Abstract

There is a body of evidence suggesting that instead of concentrating only on teaching and learning (the education task), teachers believe that their tasks are to care for their students social, emotional, and physical needs (the caring task), and to raise them to be and become functional members of society (the socialization task). However, this diversity has not been acknowledged in teachers' beliefs research done in technology integration context. To provide a more nuanced understanding of the variety and role of teachers' beliefs about technology integration this study has synthesized 35 qualitative empirical research studies via the method of meta-ethnography. The focus is on early childhood education (ECE) as so far, no reviews on early childhood teachers' beliefs have been conducted. The synthesis suggests, that education, socialization, and care all have a meaningful role in teachers' beliefs towards technology use in ECE. Each of these tasks and dimensions were identified from teachers' beliefs for or against integrating technology into ECE practices. The synthesis also suggests, that teachers' beliefs are shaped by macro- and micro-contextual factors including national educational policies and personal experiences. Implications for teacher education are discussed.

Highlights

First review study on early childhood teachers' beliefs about technology integration (TI)

First review study to map the contextual factors behind teachers' beliefs in TI

Broadens the pedagogical perspective to teachers' beliefs in TI-context

Identifies macro- and micro-contextual factors that shape teachers' beliefs about TI

Preservice and in-service teachers' share similar beliefs

Keywords:

Beliefs: Early childhood education; Educational technology; Systematic review; Technology integration; Teacher

1. Introduction

For decades, researchers have sought out the secret to successful technology[1] integration which, to combine Dockstader's (1999) and Lloyd's (2005) definitions, translates to organizing the goals of curriculum and technology into a complex but coordinated and harmonious whole. Teachers' pedagogical beliefs are considered to play a key role in achieving this objective (e.g., Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Tondeur, Hermans, van Braak, & Walcke, 2008; Tondeur, vanBraak, Ertmer, & Ottenbreit-Leftwich, 2017). Ertmer (2005, p. 25) even argues that teachers' pedagogical beliefs are "the final frontier in our quest for technology integration". Inspired by the work of Pajares (1992), she defines pedagogical beliefs as beliefs about teaching and learning. However, this view is based on a rather narrow understanding of the concept of pedagogy and what being (and becoming) a teacher entails. Traditionally, pedagogy refers to the "idea of a special, affectively charged relationship between teacher and child" (Friesen, 2017, 733–734), and a body of empirical evidence suggests that, instead of concentrating only on teaching and learning, teachers believe that their tasks are to care for and promote the holistic well-being of students, including their social, emotional, and physical needs (e.g., Estola, Erkkilä, & Syrjälä, 2003; Lasky, 2005; O'Connor, 2008).

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[1] In this study, technology refers to digital devices (i.e., computers, tablets, smartphones) and products or outputs that are viewed, played, or created on these devices (i.e., applications, games, websites) (Plowman, 2016). This inclusive and broad definition corresponds with the data-driven and interpretative nature of the present review study

This so-called "whole child" approach to teaching (Lasky, 2005, p. 906) is emerging in technology integration issues as well. Questions that are associated with the impact of digital technologies on children's and adolescents' physical and psychological wellbeing are a matter of widespread scientific and public debate (e.g., Orben & Przybylski, 2019; Palaiologou, 2017), and there are emerging indications that these issues are meaningful for teachers. For example, teachers worry whether technology use in institutional education will increase students' overall time spent on technology to an unacceptable level because they believe that technology use in the home is generally extensive (Mertala, 2019a). Additionally, many teachers believe that, even though digital solutions may not benefit students' learning, it is important that students learn digital skills for the future in their studies and/or working lives (Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010). Therefore, teachers' decisions and practices are affected by various—and sometimes competing (Wallace & Kang, 2004)—sets of beliefs and acknowledging this complexity is a prerequisite to successful technology integration.

1.1. The purpose of the study and research questions

To provide a more nuanced understanding of the variety and role of teachers' beliefs in the context of technology integration, this paper reviews existing qualitative research literature via meta-ethnography (Noblit & Hare, 1988). The focus is on research conducted in the field of early childhood education. This decision is justified with two reasons. The first reason is that early childhood education provides a fruitful environment to explore the multidimensionality of teacherhood and teachers' beliefs: Early childhood education is often conceptualized through the so called educare model consisting of education, socialization, and care which "form a harmonious whole" and allow "a holistic approach to the child's growth, development, and learning" (Finnish National Board of Education, 2016, p. 21; see also Broström, 2006; Van Laere & Vandenbroeck, 2018). The second reason is that even though review articles about teachers' beliefs research in technology integration

context has been published (Tondeur et al., 2017) so far, no systematic review of early childhood teachers' beliefs about technology integration has been conducted. Instead, the existing reviews have concentered on mapping technology practices (Kontovourki et al., 2017), early years practitioners' professional development needs (Marsh, Kontovourki, Tafa, & Salomaa, 2017), and barriers to technology use (Plumb & Kautz, 2015).

The first objective of the research was to examine how the threefold task of education, socialization, and care is reflected in early childhood teachers' beliefs about technology integration. Given that beliefs are always shaped within specific historical, material, and cultural conditions (Nuttall et al., 2015), the second research objective was to explore contextual factors behind teachers' beliefs. These objectives were formulated into the following research questions:

- How are the aspects of education, socialization, and care present in teachers' beliefs about technology integration in early childhood education?
- What is the role of contextual factors in shaping of teachers' beliefs about technology integration in early childhood education?

2. Background

2.1. Teachers' beliefs and technology integration

Richardson (2003, p. 2) has defined beliefs as "psychologically-held understandings, premises or propositions about the world that are felt to be true." This widely applied characterization acts as the definition of beliefs in this review as it neatly captures the multidimensional nature of beliefs. As argued by Pajares (1992, p. 309), beliefs often "travel in disguise and under alias," and he has provided an exhaustive list of concepts that have been used to indicate beliefs in the research literature, including attitudes, values, judgments, axioms, opinions, ideologies, perceptions, conceptions, conceptual systems, preconceptions, dispositions, implicit theories, explicit theories,

personal theories, internal mental processes, action strategies, rules of practice, practical principles, perspectives, repertories of understanding, and social strategies (see also Fives & Buehl, 2012). Beliefs are shaped within specific historical, material, and cultural conditions (Nuttall et al., 2015) as well as by chance and anecdotal observations (Nespor, 1987).

The research on teachers' beliefs dates back more than 60 years (Ashton, 2015), and it provides robust evidence that teachers' beliefs are key to guiding their decisions and actions in classroom situations (e.g. Ertmer et al., 2012; Fang, 1996; Mama & Henessey, 2013; Mansour, 2008; Pajares, 1992; Tondeur et al., 2008). Beliefs are also thought to influence both how and why teachers may or may not change their practices to incorporate a new curriculum, adopt new instructional strategies, and implement new initiatives (Biesta, Priestley, & Robinson, 2015; Levin, 2015), making teachers' beliefs a regular topic of research in the context of technology integration (see the reviews in Ertmer, 2005; Kim, Kim, Lee, Spector, & DeMeester, 2013; Tondeur et al., 2017). The relationship between teachers' pedagogical beliefs and technology integration can be described as critical (Ertmer et al., 2012) because teachers' beliefs appear to be a major predictor of their technology use (Miranda & Russell, 2012; Ottenbreit-Leftwich et al., 2010); however, these beliefs can act as a barrier to technology integration (Tondeur et al., 2017). For example, if a teacher believes that direct instruction is the most efficient way to teach, he/she may find the open nature of (some) technological solutions pedagogically unsuitable (Donnely, McGarr, & O'Reilly, 2011).

Despite the high number of studies, two shortcomings can be identified from the technology-related teachers' beliefs research. The first one is that technology integration research has had a narrower perspective on beliefs than in research on teachers' beliefs in general (Kim et al., 2013). While teachers are found to hold beliefs about many issues, including beliefs about knowledge, their students, the context in which they work, subject matter, as well as moral dilemmas and societal issues that affect their work (Biesta et al., 2015; Fives & Buehl, 2012; Levin, 2015) the majority of

technology integration studies focus on beliefs about technology's role in teaching and learning (see e.g., Deng, Chai, Tsai, & Lee, 2014; Güneş & Bahçivan, 2018; Jääskelä, Häkkinen, & Rasku-Puttonen, 2017; Liu, 2011; Tondeur et al., 2008). Given the broad spectrum of teachers' beliefs, focusing solely on beliefs about learning and teaching fails to recognize the multidimensional and complex nature of being (and becoming) a teacher. For instance, secondary school teachers in Lasky's (2005) study reported that their job is to teach the child as a whole, by which they meant that in addition to supporting students' academic performance, their professional task is to take care of their students' socio-emotional well-being. In other words, teachers do not make decisions based only on beliefs about on how children learn but based on a more holistic and complex view of children, teacherhood, and the essence of institutional education. Thus, teachers' decisions whether to use technology (and how to use it) are based on whether they believe that technology helps or prevents them to achieve the pedagogical goals they consider the most important (Ottenbreit-Leftwich et al., 2010).

The second shortcoming is that even though context has an important part in formation of teachers' beliefs (e.g., Gates, 2006; Mansour, 2008) technology integration research tends to overlook its' role. For example, the current stage of research on teachers' opinions in technology integration in early childhood education has been criticized for relying on theories and data collection tools developed in and for other educational contexts (e.g. Blackwell, Lauricella, Wartella, Robb, & Schomburg, 2013; Plumb & Kautz, 2015).

2.2. Education, socialization, and care in early childhood education

Education, socialization, and care are all complex and multidimensional concepts that are defined in various manners. In this paper education is understood as supporting and promoting children's learning, and thus, education can be described as a process through which children construct knowledge and skills (Broström, 2006; Puroila, 2002). More precisely, education refers here to

teaching children about curricular subjects such as literacy and math. Socialization, in turn, refers to decisions about which cultural values, habits, and norms should be transmitted in early childhood education and which should be shaped and regenerated (Biesta et al., 2015; Johansson, Puroila, & Emilson, 2016). According to Värri (2018, p. 16), the modern view of socialization also acknowledges the individualizational dimension of the socialization process. Here, socialization is understood as a process through which an individual becomes both a functional member of society "as is" and a unique subject that is able to criticize the prevalent societal structures and act as an agent of change in their own turn as they contribute to the development of a society that "might be" (Biesta et al., 2015, p. 634; Värri, 2018, pp. 16–17). To conclude, the key questions regarding socialization are how should institutional education react to societal changes—such as digitalization and technologization—and what kind of citizens should children be raised to be and become? Last, when approached as care, the key task of early childhood education is to meet children's needs by providing physical care and having a caring attitude toward children (Einarsdóttir, 2003; Van Laere, 2017).

The way education, socialization, and care relate to each other has also been debated. Some authors have argued that education and care are inseparable concepts, and thus, there are no meaningful distinctions between care and education for young children (Sheridan, Williams, Sandberg, & Vuorinen, 2011; Smith, 1993). Making clear-cut distinctions between these three concepts can be difficult, especially at the level of everyday pedagogical practices where teachers carry out practices and discourses in which several roles are intertwined (Einarsdóttir, 2003; Puroila, 2002). Puroila (2002) notes that teachers in her study often reflected on whether teaching or taking care of children's basic needs should be their primary task. According to Puroila (2002), in such situations, the teachers were simultaneously acting as educators and caregivers as they acknowledged the cruciality of both dimensions. Although in everyday situations education, socialization, and care are not fully separable and independent concepts, they still provide a useful framework for analytical exploration of the different tasks and dimensions of early childhood education (Broström, 2006; Van Laere, 2017).

Previous research also identified that teachers distinguish among education, socialization, and care in their everyday work. Some teachers consider education their main work (Van Laere & Vandenbroeck, 2018), while others emphasize socialization (Niikko, 2004) and care (Broström et al., 2015). One explanatory factor seems to be how early childhood education is provided: Teachers working in countries with split systems in which childcare and early education are provided by different stakeholders tend to emphasize education (Van Laere & Vandenbroeck, 2018). In countries with integrated systems, teachers move between different professional roles and expectations (Einarsdóttir, 2003; Niikko & Ugaste, 2012). For example, Puroila and Haho (2016) recognized that if teachers sensed that children were restless, they did not pursue educational goals. Instead, they changed their plans to better take care of children's emotional and physical stages and needs—i.e. they worked more from a care-oriented perspective. Another possible explanation relates to children's age: It seems that care is a salient frame when teachers work with the youngest children while education is emphasized when teachers work with older children, especially with those in pre-primary education (Ylitapio-Mäntylä, 2009).

3. Method

3.1. Meta-ethnography as a review method

The review method used in this paper is meta-ethnography (Noblit & Hare, 1988), which has been used to synthetize qualitative research in several fields of inquiry, including educational technology integration (Tondeur et al., 2012). Instead of merely aggregating the findings of previous research meta-ethnography attains a level of conceptual or theoretical development and "serves to reveal what is hidden in individual studies and to discover a whole among a set of parts" (Campbell et al., 2003, p. 680). To draw on Schtutz's (1962) notion of first- and second-order constructs, the researcher uses participants' reports (first order constructs) to make interpretations of the phenomena under

investigation (second order construct). In meta-ethnography, first and second order constructs are synthesized into a new model or theory (third order construct) (Atkins et al., 2008).

3.2. Review process

The present review followed Noblit and Hare's (1988) original protocol but acknowledged recent critical viewpoints and additions, such as quality appraisal of the primary studies (Campbell et al., 2003). The review protocol is summarized in Table 1 and discussed in more detail in following sub-chapters.

Table 1. Review protocol

Step	Description
1	Getting started
2	Decide what is relevant to the initial research interest and locate the relevant research
3	Quality appraisal
4	Read the studies
5	Determine how the studies are related
6	Translate studies into one another
7	Synthesize the translations
8	Express the synthesis (in this paper, presented as findings)

3.2.1. Step 1: Getting started

Every researcher who attempts to conduct a meta-ethnographical review must be able to answer two questions: why is this synthesis needed and why is synthesizing qualitative research an appropriate approach, considering the objective of the synthesis (Toye et al., 2014)? This study aims to provide a more nuanced and comprehensive understanding of the variety in teachers' beliefs in the context of technological integration. Additionally, it is the first review to address early childhood teachers' beliefs in this context. The added value of focusing on qualitative research here stems from the kind of information a qualitative approach can produce. Qualitative data collection methods (such as research interviews and focus group discussions) can better capture the voices and viewpoints of the

participants than closed-question surveys, as they do not restrict the participants' choices to a fixed set of predetermined options (Fives & Buehl, 2012; Plumb & Kautz, 2015).

3.2.2. Step 2: Decide what is relevant to the initial research interest and locate the relevant research

The search strategy and selection criteria are outlined in Table 2. The literature retrieval process is illustrated in Figure 1 and discussed in detail, below.

Table 2. Search strategy and selection criteria

	Choices made	Justification
Means used to locate relevant research	Databases: ProQuest (including, e.g., ERIC, Social Science Premium Collection); EBSCO (including, e.g., Academic Search Premier, PsyArticles); ScienceDirect. Backward reference searches for eligible database search hits were conducted by checking the papers' references; forward reference searches for eligible database search hits were conducted via Google Scholar's "cited by" function. Backward and forward reference search hits were screened by using selection criteria that were similar to the original database search hits.	Because the use of multiple databases and search engines provides comprehensive search results (Bramer, Rethlefsen, Kleijnen, & Franco, 2017), the initial searches were conducted via all relevant major databases that were available through the author's university library services. Backward and forward reference searches (checking the references of the primary studies/checking the papers that have cited the primary studies) make it possible to both locate relevant literature that is not indexed in the databases and provide a more complete selection of literature (Wohlin, 2014).
Keywords	preschool OR early childhood OR kindergarten AND teacher OR educator AND technology* OR ICT[1] OR digital OR computer* OR tablet.	Keywords were chosen to acknowledge the differences in the nomenclature of early childhood education settings (Plumb & Kautz, 2015). Broad and generic keywords, such as "technology," "computer," and "digital," were favored because they are included in the core concepts of technology integration research, which includes "educational technology," "technology enhanced learning," "computer supported collaborative learning," and "digital literacy." Due to the ambiguous nature of beliefs (Pajares, 1992) all papers dealing with belief-related concepts such as attitudes, views, and perceptions were included in the review. As the present study is the first to review early childhood teachers' beliefs in technology integration context an inclusive search strategy was considered essential for locating all the relevant research despite that such strategy would require extra effort when evaluating initial search hits
Search area	Title, abstract, and keywords	A broad search area was chosen for the initial searches to be more inclusive than exclusive in nature.
Time scope	1 January 2010 through 31 December 2017	The time scope was chosen for the perception that this era has been the most productive for technology integration research done in the context of early childhood education (Mertala, 2016). This

		phenomenon is—at least in part—explained by the proliferation of digital technologies in kindergartens during the 2010s (Blackwell, Wartella, Lauricella, & Robb, 2015).
Language	English	English is the dominant language in academic publishing (Hyland, 2009).
Selection criteria	Empirical qualitative study with in-service or preservice teachers as participants; must contain quotes from original research material	As the broad research interest was to review teachers' beliefs, the selected studies needed to have either preservice or in-service teachers as participants. The reviewed studies also had to include quotes from original research material (first order constructs) as such studies were thought to provide more in-depth information about teachers' beliefs (i.e., their justifications why technology should or should not be integrated in early childhood education) and make the interpretation process of the particular primary study (second order construct) more clear and transparent.

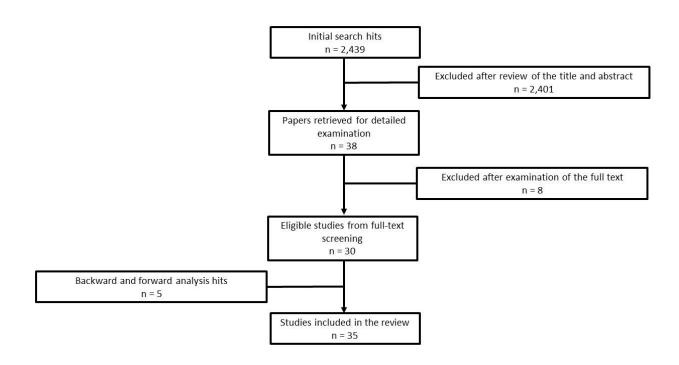[1] ICT stands for information and communication technologies

Figure 1. Flowchart of literature retrieval process

The database search[2] delivered 2,439 references, which was narrowed down to 38 after the titles and

abstracts were screened and duplicates removed. The high number of initial hits is explained by the

[2] Conducted in January 2018

inclusive search strategy. Then, the full texts were read to ensure that the papers met the predetermined selection criteria (see Table 2). At this stage, eight papers were discarded: five turned out to be either experimental studies or used only numerical data, two were qualitative interview studies that included no data extracts, and one did not discuss themes relevant to this study. Four mixed-methods studies whose qualitative sections met the predetermined criteria were included in the review. At this point, 30 papers remained. Then, backward and forward reference searchers were conducted, and five more papers were included via this stage. These 35 papers were then reviewed for their quality.

3.2.3. Step 3: Quality appraisal

An adapted[3] version of the checklist provided by the Critical Appraisal Prorgamme (2018) was used as the basis for quality appraisal. With respect to the second research question (What is the role of contextual factors in shaping teachers' beliefs about technology integration in early childhood education?), contextual information, such as the site of the research, was also included in the quality appraisal. Table 3 provides the results of a paper-level quality appraisal. A can be seen from it there was variation in quality of the research papers –a notion made by several other meta-ethnographiers as well (E.g. Atkins et al., 2008; Campbell et al., 2003; Tondeur et al., 2012).

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[3] Besides the addition of context-related question, adaptation here refers to re-wording of one appraisal question and neglection of another. The original form of eighth question was "[w]as the data analysis sufficiently rigorous". The problem with such wording is that it assumes a perfect correspondence between the quality of the actual data analysis and the quality of the report of the data analysis. As noted by Atkins et al., (2008) "poor reporting of methods does not equate with poorly conducted research". Thus, the question was reworded to evaluate the way how data analysis was reported. The neglected question was "[h]ow valuable is the research?" as such question was thought to be impossible to answer objectively.

Table 3. Quality appraisal.

Appraisal question	Yes	Moderately	No
Was there a clear statement of the aims of the research?	30	5	
Was a qualitative methodology appropriate?	35		
Was the research design appropriate to address the aims of the research	32	3	
Was the recruitment strategy appropriate to the aims of the research?	32	3	
Was the data collected in a way that addressed the research issue?	34	1	
Has the relationship between researcher and participants been adequately considered?	5	12	18
Have ethical issues been taken into consideration?	8	16	11
Was the data analysis reported in sufficiently detailed manner?	13	18	4
Is there a clear statement of findings?	32	3	
Does the paper provide information about the research context?	22	12	1

Due the interpretative nature of meta-ethnography, researchers are encouraged to use more inclusive than exclusive quality appraisal frameworks (Dixon-Woods et al., 2006; Toye et al., 2014). Thus, studies that did not report some of the methodological aspects or lacked a clearly stated research objective were considered to provide contributions to the synthesis via first-order constructs (quotes from original research material) and were thus not excluded based on the quality appraisal.

3.2.4. Steps 4 and 5: Read the studies and determine how the studies are related

This stage of meta-ethnography involves reading and re-reading the studies, in order to identify and describe the key concepts[4] (Toye et al., 2014) and requires "extensive attention to the details" (Noblit & Hare, 1988, p. 28). At this point, each study was identified with a unique ID-number (ST-x) (Parry & Laroux, 2019). Studies and their ID-numbers are reported in Table 4. A more detailed outline is presented in the Appendix.

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[4] Depending on the study, the term "metaphors" may have been used instead of "concepts" (Atkins et al., 2008). Based on Noblit and Hare's (1988) original writings and more recent adaptations by other authors (e.g., Atkins et al., 2008; France et al., 2014; Toye et al., 2014), concepts and metaphors are terms of equal value, and it is up to the research objectives and the nature of the primary studies as to which term the meta-ethnographer will use when reporting the study. In the case of the present paper, the three core terms—education, socialization, and care—are clearly more concepts than metaphors; they describe the objectives and tasks of early childhood education rather than provide metaphorical accounts of them.

Table 4. Reviewed papers and their ID-numbers

ID	Study	ID	Study	ID	
ST-1	Beschorner & Hutchinson (2013)	ST-13	Ihmeideh & Alkhawaldeh (2017)	ST-25	Mertala (2017)
ST-2	Blackwell (2013)	ST-14	Ingelby (2015)	ST-26	Mertala (2019a[1])
ST-3	Bourbour & Masoumi (2017)	ST-15	Istenic Starčič et al. (2016)	ST-27	Mertala (2019b[1])
ST-4	Brown et al. (2016)	ST-16	Izumi-Taylor et al. (2010)	ST-28	Nuttal et al. (2015)
ST-5	Brown & Englehardt (2017)	ST-17	Kara & Cagiltay (2017)	ST-29	Palaiolougou (2016)
ST-6	Dong & Newman (2016)	ST-18	Knauf (2016)	ST-30	Ramírez et al. (2017)
ST-7	Fenty & McKendry Anderson (2014)	ST-19	Lindahl & Folkesson (2012a)	ST-31	Roberts-Holmes (2014)
ST-8	Flewitt et al. (2015)	ST-20	Lindahl & Folkesson (2012b)	ST-32	Sak et al. (2016)
ST-9	Friedrichs-Liesenkötter (2015)	ST-21	Lu et al. (2017)	ST-33	Tokmak (2013)
ST-10	Hernwall (2016)	ST-22	Lynch & Redpath (2014)	ST-34	Vaughan & Beers (2017)
ST-11	Howard et al. (2012)	ST-23	Marklund & Dunkels (2016)	ST-35	Yuksel-Arslan et al. (2016)
ST-12	Hu & Yelland (2017)	ST-24	Masoumi (2015)		

[1] These papers were originally published in 2017 as advanced online publications.

During the initial reading of the papers, the parts that included information about the research interest were highlighted, and a note which explained why the extract was highlighted and what kind of interpretations were made about it was written. The extracts and notes were collected in Excel files that also contained the basic information of the study (e.g., authors, year, title, country, participants, research focus, research questions, and method). The extracts where then categorized based on which phenomenon –education, socialization, or care– they were about. As concerns have been expressed regarding the loss of explanatory context when the findings of multiple studies are combined (Toye et al., 2014), contextual information, such as descriptions of the pedagogical traditions of these particular cultures, were screened for and summarized in the Excel files (Britten et al., 2002).

3.2.5. Steps 6 and 7: Translate studies into one another and synthesize the translations

The translation phase was approached by first arranging the papers chronologically, comparing the themes from paper 1 with paper 2. The synthesis of the themes found in these two papers was then compared with paper 3. This process was replicated until all 35 studies had been compared (Atkins

et al., 2008; Tondeur et al., 2012). During these steps, the general categories were refined into more specific sub-categories. For instance, technology's potential to engage children for preschool activities —a theme included in numerous papers— was discussed from several perspectives. The following two extracts represent examples of two different approaches:

> I think the biggest thing with technology is motivation and promoting attention… just the size of the Smartboard screen helps (ST-7, p. 121).

> Many young children's families have an iPad at home and they are very interested in it. If we still teach these children with a blackboard and books, they may not have interest or have low interest and a short attention span… If ICT can entice young children's attention, I think we need it. (ST-6, p. 230)

The key argument in both extracts is that technology integration can increase children's engagement in preschool activities, but the points of view notably differ. In the first example, the reason for engagement is derived from technological features like the size of the Smartboard screen. This extract is conceptualized to share positive educational beliefs that are, by their nature, technology-centered. In the second example, the engagement is believed to be due to the overall digitalization of children's life-worlds: children born in a digital era can be engaged only with digital practices and thus a digital divide between children's informal and formal learning environments should be dispelled. By equipping early childhood centers with similar technology that children use at home, this divide can be eliminated. This extract is intended to describe socialization-related belief-types called societal assimilation. Such interpretative process is what Noblit and Hare (1988) call line of argument synthesis, which is used to synthesize primary studies that appear to address only certain parts of the phenomenon after investigation. Table 5 summarizes the key themes arisen during the synthesis. Last, notes on contextual remarks were revisited to identify the contextual factors shaping teachers' beliefs. This process identifies two kinds of contextual factors: macro- and micro-contextual. Macro-contexts

refer to global and nation-wide influential trends, traditions, and policies, whereas micro-contexts refer to the level of an individual kindergarten or child group.

Table 5. Key themes in relation to each study

Column groups — Education (Positive): columns 1–6; Socialization (Negative): columns 7–8; Socialization (Preparation): columns 9–10; Socialization (Assimilation): columns 11–12; Socialization (Protection): columns 13–15; Care (Positive): column 16; Care (Negative): columns 17–18.

Study	Tech is beneficial for academic performance	Tech is beneficial for generic learning skills	Tech is beneficial for socio-emotional skills	Tech is beneficial for children with special needs	Technology-centered beliefs	Child-centered beliefs	Low quality and distractive software	Tech provides inactive learning	Tech is needed to prepare children for primary school	Tech is needed to prepare children for i digitized society	Tech is needed for modelling children's informal practices	Digital native discourse	Tech threatens imaginary play and creativity	Tech threatens outdoor activities	Tech threatens social interactions	Tech helps children to relax	Tech causes issues with physical well-being	Tech causes issues with psychological wellbeing
ST-1	x		x			x												
ST-2	x					x	x										x	
ST-3	x				x	x				x								
ST-4	x							x			x							
ST-5					x						x							
ST-6	x		x		x					x	x	x						
ST-7					x										x			
ST-8	x		x	x		x	x			x			x		x		x	
ST-9										x							x	
ST-10	x			x		x									x			
ST-11	x		x		x													
ST-12																		
ST-13												x						
ST-14	x									x								
ST-15	x		x		x	x			x				x					
ST-16	x									x			x	x	x		x	
ST-17					x					x				x	x		x	x
ST-18										x								
ST-19	x				x	x		x			x		x					
ST-20	x						x				x		x					
ST-21	x					x												
ST-22	x	x				x												
ST-23	x		x	x				x	x									
ST-24	x			x		x		x	x	x								
ST-25	x		x		x	x			x									
ST-26										x			x	x	x		x	x
ST-27	x				x					x				x	x	x	x	x
ST-28	x												x					
ST-29								x		x				x	x		x	
ST-30	x				x					x								
ST-31	x	x		x		x						x						
ST-32	x				x					x							x	
ST-33									x									
ST-34			x		x	x												
ST-35		x				x												

4. Findings

Findings of this review are presented in three main parts. The first one (4.1.) discusses the general characteristics of the reviewed papers. The second one (4.2. and 4.3.) discusses how the themes of education, socialization, and care were present in teachers' beliefs and the third one (4.4.) has its focus on the contextual factors that shape teachers' beliefs.

4.1. Characteristics of the studies

Table 6 presents the basic information of the reviewed papers. To summarize the key characteristics, the existing research is Western-centric, published mainly during the latter half of the past decade, and frequently uses interviews as research data.

Table 6. Summary of the background information of reviewed papers

Publication year[1]	2010 (1); 2011 (0); 2012 (3); 2014 (3); 2015 (5); 2016 (9); 2017 (11)
Context of study[2]	Europe (20); North America (8); Asia (5); Australia (3)
Participants	In-service teachers (24); Preservice teachers (11)
Data collection methods[3]	Interviews (21); Observations (13); Written assignments (7); Focus group discussions (6); Open ended surveys (3); Field notes (1); Internet forum posts (1)

[1]Some of the reviewed papers were not yet published in a volume but as advanced online publication. Such papers were dated based on the year of their initial online publication. [2]The number of references is higher than the actual number of studies as two studies were conducted in multiple locations involving teachers from two continents. [3]The number of references is higher than the actual number of studies as 20 papers combined multiple qualitative methods. See Appendix for more detailed information.

All three overarching themes—education, socialization, and care—were identified in the reviewed papers. Education-related themes were present in 32 papers, socialization-related themes in 28 papers, and care-related themes in 12 papers. All the main categories included several subcategories, the key themes and distribution of which are summarized in Figure 2 and discussed in more detail in corresponding sections.
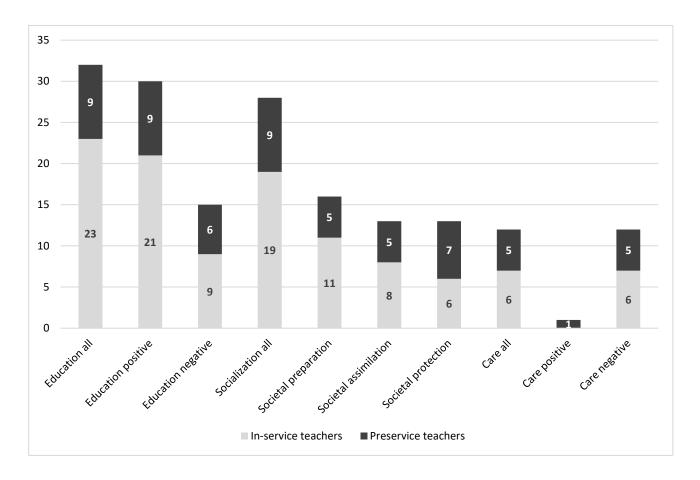
Figure 2. Distribution of key themes

Regarding the differences between beliefs of preservice and in-service teachers, the unequal distribution between papers having in-service (24) and preservice (11) teachers as participants prevents straightforward numerical comparison. However, the notable overlapping of the themes (see Figure 2) suggests that preservice and in-service teachers share the same hopes and concerns for technology integration, challenging the presumption that preservice teachers favor technology integration more in principle (Lei, 2009; Szeto, Cheng, & Hong, 2016). Therefore, the term "teacher" is used to refer to both groups throughout the remainder of this paper.

4.2. Education

Education related themes were present in 32 papers, and they were further divided into two main categories: 1) positive educational beliefs and 2) negative educational beliefs, which are both discussed in their own subchapters.

4.2.1. Positive educational beliefs

Positive educational beliefs were identified from 30 papers in total. The most prominent positive educational belief, found from 23 papers, was that technology use in early childhood education can benefit children's academic performance (ST-1–4; ST-6; ST-8; ST-10–11; ST-14–16; ST-19–25; ST-27–28; ST-30–32). A common theme in the aforementioned papers was, that teachers believed that technology integration would increase children's subject related knowledge and skills, particularly in literacy and mathematics. This view is well captured in the following statement by one teacher (ST-19, p. 1734):

> I think that the program [Clicker 5] was stimulating linguistic skills, and a very good alternative to books for example, to develop linguistic awareness. The children got the opportunity to practice word order, concepts, the sound of the letters, classifying, counting, etc.

In addition, in three papers (ST-22; ST-31; ST-35), teachers expressed beliefs that technology integration could benefit the development of children's general learning skills, as technology-mediated practices were believed to promote, for example, self-regulation, which is considered essential for efficacious learning (Panadero, 2017). Moreover, while technology integration was thought to benefit all children's learning, some teachers believed that children with special needs would benefit further (ST-8; ST-10; ST-23–24; ST-31). Although academic benefits were the most prevalent theme in positive educational beliefs, some teachers believed technology to have educational value outside the academic domain: In eight studies teachers expressed beliefs that technology integration could support the learning of socio-emotional skills via collaborative practices (ST-1; ST-6; ST-8; ST-11; ST-15; ST-23; ST-25; ST-34).

Regardless of the perceived benefit, whether related to academic, socio-emotional, subject-based skills, or general learning skills, a common logic behind positive educational beliefs was that

technology-mediated education is more effective than the use of traditional hand-made materials, and the benefits of technology use were typically reasoned with children displaying increased motivation and engagement. Even so, there remain notable differences in what teachers mean by engagement. In some cases, engagement was discussed within a technology-centered perspective, while child-centered rationales were used elsewhere. Next, these two perspectives are discussed in more detail.

Technology-centeredness refers to views in which technology by itself is believed to engage children. Two main themes were identified from this category: attractiveness of multimedia presentations (ST-3; ST-6–7; ST-15; ST-17; ST-25; ST-30; ST-32; ST-34) and the allure of digital learning games (ST-5; ST-11; ST-19; ST-25; ST-27). Multimedia presentations were considered superior to traditional forms of representation because their multimodal and dynamic affordances were believed to capture children's attention better than still images. This view is captured in one teacher's piquant comment:

> Just a single picture cannot attract the children whereas an animated presentation can. The children's attention and concentration are higher if we use multimedia devices to show animations. (ST-6, p. 229.)

Typical reasoning for the usefulness of digital games was that they provide a fun activity which enables subconscious learning. Bruckmann (1999, p. 75) has satirically called this way of thinking "chocolate-dipped broccoli", where fun is the sweet coating added to an educational core to engage the children. Based on the reviewed studies children's awareness of the purpose of playing games was not seen to be that important, and one teacher said frankly that with games

> we can cheat children a little so that they don't realize that while they are gaming, they are also learning (ST-25, p. 202).

Child-centeredness refers to beliefs that emphasize children's active role in technology-mediated learning processes (ST-1–3; ST-8; ST-10; ST-15; ST-19; ST-21–22; ST-24–25; ST-31: ST-34–35). It appears that such beliefs are related to the use of open-ended and creative tasks, that is, making

animations, writing short stories, and creating picture books In these views, it is the possibility for self-expression—not merely the use of technology—which was understood to engage children and benefit their learning. According to the teachers, children were willing to go through multiple levels of planning (writing, acting out their writing, and then making recordings):

> because at the end they get to use a camera or to film it, that's their goal and they're quite willing to do all the work that leads up to it... [that's a] huge factor and relevant to their lives. (ST-8, pp. 12–13)

The relationship of child-centered and technology-centered beliefs, however, is not mutually exclusive. In one study (ST-25), it was noticed that while teachers in general level possess child-centered pedagogical beliefs (and reports child-centered practices), their technology-related pedagogical beliefs were technology-centered. One reason for this mismatch appears to be professional self-confidence, as those who are uncertain of what is expected from them in technology integration tend to use the features of technology as the starting point of their educational practices (ST-6; ST-10; ST-25). This uncertainty is more about pedagogical than technological proficiency as even though teachers report high technology efficacy, they feel that they do not possess the competencies needed for pedagogically appropriate technology integration (ST-29).

4.2.2. Negative educational beliefs

Despite the notable number of references to positive educational beliefs, not all teachers were impressed with technology's affordances concerning teaching. The quality of educational software drew criticism, and teachers doubted whether children really learn from instructional games, or whether the children simply try to win the game without paying attention to the learning tasks (ST-2; ST-4; ST-20). The visual effects of instructional software were considered to draw attention from the actual substance, and there were fears that the fast-moving pace of digital games would cause a lack of the perseverance needed to learn to read and write (ST-8).

In addition, some teachers believe that traditional methods and materials are more effective than digital ones as the traditional methods provide tactile experiences and allow children to have a more active role in their learning (ST-6; ST-15; ST-19; ST-23–24; ST-29; ST-33). One teacher, for example, commented that

> [c]omputers provide passive activities of watching, listening, playing games pressing the button, which destroys the child's creativity" (ST-15, p. 44).

Interestingly, open-ended educational applications were also considered to be more restrictive than traditional methods. Take Minecraft (Education Edition[5]), for example, which is typically praised for its creative and open-ended affordances for educational use, particularly when compared to traditional drill and practice games (Kentz, Sintonen, Lipponen, 2017; Schifter & Cipollone, 2015). Teachers' distrust towards the possibilities of "digital creation" is piquantly captured by one teacher in the following comparison between playing Minecraft and drawing geometric shapes on paper:

> Take Minecraft, for example. […] It is supposed to be something that children can build, construct, explore with geometrical shapes, but it is so limited to what children can do […] when a child draws on a piece of paper they can draw a line which is not straight and they can also create shapes and designs so they are not restricted by the graphics of a game. (ST-29, p. 315)

This notion can be perceived as reflecting the variance of different educational domains. Whereas in primary and secondary education the open-endedness of Minecraft appears novel, creative, and learner-centered, (e.g. Ames & Burrell, 2017; Overby & Jones, 2015) in the context of early childhood education such technologies can appear restrictive in comparison to traditional methods like art-based activities and play.

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[5] A game-based learning platform built around the popular Minecraft Gameworld with standards-aligned content across K12 subjects and special features designed for classroom use (https://education.minecraft.net/).

4.3. Socialization and care

This section presents the findings related to socialization and care. Socialization related themes were present in 28 papers, whereas care related themes were discussed in 12 papers. Three different kinds of socialization-related beliefs were identified from the reviewed papers: 1). technology integration as societal preparation; 2). technology integration as societal assimilation, and 3). early childhood education as societal protection and care. Societal preparation refers to the belief that technology integration is vital for children's future citizenship. Societal assimilation, in turn, refers to views that the digitalization in children's life-worlds must be taken into account in early childhood education by equipping classrooms with technology, but does not refer to any particular socialization-related goals. The third socialization-related theme is protection, which refers to a belief that the task of early childhood education is to safeguard children from the digitalization of society. As protective beliefs are interlinked with care-related beliefs, they will be discussed within the same subchapter.

4.3.1. Technology integration as societal preparation

Two subthemes were identified within the societal preparation discourse: 1) preparation for primary school and 2) preparation for the digitalized society. In the first subtheme, technology use in early childhood education is needed to prepare children for primary school education, the practices of which were believed to be notably digitalized (ST-19; ST-23; ST-25). A concrete example of the school-preparation belief was the view that the kinds of technologies used in early childhood education should be the same as those that are used in primary education (ST-25). Typically, no critical reflection on the differences of these two educational domains—early childhood education and primary education—was included in such views. Early childhood education scholars have addressed this phenomenon with the concept of "schoolification," in which early childhood education is understood as a mere "preschooling" rather than a legitimate stage of institutional education in its own right (Brogaard Clausen, 2015).

The second—and more prominent—subtheme referred to the role of early childhood education in preparing children for the changing society (ST-3; ST-8–9; ST-14; ST-16–18; ST-20; ST-24; ST-26–27; ST-29–30; ST-32). Because society is — and will be — highly digitalized, one of the core tasks of early childhood education is to provide children the skills they need for full citizenship. As put by one teacher:

> I think it is good that technology is introduced in early childhood education as online services have become a part of everyday life and knowing how to manage them is becoming more and more a part of the civic skill set (ST-27, p. 7).

Sometimes preparation for the "high tech world" (ST-16, p. 413) means learning basic operational skills, such as using a mouse or keyboard (ST-9; ST-30; ST-32). At other times, more sophisticated goals were expressed: For example, one teacher commented that improving children's understanding of online safety and privacy is one of the main educational goals for technology use in her class (ST-18). Some teachers mentioned that the key factor for technology integration relates to its communicational possibilities, that is, contacting other groups around the world (ST-16; ST-18). In addition, technology is seen to have value in helping children become citizens of culturally pluralistic societies because technology can be used to explore maps, pictures, and video clips from different countries and cultures (ST-24). Last, technology integration is understood to have an affirmative task, as not all children have equal access to computers in their homes (ST-9)

4.3.2. Technology integration as societal assimilation

Societal assimilation refers to beliefs that early childhood education should imitate the technological landscape of children's life-worlds outside of early childhood education, namely the home. Such beliefs were typically framed with an uncertainty as to whether children find technology-free early childhood education environments meaningful places, and some teachers straightforwardly questioned whether children who have grown accustomed to using tablet computers at home would

be motivated to work with traditional materials in an early childhood education context (ST-4–6). In the words of one teacher:

> They [iPads] are really a good idea especially now that kids are more involved with technology than they used to be. It's good to incorporate iPads because that way you are keeping them engaged, and they don't get bored; since nowadays, all they want to do is play games on the iPads. So if you bring iPads into the classroom, you are able to relate to their experiences more. (ST-5, p. 28)

Children were also believed to possess notable technological competences, and thus, using technology in early childhood education would allow the children to utilize the skills and knowledge they learned at home in early childhood education (ST-6; ST-8; ST-13; ST-19–20, ST-31). The following extract exemplifies how such beliefs are discussed by the teachers:

> They learn it all at home and bring it in here… It's just amazing what he can do. He's way beyond what I can do and he's constantly showing me things I don't know were there. (ST-31, p. 7)

Such beliefs were influential when early childhood education centers were deciding which kinds technological resources they would invest in. For example, the early childhood education centers in in study had bought touch screen personal computers because they "had the same touch screen technological features as the families' smart phones" (ST-31, p. 6).

4.3.3. Early childhood education as societal protection and care

The third socialization-related theme was protection, which refers to a belief that the task of early childhood education is to safeguard children from the digitalization of society. In such views, technology and childhood are seen as an incompatible combination, and teachers in several studies explicitly stated that early childhood education should offer an alternative and technology-free

environment for the children (ST-9–10; ST-15; ST-17; ST-19; ST-26–29). This standpoint is well illustrated in the following comment by one teacher

> I think that children should be outside playing and having fun together and entirely be children the short period they actually are allowed to be children (ST-19, p. 1732).

This extract describes how technology use is thought to take time from outdoor activities (see also ST-8; ST-16–17; ST-26–27; ST-29) and hinder children's social interaction (see also ST-7: ST-10; ST-16–17; ST-26–27; ST-29). Teachers also reported that introducing technology in early childhood education threatens imaginary play and children's creativity, as children were thought to merely imitate the games they play or movies or programs they watch (ST-15–16; ST-19, ST-26; ST-28). Teachers were also worried about the values that digital media teach to children (ST-9). These views were often linked to beliefs that children use technology at home for prolonged periods (ST-26–27)

Some concerns were more care-related, as technology use was believed to threaten children's physical and psychological well-being. Technology use was thought to be over-stimulating, raise children's state of alertness, and cause restlessness and problems for children's physical posture, motor development, and health (i.e., eye fatigue and obesity) in general (ST-2; ST-8–9; ST-16–17; ST-26; ST-29, ST-32). Concerns about children being exposed to psychologically harmful content, such as violence, were also expressed (ST-8; ST-17; ST-26). Some teachers commented that they would not use technology with the youngest of children (ST-6; ST-19, ST-27)), while in others' views all early childhood education-aged children are too young to use technology or the internet per se (ST-9; ST-29). As previous research suggested that preschool teachers tend to orient toward working with the youngest children from a pronouncedly care-related perspective (Ylitapio-Mäntylä, 2009), these beliefs appear to have care-related origins. Only one example of the beliefs that technology could have positive effects on providing care were found in the reviewed literature as one teacher commented that

children's naptime could be enforced by using a developed sound system (26, p. 12).

What the quoted teacher suggests is that, using a good sound system, some comforting music (or other calming soundscapes) could be played to children during naptime to make the situation hassle-free and relaxing.

4.4. Contextual factors shaping teachers' beliefs

The second objective of the study was to explore the role of contextual factors in shaping teachers' beliefs about technology integration in early childhood education. Two main categories of contextual factors that shape teachers' beliefs were identified: 1). macro-contexts in reference to global educational trends, as well as national early childhood education policies and traditions; 2). micro-contexts which, in turn, refer to teachers' immediate environments, including the early childhood education center where the teacher works in addition to environments outside the workplace. Figure 3 presents the contexts in descending order starting from the universal and ending with the most subjective.
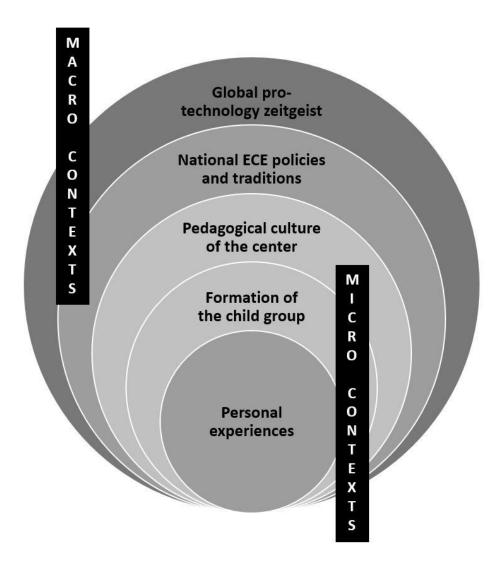
Figure 3. Contextual factors shaping teachers' beliefs

4.4.1. Macro-contexts: Global pro-technology zeitgeist and national early childhood education policies and traditions

The most universal contextual factor is pro-technology zeitgeist, which refers to an inherent positivity that has become an all-encompassing feature of discourses regarding educational technology on a global scale (Selwyn, 2011). For years, international stakeholders, such as the Organization for Economic Cooperation and Development, have been recommending equipping ECE centers with technology (Taguma, Litjens, & Makowiecki, 2012), and these suggestions have effected national policies: According to one study (ST-14), successive United Kingdom governments have propagated a pro-technology ideology that "e is best" for learning, and that this hegemonic dogma could be

identified from teachers' educational beliefs, which were profoundly positive. Similarly, it was reported (ST-24) that preschools in Sweden are increasingly investing in technology as one possible solution to their educational dilemmas which also indicates trust in the positive effects of technology integration.

Second, the findings of this review suggest that early childhood education traditions and policies vary across countries, and these variations have a role in teachers' beliefs. To give an example, in one comparative study (ST-16), no American participants related technology to communication while their Japanese counterparts did. However, no Japanese participants related technology use to education while their American colleagues did. The authors suggested that this difference in beliefs may be because in Japanese early childhood classrooms new technologies are primarily valued as a means of communication, while their role in American early childhood education may be different (ST-16). Authors of one study (ST-6), in turn, commented that Chinese culture and communist ideology, which value unity, order, collectivism, and control, have influenced Chinese teachers into believing that technology should be used for whole-class practices.

Likewise, Swedish teachers' beliefs for and against technology use were often based on whether the teachers considered technology to support or weaken children's independence which is highly valued in the Swedish ECE tradition (ST-19–20). In addition, Finnish teachers' aggravated perceptions regarding the low quality of children's technology-related upbringing at home were argued to reflect the history of the Finnish early childhood education system as a social service for a self-sufficient child of a weak family (ST-27), and German teachers' certainty about children watching television throughout the weekend was presented as a collective tacit belief transmitted from one teacher generation to other (ST-9).

4.4.2. Micro-contexts: Training, pedagogical culture of the center, formation of the child group, and personal experiences

This review suggests that initial and continuous training are not systematically provided. One study (ST-25) found that teachers who participated in different in-service trainings varied in their beliefs of what pedagogically appropriate technology integration involves, and that these beliefs reflected the contents of the training. Accordingly, it was reported that if centers had hired technology facilitators or digital media consultants, their input was reflected in teachers' beliefs about appropriate technology integration (ST-2, ST-31). The lack of preservice and in-service training was generally addressed in various papers (ST-2; ST-4: ST-6–7; ST-9–10; ST-14; ST-24–25; ST-29; ST-31).

Pedagogical culture of the particular early childhood education center can influence teachers' technology-related beliefs regarding the types and frequency of technology use. In one study, a teacher had adapted the center's motto "Be safe, be kind, be responsible" to online behavior, and she, for example, taught her students how to log out from online platforms and discussed what content is appropriate to share on them (ST-18). Other studies suggested that teachers simply internalized centers' policies on the methods and frequency of technology use (ST-6; ST-12; ST-30–31). It was also observed that if the center was located within a school, the teachers were likely to adopt technology practices from primary education to prepare children for the first grade (ST-25; ST-30).

The formation of a specific child group can also affect teachers' beliefs about technology integration. In one study, the teachers commented that technology could have pedagogical value for supporting children's cultural awareness. These particular teachers worked in groups that included children with immigrant backgrounds, which suggests that the teachers' beliefs are rooted in the needs of these specific children. (ST-24).) Similarly, beliefs regarding technology's possibilities in special education were often discussed by teachers who had children with special needs in their groups (ST-8; ST-31). Teachers' beliefs are also affected by the age of the children they work with: Technology use was considered unnecessary or harmful for the youngest children whereas older, particularly pre-primary school–age children were believed to benefit from technology use (ST-6; ST-19; ST-25; ST-27).

Personal experiences included observations of children's technology use outside the early childhood education environment. Sometimes, this meant observations of one's own children (ST-6) and sometimes of others' children (ST-26–27). These observations led to beliefs that children engage better in technology-mediated practices than in traditional practices, that children are born-competent technology users, and that children use technology extensively at home (ST-6).

5. Discussion and conclusions

In this paper, 35 qualitative empirical research studies were reviewed via the method of meta-ethnography to provide answers for the following two research questions: 1) How are the aspects of education, socialization, and care present in teachers' beliefs about technology integration in early childhood education? 2) What role do contextual factors play in shaping teachers' beliefs about technology integration in early childhood education?

With regards to the first research question, this review has demonstrated that education, socialization, and care all have a meaningful role in teachers' beliefs towards technology use in early childhood education. Each of these tasks and dimensions were identified from teachers' beliefs for or against integrating technology into early childhood education practices. For example, the use of digital devices and software was believed to be either beneficial or adverse for children's learning. The threefold perspective of education, socialization, and care used as the conceptual frameworks in this review has managed to refine and complicate the rather narrow way in which teachers' beliefs have been approached in previous research (Kim et al., 2013). There was also subtle empirical evidence, that an individual teacher can believe that technology use can have both pros and cons for early childhood education according to the task—education, socialization, or care—by which he or she approached the question (ST-27).

In relation to the second research question, the findings suggest that teachers' beliefs are shaped by the broader cultural sphere. This includes the global pro-technology zeitgeist and national early

childhood education policies and traditions. It also includes micro-scale and situational factors, including initial and continuing training, the pedagogical culture of the center, the formation of the child group, and personal experiences.

Additionally, the findings of this review challenge the prevailing dichotomic view in which young preservice teachers are portrayed as "digital-native teachers" who can ride the wave of potential pedagogical affordances of new technologies (Szeto et al., p. 36), whereas their older in-service colleagues are represented as disempowered and anxious about the use of such technologies (Byron, 2008). However, the findings of this review imply that both of these groups share similar hopes and anxieties with regards to technology integration in early childhood education.

5.1. Implications for initial and continuing teacher education

The lack of initial and continuing training was addressed in many of the reviewed studies, and training also appeared to concentrate solely on using technology as a tool for teaching curricular subjects. Such an approach, however, fails to pay respect to aspects of socialization and care and thus, is based on a one-sided and restricted understanding of early childhood education. Additional literature suggests that such courses are mainly about the introduction of appropriate resources and methods and pay no attention to teachers' beliefs (Campbell & Scotallero, 2009; Salomaa, Palsa, & Malinen, 2017). Given the variety of pedagogically problematic beliefs, the findings of this review challenge the adequacy of such course designs. As beliefs are difficult to change (Brownlee, Purdie, & Boulton-Lewis, 2001), working with them should be given special attention in teacher education. Due to the strong relationship between teachers' beliefs and practices (Mama & Henessey, 2013; Palak & Walls, 2009), it is crucial to critically evaluate the pedagogical appropriateness of teachers' beliefs during initial and continuing training.

Based on the findings of this review, teachers' positive beliefs should be critically reflected upon. In many cases, teachers' examples of good technology-mediated teaching meant engaging children with

multimedia presentations and digital games without the children being aware of the learning goals. These methods represent children as passive recipients, which contradicts current scientific understanding of how young children engage in learning (Sandberg et al., 2017). The advantages of using multimedia presentations are often based on a transitional concept of learning, for example, and previous research suggests that the belief–practice relationship is strongest within beliefs that consider learning the transition of knowledge (Palak & Walls, 2009). Accordingly, the use of digital learning games as "sugarcoating" is problematic because the assumption behind this approach is that learning is unpleasant and that children will eventually internalize this implicit message (Bruckmann, 1999). In addition, all the views that considered societal preparation were about the development of predetermined capacities and dispositions. Such views, as previously discussed, are more concerned with equipping children to function effectively in a society "as is" rather than providing them with the skills to be agents of change in their own turn as they contribute to the development of a society that "might be" (Biesta et al., 2015). Thus, the findings of this review suggest that the individualization task of the socialization process (Värri, 2018) is neglected in early childhood teachers' beliefs about technology integration.

Beliefs against technology integration should also be critically reflection on in initial and continuing teacher education. For example, exaggerated beliefs about children's excessive technology use at home are not supported by empirical research. Although digital technology is an important part of children's lives, it does not dominate them (Slutsky & DeShelter, 2016), and parents consider the regulation of children's technology use to be an important task (Aarsand, 2011). While negative beliefs must be contested, it is important that negative beliefs regarding technology integration are not stigmatized as reactionary by default. For example, doubts about the effectiveness of digital learning games expressed by several teachers are not unfounded. A recent study by Callaghan and Reich (2018) revealed that the pedagogical design of educational apps for young children are often far from optimal. The use of feedback that could explain failures and how to succeed in play, for

instance, is rarely used. Their conclusions are supported by empirical research done in preschools. In Falloon's (2013) study, only four out of 18 children were able to ignore potentially distracting content (such as responsive animations) and keep their focus on learning goals. Accordingly, Kjällander and Moinian (2014) observed that when children do not find a game design sufficiently interesting, they may rapidly discard the didactic design and start to play the game according to their own rules.

As beliefs are shaped by social and cultural conditions (Mansour, 2008), changing beliefs cannot be approached only as changing individual teachers' thinking but must also be approached as changing the professional community's beliefs. Thus, it is important that teachers working in the same center regularly discuss and critically reflect their beliefs and values regarding technology and early childhood education and create a shared vision for technology integration. This point is also crucial from the viewpoint of preservice teachers' learning as they are found to assimilate with the technology pedagogical culture of their teaching practicum placements (ST-9; ST-12).

5.2. Limitations of the study and suggestions for future research

Although systematic reviews provide a rich account of the key findings of a certain research area, they can only address and synthesize the information that has been provided in the primary studies. Thus, the high number of papers addressing beliefs about technology's educational benefits does not represent the world as such but indicates the topics in which the researchers are most interested. Some of the reviewed studies focused only on teachers' beliefs of the advantages of technology use (ST-21; ST-25)—a prominent feature of educational technology research in general (Selwyn, 2011). Thus, the high number of positive education-related beliefs does not necessarily mean that the vast majority of teachers have such beliefs, but that they are currently the most studied topic. This publication bias -related point needs to be taken into account when making conclusions based on the frequency of how beliefs related to education, socialization, and care was distributed in the reviewed literature. In addition, not all beliefs are valued alike; they are ranked in order of importance (Rokeach, 1968). When a situation produces conflicting beliefs, the belief with the higher-ranked importance overrides

the other (Ottenbreit-Leftwich et al., 2010). Although this review revealed that various competing beliefs exist, the dynamics between different belief systems remains to be explored with future empirical research.

In addition, most of the reviewed studies were conducted in Western contexts—Australia, Europe, and North America (see Table 6). This geographic one-sidedness should be considered when making conclusions and generalizations from the findings presented in this paper. In addition, by focusing on articles published in English, a notable number of relevant and high-quality research published in languages other than English were overlooked in this review. It is important that future research pay closer attention to publications written in languages other than English and bring the findings of these research studies within the reach of the international scientific community. Such information would be highly valuable for better understanding of the contextual differences and similarities taking place in the international field of early childhood education. This objective is attainable through systematic international collaboration.

Last, the remarks made in this review paper are not limited to early childhood education: Teachers, regardless the age of their students, have reported that in addition to teaching the curriculum and academic skills their task is to take care of the "whole child" (Lasky, 2005) by addressing aspects of care (O'Connor, 2008) and socialization (Biesta et al., 2015). In other words, teachers do not make decisions based only on beliefs about how students learn but based on a more holistic and complex view of children, teacherhood, and the essence of institutional education. Thus, it is important to pay attention to aspects of socialization and care in technology integration studies conducted within the contexts of primary and secondary education as well.

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Appendix 1

Overview of the reviewed studies (alphabetical order).

Paper	Qualitative data from teachers	Participants	Research topic	Country	Journal
Beschorner & Hutchinson (2013)	Interviews and classroom observations	4 teachers	The use of iPads as tools for teaching literacy	USA	International Journal of Education in Mathematics, Science and Technology
Blackwell (2013)	Interviews and classroom observations	9 teachers	How do tablet computers afford or limit teacher practices? How do teacher attitudes afford or limit the use of tablet computers in the classroom?	USA	Journal of Education Research
Bourbour & Masoumi (2017)	Interviews and classroom observations	4 teachers	The thinking behind the embedding of interactive whiteboards in the early years' mathematics classroom	Sweden	Early Child Development and Care
Brown et al. (2016)	Written assignments and interviews	20 preservice teachers	Preservice teachers' conceptual and practical understandings of adopting iPads in their teaching of young children	USA	Teaching and Teacher Education
Brown & Englehardt (2017)	Written assignments and interviews	20 preservice teachers	Preservice teachers' reasoning in incorporating iPads in their instruction with children	USA	Journal of Early Childhood Teacher Education
Dong & Newman (2016)	Interviews	4 teachers	Teachers' reasons for using ICT in preschool	China	International Journal of Early Years Education
Fenty & McKendry Anderson (2014)	Interviews and classroom observations	10 teachers	Educators' knowledge, beliefs, and practices about using technology with young children	USA	Journal of Early Childhood Teacher Education
Flewitt et al. (2015)	Interviews and classroom observations	3 teachers	Practitioners' views on new technologies in the classroom	Australia	Journal of Early Childhood Literacy

Friedrichs-Liesenkötter (2015)	Interviews and focus group discussions	39 preservice teachers	Media educational habitus of preservice early childhood teachers	Germany	Journal of Media Literacy Education
Hernwall (2016)	Field notes from in-service training session	12 teachers	Preschool teachers' conceptualization of digital media	Sweden	Nordic Journal of Digital Literacy
Howard et al. (2012)	Interviews	12 teachers	Teachers' views about computer use within a play-based early years curriculum	England	International Journal of Early Years Education
Hu & Yelland (2017)	Interviews, classroom observations, and documents	15 preservice teachers	How preservice teachers adapt ICT in their teaching	China	Journal of Early Childhood Teacher Education
Ihmeideh & Alkhawaldeh (2017)	Interviews	10 teachers	An examination of the perceptions of preschool teachers of the extent to which technology contributes to developing child culture	Jordan	Children and Youth Services Review
Ingelby (2015)	Interviews and focus group discussions	20 educators	Implications of policy approaches to ICT in education by exploring the views of early years educators	England	Professional Development in Education
Istenic Starčič et al. (2016)	Written assignments	115 preservice teachers	Identification of the perceptions held by preservice teachers about ICT and specifically multimodal design in digital storytelling	Slovenia	British Journal of Educational Technology
Izumi-Taylor et al. (2010)	Open-ended survey questions	82 preservice teachers	Preservice teachers' perceptions of teaching technology to children	USA, Japan	Research in Comparative and International Education
Kara & Cagiltay (2017).	Interviews	18 teachers	Preschool teachers' thoughts about technology and technology use in early educational settings	Turkey	Contemporary Educational Technology
Knauf (2016)	Interviews and classroom observations	1 teacher	How digital media are employed in ECE	USA	Early Years
Lindahl & Folkesson (2012a)	Written assignments	31 preservice teachers	Preservice teacher interpretations of ICT use and preschool traditions	Sweden	Computers in Human Behavior
Lindahl & Folkesson (2012b)	Written assignments	31 preservice teachers	The interplay between norms and ICT use in preservice teachers' views of ICT integration in ECE	Sweden	International Journal of Early Years Education
Lu et al. (2017)	Interviews and classroom observations	4 teachers	Teachers' use of iPads with children in ECE classrooms	USA	Computers in the Schools
Lynch & Redpath (2014)	Interviews and videoed classroom observations	1 teacher	Pragmatic tensions in iPad use in ECE classrooms	Australia	Journal of Early Childhood Literacy
Marklund & Dunkels (2016)	Internet discussion forum posts	Not described	How teachers intend to use tablets and digital play in order to support children's literacy development	Sweden	Early Years
Masoumi (2015)	Interviews and classroom observations	6 teachers	Identification of the ways in which ICT is integrated in preschools	Sweden	Contemporary Issues in Early Childhood
Mertala (2017)	Interviews	8 teachers	Preschool educators' positive ICT pedagogical beliefs	Finland	Computers in Human Behavior
Mertala (2019a)	Written assignments	38 preservice teachers	Beliefs about children's technology use at home	Finland	Early Child Development and Care
Mertala (2019b)	Written assignments	38 preservice teachers	Perceptions of ICT use in ECE	Finland	Early Child Development and Care
Nuttal et al. (2015)	Focus group discussion	3 teachers	The role of motive objects in early childhood teacher development concerning children's digital play and play-based learning	Australia	Professional Development in Education

Palaiolougou (2016)	Focus group discussions	50 teachers	ECE teachers' dispositions toward digital technology in play-based pedagogy	Greece, Malta, England, Kuwait, Luxemburg	Early Years
Ramírez et al. (2017)	Interviews and videoed classroom observations	9 teachers	Analysis of teachers' conceptions of ICTs and how they use them in the classroom	Spain	Early Childhood Education Journal
Roberts-Holmes (2014)	Interviews and classroom observations	11 educators,	Identification of the ways that ECE supports children's learning through the use of ICT and examination of the teachers' ICT pedagogical practices	England	Early Child Development and Care
Sak et al. (2016)	Open-ended survey and interviews	16 teachers	Early childhood teachers' beliefs and practices regarding computer use	Turkey	Journal of Education and Future
Tokmak (2013)	Focus group discussion and open-ended questionnaire	12 preservice teachers	Changing preschool teacher candidates' perceptions about technology integration in a material design course	Turkey	Education as Change
Vaughan & Beers (2017)	Interviews and focus group discussions	18 teachers	Teachers' innovative practices with iPads in early childhood classrooms	USA	Early Childhood Education Journal
Yuksel-Arslan et al. (2016)	Interviews and classroom observations	5 teachers	How early childhood teachers perceive and describe the educational uses of digital storytelling in early childhood education	Turkey	Educational Studies