the curriculum becomes part of the domestication process. In the interviews, there was discussion about their views of the concept "adequate competence" from the curriculum, and its relevance to their mission, as in the following example:

> I think we should be a counterweight to the games. My experience is that many children have access to games at home, that is what they tell us anyway, and then I think we need to help and think of how the tablets can be used except for playing games. So, that is what is adequate for us, like 20 years ago when children were playing a lot with a certain material, we should offer something else, so the children could have everything.

The conversion phase in the domestication process of digital technology in ECE is here interpreted as the teachers having taken a step further than those in the incorporation phase by using digital technology in a way which supported the children in building their own identity, for example through language:

> We have looked up information on the computer for these cards we have made [with signs …], there's also other languages, for example Sorani, so first it's in Swedish, then the sign – an image of what it represents – and then there is Sorani. Then he can teach me this word in his language, and I can teach him what it is in Swedish, and we make the sign [with our hands].

Conversion can also involve how teachers used digital technology to explore topics with the children, and support them in cultivating awareness of their own part in the bigger whole, while technology can be intertwined in all activities:

> It covers everything: values, construction, development, learning, democracy. You can use technology in all these aspects and highlight it so that the children own their development and learning. We cannot be the ones who own their world, it must be the children themselves. We should help and support and make it clear to them.

Another example is when a teacher described using drama with the children, and asked if they wanted to perform it to the younger children. They did not, but said she could record a video, and as a natural part of the activity, she recorded them, and the children showed it to the younger ones. The teacher offered alternatives to the children by asking them. This was an opportunity to make the children aware of these possibilities, and also help them to develop their identity and group solidarity. She recounted how proud the children were of the result.

The conversation phase also involves how teachers create meaning in their profession and how they use tools to develop their relations to the children's guardians. Communication, both with their manager and the children's guardians, is quicker and easier.

Another recurring aspect from the interviews has been interpreted as part of the teachers' views on how digital tools are related to the world around them:

> I think that maybe we should work more with making our own videos. […] Ask us what kind of pictures we take – critical thinking and that part. For what

purpose do we use the picture, and what is ok. We talked a lot about that it's necessary to ask first. When they got this tablet and could take photos, they always had to ask for permission first. So, it's more automatic to them than it was to us.

As shown above, most teachers had converted the digital technology they used for administration, and also tools they had used in connection with in-service training and were encouraged to use. The analysis clearly also shows that teachers can be in different phases at the same time, depending on the technology.

5.2 Aspects affecting domestication

5.2.1 Reversed domestication

Evidence of reversed domestication recurs in the interviews. In several cases, this was connected to the use of programmable floor robots. The tool has been well domesticated, but then ends up in a storage room and is not used at all. Possible reasons could include placement: in a storage room, use becomes impractical and neither the children nor the teachers are reminded of or inspired to use them. The fact that they are not easily accessible becomes an obstacle, and therefore is a practical aspect affecting domestication. Another possible reason can be that the robots have been in focus in a project, and when the project is over, priorities change and there is not enough time for the robots.

There are also examples of reversed domestication occurring when the children lost interest and a tool is no longer used or used less frequently. Examples given in the interviews included the use of QR codes and green screens:

When it was new, they used it a lot, it was exciting to be there and they found out that if you put on a green t-shirt, you become invisible. You become like the background, and I think that was the most fun. They fetched our green aprons from the "painting room", and they became "nothing"; just heads and hands. Wow…. Super cool! But not as many are doing it now. It was fun when we started, but the interest might come back. The benefit was that we could discuss what was true and not true.

I experienced the work with the QR codes […], they did it and after it were like: Ok, now we know this.

There are several possible explanations for reversed domestication: the teachers could for example not meet the demands and challenge the children further:

Maybe what is needed is that we should help them more, like adding another level….

Here, the teacher points at a cognitive aspect of reversed domestication, when they have not received enough training. Sometimes the tools were not considered as useful in ECE activities, which is an example of a symbolic aspect affecting domestication.

5.2.2 One-to-one tools

Several municipalities follow the one-to-one principle for allocating computers and tablets. In schools, this means one computer or tablet per pupil, but in the ECE institutions it meant one tablet per teacher (and childcare worker). Teachers consider the principle to have both benefits and disadvantages. On the positive side, each teacher had an updated, easily accessible and practical working tool. On the negative side, the children's use of this tool was conditioned, because of the teachers' personal responsibility for their tablets. The children's use was also limited due to the presence of confidential documents. Owners were afraid that documents would be visible, disappear, or be erased, and therefore the children were not allowed to use the tablet without careful supervision. Another hinder is thereby revealed – time to spend with the children when using digital tools. Teachers in ECE without "child tablets" claimed that the digital tools were less available to the children compared to before the introduction of the one-to-one principle. The remaining tablets for the children are seldom updated and were not always compatible with newer apps, and this practical aspect leads to a reversed domestication process:

> It's my tool, it's my responsibility, and I have to be careful, it mustn't break. Earlier, we had two "child tablets" in each unit, and they shouldn't break either, but it was not the same. So, with my tool you can borrow it under my supervision.
> I often take notes with the iPad, you don't use paper and pen anymore, you take notes in the iPad. And then it's like "Oh, what if they press something and erase something important"?

5.2.3 Various problems

Several interviewees mentioned technical problems as a reason and practical aspect complicating the domestication process:

> 90% of the time it works super, but this morning the network was down for a while, and when that happens, there's total chaos.

Several interviewees also highlighted the effect of guardians' attitudes about using technology on their work, and that they feel the need to justify what they do, which is another example of a symbolic aspect that affects domestication. Guardians' attitudes can affect teachers work negatively through moral economy:

> Like, if it's late afternoon and only one child is left, you sit and read a book on the iPad or play a game together, and you get this [from the guardian]: "My child shouldn't sit here with an iPad!".

However, not all teachers had met these attitudes from guardians. Some have positive experiences from talking to guardians and been given their view of using digital tools. They had explained that screen time can mean many different things, and they thought that the guardians' attitude had changed.

5.2.4 Moral economy

Choices and decisions made are affected by the existing moral frameworks and values in the ECE context, or the moral economy, which is part of the symbolic aspect. Some values are shared by everybody, but this also concerns individual values. The moral economy of ECE – including the curriculum – can further be affected by outside factors, such as guardians' opinions or media debates. Depending on its constitution, the ECE institution's moral economy can affect the domestication process negatively. Several teachers expressed their moral values and thoughts about using digital tools:

> It is a useful tool, it is, but we mustn't forget how to use paper and pencils. If I'm allowed to give an example: my 12-year-old son writes terribly, and you can wonder if it is because he sits a lot at the computer and presses the keys. Do you follow me?

Moral values can also affect where the digital tools are placed in the institution. Some of the teachers claimed that the use of digital tools must be limited, and regarded addressing this as part of their mission as teachers:

> They are locked in. Only staff can get them, so we rule so to speak.
> We are always there when they use them asking "For what purpose will you use it?" And they have to tell us. They are not used spontaneously by the children.

One of the interviewees highlighted that many children have more or less unlimited access to tablets at home, but there are limitations at the institution. She claimed that ECE institutions have to take the guardians' approaches into consideration.

Domestication is complicated when ECE institutions do not have free access. Another factor complicating domestication is economic issues, as in the example above where institutions have to pay for an app before testing it, but it turns out not to be useful. Some teachers also described finding useful activities on the tablet as difficult, since the children are so young. Stress is another factor affecting work with the tablets negatively. However, also when the children are given more access – when tablets are used as babysitters to obtain a quieter working situation – this is considered to affect the domestication process negatively. From these examples, it is obvious that the practical, symbolic and cognitive aspects can be intertwined in the domestication process.

5.2.5 Lack of competence

A recurring hindrance for domestication of digital tools is a lack of relevant competence and training, which is an example of a cognitive aspect. Most of the interviewees either had no or outdated training in digital technology, and had received no in-service training. Interestingly, those who had received in-service training were the teachers with the longest length of service, which also means they trained as

teachers a long time ago. Two of these teachers had become IT pedagogues after an additional year at university, and some of the interviewees had taken basic computer courses when computers first started entering ECE. It seems that organised opportunities for in-service training had recently become less frequent, and that the individual is responsible for keeping their knowledge up to date. The in-service training teachers are offered mostly concerns administrative tools rather than digital tools used with the children. Here are two reflections on this subject:

> I'm an autodidact. The tools arrived and we just had to learn.
> There's not so much in-service training, more this IT group in the municipality, where we share things, if there's a new app we want to show or something, or now somebody has learnt something that person wants to share, and we can show each other. So, we can say that we learn, but there's no real training.

Tools used with the children, like tablets, beamers and floor robots, are paid for and provided by the institution. The results show a lack of in-service training in using digital tools with the children in a pedagogical way. All interviewees expressed a need to increase their competence and stay updated. Several interviewees said that there is no support to contact when the tools do not work or just to ask for advice. These factors increase the risk that the domestication process slows down or reverses.

5.3 Summary of results

The teachers face different conditions and have various experiences and understandings concerning the domestication of digital tools in ECE. Most of the interviewed teachers are either in the objectification or the conversion phase of the domestication process, but the analysis also shows that teachers can be in different phases at the same time, depending on the technology. The digital tools used for administration are domesticated to a greater extent than the tools used with the children. In-service training is also offered to a greater extent for administrative tools, which can explain the higher degree of domestication.

The perceived need for a clearer purpose had been strengthened, since teachers had received their own tablets, because this has meant that children have less access and the domestication process is slowing down for educational purposes. While several of the teachers emphasised the importance of a pedagogical aim and their own role, they were also uncertain about how and why the tools should be used with the children.

Despite their overall positive attitude towards digitalisation in ECE, this study clearly shows that teachers lack in-service training, which makes it more difficult to domesticate the digital tools. Much of the responsibility for developing digital and pedagogical competence in relation to digital tools lies with the teachers themselves. Various surrounding structures, for example on purchasing apps, as well as the lack of support make domestication more difficult. There is also reversed domestication of digital tools, possibly due to a lack of accessibility, shifting focus and, in some cases, teachers' difficulties in finding some of the digital tools meaningful. Practical,

symbolic as well as cognitive aspects affect domestication, and it is shown that individual driving force and professional learning and development are important factors for domestication.

6 Discussion

First, the teachers' integration of digital tools in ECE is discussed in relation to previous research. Second, the focus is on aspects affecting this work, and third, the limitations of this study are stated. The discussion ends with suggestions for further research.

6.1 Teachers' integration of digital tools in ECE

The results show that several of the teachers interpreted their mission as including giving children wide exposure to digital tools and showing them alternatives to playing games, which they claimed was what the children most often encountered at home (see Chaudron, 2015). In the present study, digital play was mostly seen as a non-pedagogic activity, and therefore teachers avoided the word 'playing' in connection with digital tools and some also avoided games on the tablets, since they thought it would be associated with an activity without pedagogic aims (see Jernes et al. 2010). On one hand, this is not unreasonable, since playing games does not automatically lead to learning (see Nilsen, 2018). On the other hand, in a play-based learning environment like ECE (Edwards & Birds, 2017), play should be considered a learning opportunity.

The interviews in the present study clearly showed that pleasure is regarded as less important than learning. The results shows that teachers regard their digital mission as important for preparing the children for school. Forsling (2021) and Nilsen (2018) have also found prospective methods important. Forsling and Nilsen claimed that the use of digital tools in relation to pleasure is not highlighted in the same way as in relation to learning, democracy and working life, all parts of the forward-looking, prospective efforts. The teachers find it important to have a clear aim with the activities and be present as teachers. According to research, teachers' presence is a positive development, since this is key to the meaningful use of digital tools (Abdullahi & Abdulganiyu, 2019; Dong, 2018; Morgan et al. 2016). The teachers were also concerned that digital tools should not take over, but their main concern was that the activities should be in collaboration with other children and/or staff (see Abdullahi & Abdulganiyu, 2019; Bourbour, 2020 Jernes et al., 2010; Mangen et al. 2019).

It should be remembered that integrating digital tools in ECE is a complex process (Dezuanni and Knight, 2015; Edwards & Birds, 2017; Mertala, 2019), and it takes time (Engen, 2019). However, the results show that two common tools are used in very many ways and give us examples of triple articulation (see Courtois et al. 2012; de Reuver et al. 2016). The tablet and the beamer are both digital artefacts, bearers of meaning and used in different contexts within the ECE institutions,

and are therefore used to fulfil many aims. The various uses of these two artefacts could be a reason why the domestication process is so well developed.

The teachers in this study highlighted the importance of promoting the children's critical thinking skills, something not found explicitly in earlier research – or at least not explicitly for children in ECE – even if several researchers have touched upon the subject in connection with democracy (Chukwuere, 2017; Enochsson & Ribaeus, 2020; Lindahl & Folkesson, 2012). In this study, teachers are seen as regarding critical thinking as part of their mission in ensuring 'adequate digital competence', and this topic was not further discussed by the interviewees.

6.2 Aspects affecting teachers' integration of digital tools

The results show that professional training is important in developing teachers' understanding so that it contributes to the domestication of digital tools in ECE. Those who had the most relevant and thorough knowledge within the area had also domesticated the tools to a greater extent. These results are well in line with earlier research pointing at education and training as important aspects in relation to digital technology in ECE (Artemieva et al. 2020; Dong, 2018; Magen-Nagar & Firstater, 2019; Plowman & McPake, 2013), and also for changing teaching (Magen-Nagar & Firstater, 2019). Tools that teachers have received training in are domesticated to a greater extent than other tools. Tools that have come with the most training are administrative tools (see Jernes et al. 2010; Morgan et al. 2016) and documentation tools are found useful (see Knauf, 2020).

According to the interviewees, their own understandings or methods can lead to not using digital tools at all, not using digital tools to their full potential, or decreased interest from the children. Some of them claimed that they had failed to introduce technology in a relevant way, show children how to use it or were unable to challenge the children further in their activities. This is interesting in relation to earlier research showing that teachers, despite positive attitudes, show a low level of pedagogy and limited awareness of their pedagogical role in relation to children's use of technology (Dong, 2018). Dong's study was conducted in China where ECE curricula and teaching methods differ from those in a Swedish context, thus making comparison difficult. Nevertheless, the results here show that teachers are aware of the importance of their pedagogical role, although the pedagogy is at a low level in some cases. It is therefore important that training not only focuses on technological skills, but also on using digital tools pedagogically.

Here, discussions with guardians about screen time were seen as less of a problem than in earlier research (Blum-Ross & Livingstone, 2018; Forsling, 2019), although the problem exists. This could be because most teachers in this study were clear on using technology for educational purposes and avoiding "gaming", which seems to be a trigger to some guardians. As mentioned above, play is a natural part of education in ECE (see Edwards & Birds, 2017), and teachers in ECE could benefit from training, including on the specific use of digital tools in play-based learning environments.

Training is not the only success factor, since some teachers in the study did not have any training within the area. Instead, their personal driving force, interest and commitment had helped them to convert technology. Several researchers have claimed that in addition to a high level of digital competence, a personal driving force is needed to successfully support children in developing their digital competence (Hernwall, 2016; Magen-Nagar & Firstater, 2019; Nilsen, 2018). In this study, part of this driving force originated from colleagues through teamwork. Teachers in Sweden work in teams and the teachers in this study thought that individuals in a team have different competences and therefore support each other.

The variation in the conditions the teachers face is important to consider, since it affects the success of the domestication process, which national guidelines concerning digital tools in education aspires to in the long term (Chaudron, 2015; SNAE, 2018). Existing differences between individuals can increase when introducing new technology, if some can mobilise resources and social capital more effectively than others (Lohnes Watulak & Whitfield, 2016).

6.3 Limitations

There are of course limitations to this study. There was a small number of interviewees – and municipalities – and more similar studies are needed. The general challenge with replicating a study on contemporary technology is that both technology and society change before this can happen. Nevertheless, there was saturation in the answers (see Christoffersen & Johannessen, 2015). The aim of this study was to understand the phenomenon of the domestication process of play-based education with digital technology in ECE. Brinkmann and Kvale (2015) discuss different types of generalisation, and from their perspective, this can be seen as *naturalistic generalisation*, meaning a generalisation that comes from tacit knowledge made explicit, rather than a generalisation on the basis of which predictions can be made.

Because the request was sent to principals, they may have selected those thought to give the 'best' answers. The interviewees also had the interview questions in advance, and could prepare. This may be regarded as problematic, but could also have led to more reflective answers that better fit the purpose of the study. By asking the teachers to write diaries or self-reports the analyses could have been further strengthened, but this will have to be done in a future study.

Only the teachers' perspectives are represented here. ECE also involves children and childcare workers. The focus of this study was on teachers, since they have the pedagogical responsibility, but it would of course be interesting to study all groups concerned.

6.4 Conclusions

This study shows that teachers make efforts to bring digital technology into ECE. Despite a lack of continuing education, they work to bring about a change both within themselves and for the children. Important factors in the successful domestication of digital tools in ECE include hands-on as well as pedagogical digital

competence in combination with personal drive and professional learning and development. Domestication theory has been very useful when analysing teachers' understandings and experiences of the digitisation of ECE, and also as a theoretical framework for visualising changes when it comes to the uses of and approaches to digital technology. It is possible to distinguish the incorporation phase, where teachers use digital technology and see it as a useful tool, from the conversion phase, where the process has developed further, forms part of one's identity, and individuals and technology interact in a natural way that leads to further development.

Research within the area of play-based learning by using digital tools in ECE is sparse, as stated by Edwards and Birds (2017). The results from the present study can contribute important knowledge on how teachers view their digital mission in ECE, in what ways they find the use of digital tools meaningful, and what challenges they face when implementing new technology in their play-based educational activities. There is also a need to understand more fully how to prepare the youngest children for a digital society in a meaningful way and within existing policy frameworks and practical conditions (see Mertala, 2019), and therefore this area must be studied further. From an organisational perspective, these results can be used to plan in-service training, while also increasing individual and group knowledge and providing inspiration to teachers in developing their work with digital tools.

References

Abdullahi, N. J. K., & Tijani, AbdulganiyuA. (2019). Digitalization in education system and management of early childhood care education in Nigeria. *Southeast Asia Early Childhood Journal, 8*(2), 28–42. https://doi.org/10.37134/saecj.vol8.no2.3.2019

American Academy of Pediatrics. (2016). Media and young minds (policy statement). *Pediatrics, 138*(5), 1–8. https://doi.org/10.1542/peds.2016-2591

Artemieva, V. V., Voronina, L. V., & Utyumova, E. A. (2020). Development of information culture of future teachers in the conditions of digitalization of education. *Advances in Economics, Business and Management Research, 138,* 841–847.

Berker, T., Hartmann, M., Punie, Y., & Ward, K. (2006). Introduction. In T. Berker, M. Hartmann, Y. Punie, & K. Ward (Eds.), *Domestication of Media and Technology* (pp. 1–17). Open University Press.

Bjereld, U., Demker, M., & Hinnfors, J. (2018). *Varför vetenskap? [Why science?].* Studentlitteratur.

Blum-Ross, A. & Livingstone, S. (2018). The trouble with "screen time" rules. In G. Mascheroni, C.Ponte & A. Jorge (Eds.), *Digital Parenting: The Challenges for Families in the Digital Age*. Nordicom. https://www.nordicom.gu.se/sv/publikationer/digital-parenting. Accessed 9 Mar 2021.

Bourbour, M. (2020). Using digital technology in early education teaching: learning from teachers' teaching practice with interactive whiteboard. *International Journal of Early Years Education*. https://doi.org/10.1080/09669760.2020.1848523 Advance online publication.

Brinkmann, S., & Kvale, S. (2015). *Interviews*. Sage.

Brito, R., Dias, P., & Oliviera, G. (2018). Young children, digital media and smart toys: How perceptions shape adoption and domestication. *British Journal of Educational Technology, 49*(5), 807–820. https://doi.org/10.1111/bjet.12655

Carson, V. et al. (2019). Physical activity and sedentary behavior across three time-points and associations with social skills in early childhood. *BMC Public Health 19*(27). https://doi.org/10.1186/s12889-018-6381-x.

Chaudron, S. (2015). *Young children (0–8) and digital technology: A qualitative exploratory study across seven countries (Report EUR 27052)*. Publications Office of the European Union. https://doi.org/10.2788/00749

Chonchaiya, W., & Pruksananonda, C. (2008). Television viewing associates with delayed language development. *Acta Pædiatrica, 97*(7), 977–982. https://doi.org/10.1111/j.1651-2227.2008.00831.x

Christoffersen, L., & Johannessen, A. (2015). *Forskningsmetoder för lärarstudenter [Research Methods for Student Teachers]*. Studentlitteratur.

Chukwuere, J. E. (2017). From decolonization to digitalization of education in South Africa. *International Journal of Sciences and Research, 73*(12/1), 232–241. https://doi.org/10.21506/j.ponte.2017.12.15

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (7th ed.). Routledge.

Courtois, C., Verdegem, P., & De Marez, L. (2012). The triple articulation of media technologies in audiovisual media consumption. *Television & New Media, 14*(5), 421–439. https://doi.org/10.1177/1527476412439106

Dahlgren, L-O. & Johansson, K. (2019). Fenomenografi [Phenomenography]. In A. Fejes & R. Thornberg (Eds.), *Handbok i kvalitativ Analys* (s.179–192). Liber.

de Reuver, M., Nikou, S., & Bouwman, H. (2016). Domestication of smartphones and mobile applications: A quantitative mixed-method study. *Mobile Media & Communication, 4*(3), 347–370. https://doi.org/10.1177/2050157916649989

Dezuanni, M. & Knight, L. (2015). Networking Ipads into preschool spaces (p. 142–160). In M. Dezuanni, K. Dooley, S. Gattenhof & L. Knight, *iPads in the Early Years: Developing literacy and creativity*. Routledge.

Dong, C. (2018). Preschool teachers' perceptions and pedagogical practices: Young children's use of ICT. *Early Child Development and Care, 188*(6), 635–650. https://doi.org/10.1080/03004430.2016.1226293

Eckeskog, L. (2019). *Communication in pre-school : pre-school teachers and childcare workers communicating with parents in a digitalised media landscape*. Published Doctoral Thesis, Umeå University.

Edwards, S., & Birds, J. (2017). Observing and assessing young children's digital play in the early years: Using the digital play framework. *Journal of Early Childhood Research, 15*(2), 158–173. https://doi.org/10.1177/1476718X15579746

Engen, B.K. (2019). Comprendiendo los aspectos culturales y sociales de las competencias digitales docentes [Understanding social and cultural aspects of teachers' digital competencies]. *Comunicar, 27*(61), 9–19, https://orcid.org/0000-0003-2446-8866.

Engen, B.K., Glæver, T.H. & Mifsud, L.M. (2014). Out of the WILD and into the schools: iPads from a domestication perspective. In M. Searson; M. Ochoa *Society for Information Technology & Teacher Education 25th International Conference Proceedings*, 1237–1242.

Enochsson, A.-B., & Ribaeus, K. (2020). *"Everybody has to get a chance to learn": Democratic aspects of digitalisation in preschool*. Advance online publication. https://doi.org/10.1007/s10643-020-01117-6

European Commission (2019). *Digital education at school in Europé* (Eurydice report). Publications office of the European Union. https://www.uhr.se/globalassets/_uhr.se/internationellt/eurydike/digital-education-at-schools-in-europe_eurydice-report.pdf. Accessed 9 Mar 2021.

Forsling, K. (2019). Kartläggning av digitalisering i Nacka kommuns förskolor [Mapping digitalisation in Nacka municipality preschools], LnK Company. http://shorturl.at/kszSV.

Forsling, K. (2021). Children's Cultural Backpack and Preschool Education: A Design-Based Study in a Swedish Preschool (pp. 169–191). In L. Haas & J. Tussey (Eds.), *Connecting Disciplinary Literacy and Digital Storytelling in K-12 Education*. IGI Global, https://doi.org/10.4018/978-1-7998-5770-9.ch009.

Hernwall, P. (2016). 'We have to be professional' – Swedish preschool teachers' conceptualisation of digital media. *Nordic Journal of Digital Literacy, 11*(1), 5–23. https://doi.org/10.18261/issn.1891-943x-2016-01-01

Hinkley, T., et al. (2014). Early childhood electronic media use as a predictor of poorer well-being: A prospective cohort study. *JAMA Pediatrics, 168*(5), 485–492. https://doi.org/10.1001/jamapediatrics.2014.94

Holmgaard Christensen, L. (2019). *Hvad gør vi med medieteknologier?: En kritisk introduktion til domesticeringsteori [How do we handle media technologies?: A critical introduction to domestication theory]*. Syddansk Universitetsförlag.

Ihmeideh, F., & Alkhawaldeh, M. (2017). Teachers' and parents' perceptions of the role of technology and digital media in developing child culture in the early years. *Children and Youth Services Review, 77,* 139–146.

Jernes, M., Alvestad, M., & Sinnerud, M. (2010). "Er det bra, eller?" Pedagogiske spenningsfelt i møte med digitale verktøy i norske barnehager ["Is it good, or?" pedagogical tensions when meeting digital tools in Norwegian early childhood education]. *Nordisk barnehageforskning, 3*(3), 115–131. https://doi.org/10.7577/nbf.280

Karlsen, F., & Syvertsen, T. (2016). You can't smell roses online: Intruding media and reverse domestication. *Nordicom Review, 37,* 25–39.

Kjällander, S., & Riddersporre, B. (Eds.). (2019). *Digitaliseringiförskolan: Påvetenskapliggrund [Digitalisation in preschool: On scientific ground]*. Naturochkultur.

Knauf, H. (2020). Super-Documentation? Roads to digitalisation of documentation and their implications (241–255). In M. Alasuutari, H. Kelle & H. Knauf, *Documentation in Institutional Contexts of Early Childhood*. Springer Nature, CH.

Lindahl, G., & Folkesson, A.-M. (2012). ICT in preschool: Friend or foe? *International Journal of Early Years Education, 20*(4), 422–436. https://doi.org/10.1080/09669760.2012.743876

LohnesWatulak, S., & Whitfield, D. (2016). Examining college students' uptake of facebook through the lens of domestication theory. *E-Learning and Digital Media, 13*(5–6), 179–195. https://doi.org/10.1177/2042753016689633

Magen-Nagar, N., & Firstater, E. (2019). The obstacles to ICT implementation in the kindergarten environment: Kindergarten teachers' beliefs. *Journal of Research in Childhood Education, 33*(2), 165–179. https://doi.org/10.1080/02568543.2019.1577769

Mangen, A., Hoel, T., Jernes, M., & Moser, T. (2019). Shared, dialogue-based reading with books vs tablets in early T childhood education and care: Protocol for a mixed-methods intervention study. *International Journal of Educational Research, 97*(2019), 88–98. https://doi.org/10.1016/j.ijer.2019.07.002

Marklund, L., & Dunkels, E. (2016). Digital play as a means to develop children's literacy and power in the Swedish preschool. *Early Years, 36*(3), 289–304. https://doi.org/10.1080/09575146.2016.1181608

Mertala, P. (2019). Digital technologies in early childhood education: Aframe analysis of preservice teachers' perceptions. *Early Child Development and Care, 189*(8), 1228–1241. https://doi.org/10.1080/03004430.2017.1372756

Morgan, K., Morgan, M., Johansson, L. & Ruud, E. (2016). *A systematic mapping of the effects of ICT on learning outcomes.* Oslo: Knowledge Center for Education. https://pdfs.semanticscholar.org/6fde/94066bbdc2a1436de860f5fd01677f8c62dd.pdf. Accessed 9 Mar 2021.

Nilsen, M. (2018). *Children's and teachers' activities with tablets and apps in preschool.* (Published Doctoral dissertation). Gothenburg: Acta Universitatis Gothoburgensis.

Palaiologou, I. (2016). Teachers' dispositions towards the role of digital devices in play-based pedagogy in early childhood education. *Early Years, 36*(3), 305–321. https://doi.org/10.1080/09575146.2016.1174816

Plowman, L., & McPake, J. (2013). Seven myths about young children and technology. *Childhood Education, 89*(1), 27–33. https://doi.org/10.1080/00094056.2013.757490

Selwyn, N. (2012). Making sense of young people, education and digital technology: The role of sociological theory. *Oxford Review of Education, 38*(1), 81–96.

Sepúlveda, A. (2020). *The digital transformation of Education: Connecting schools, empowering learners*. International Telecommunication Union UNESCO UNICEF.

Silverstone, R. (2006). Domesticating domestication: Reflections on the life of a concept. In T. Berker, M. Hartmann, Y. Punie, & K. Ward (Eds.), *Domestication of media and technology* (pp. 229–248). Open University Press.

Sørensen, K. H., Aune, M., & Hatling, M. (2000). Against linearity: On the cultural appropriation of science and technology. In M. Dierkes & C. von Grote (Eds.), *Between understanding and trust: The public, science and technology* (pp. 237–257). Routledge.

Swedish National Agency for Education (2018). *Curriculum for the preschool, Lpfö 18*. SNAE.

Swedish Research Council (2017). *Good Research Practice*. Swedish Research Council. https://www.vr.se/english/analysis/reports/our-reports/2017-08-31-good-research-practice.html. Accessed 9 Mar 2021.

The Swedish Internet Foundation. (2019). *Barnen och internet 2019 [The children and the internet 2019]*. https://svenskarnaochinternet.se/rapporter/barnen-och-internet-2019/. Accessed 3 Nov 2020.

Voujärvi, H., Isomäki, H., & Hynes, D. (2010). Domestication of a laptop on a wireless university campus: A case study. *Australasian Journal of Educational Technology, 26*(2), 250–267.

World Health Organization (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. https://apps.who.int/iris/handle/10665/311664. Accessed 3 Nov 2020.

Ytre-Arne, B. (2019). Media use in changing everyday life: How biographica disruption could destabilize media repertoires and public connection. *European Journal of Communication, 34*(5), 488–502. https://doi.org/10.1177/0267323119869112