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Characterizations of preschool technology education: analyses of seven individual preschool teachers' and childcare attendants' descriptions of their teaching

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Abstract

In recent decades the preschool has leaned more towards a learning-oriented pedagogy, where the subject of technology has been given a more prominent place. Still, studies on how individual preschool staff members perceive and teach technology is scarce. This study shows how seven preschool staff in Sweden describe their work with the subject of technology and how technology education is characterized in these descriptions. The data was produced by means of semi-structured interviews and a questionnaire and analyzed with narrative analysis. The results show very diverse practices of technology education, implying the learning possibilities for children in different preschools are not equal. Some of the staff describe a clear and conscious teaching of technology, while others describe teaching what can be viewed as a limited and/or shallow technology education, where technology is sometimes used as means for learning other subjects or contents rather than being the learning objective. Six ways to characterize technology education was found, namely: technology education (1) concerns technological objects and systems in children's environment, (2) concerns learning to handle technological objects, (3) is doing experiments, (4) involves developing abilities, (5) is naturally included in children's play and (6) departs from digital technology.

Keywords Technology education · Preschool · Early childhood education · Preschool teachers · Narrative analysis

Introduction

Many countries, including Sweden, have experienced a change in preschool pedagogy in recent years towards one that is more learning oriented (Broström, 2017; Van Laere et al., 2014). In Sweden, the change has been gradual through the revisions of the curriculum (Swedish National Agency for Education, 1998, 2010, 2016, 2018). For the subject technology, the revision of 2010 imported significant changes as it explicitly states technology

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as an area for children to learn about. To date, we still know little about what and how children are given opportunities to learn regarding technology in preschool. Much of the existing research has focused either on children's learning from interventions (see e.g. Metin, 2020; Sullivan & Bers, 2013, 2016, 2018), or expressed knowledge in their own activities such as play (see e.g. Hallström et al., 2015; Kodsi, 2020; Mawson, 2011; van Meeteren & Zan, 2010), or reported on teachers' perspectives on, or teaching in, technology education on an aggregated level (see e.g. Campbell & Jobling, 2008; Elvstrand et al., 2018; Otterborn et al., 2019; Sundqvist, 2020; Sundqvist et al., 2018; Sundqvist & Nilsson, 2018; Öqvist & Högström, 2018). Also, in some studies where preschool staff talk about technology education, they do not clarify what the content of the teaching is (Elvstrand et al., 2018; Öqvist & Högström, 2018).

This study is interested in how preschool staff perceive and teach technology. Although it is relevant to know how preschool staff as a group view and describe technology education, it is the teaching of each preschool teacher, or child-care attendant, that constitutes a child's opportunity to learn technology. The aim of this study is therefore to contribute knowledge about how individual preschool staff members characterize technology education, by analysing their own descriptions of their teaching. The research question is: *How do preschool staff characterize technology education?*

Technology education in the Swedish preschool

Since the 2010 revision of the curriculum (Swedish National Agency for Education, 2010), preschool staff are commissioned to work with children's abilities to build, create, explore and talk about technology in different ways. Children should be encouraged to observe, examine and handle technological objects to determine, for example, their function, material, construction and design. Preschool staff are also tasked with helping children to reflect on technological development and to understand technical solutions and how they work. Children should also be provided with opportunities to build and construct in order to experience balance and stability; make sketches, plans and models; and test, improve and talk about different solutions and constructions (Swedish Ministry of Education and Research, 2010). Teaching is to be embedded in a holistic context and should be based on children's interests and experiences. The curriculum is grounded in a sociocultural perspective and states the child's right to participation and to influence the approach and content of the daily practice. There is a tradition of integrating several content areas around themes and including learning in the common daily practice, rather than giving "lessons" (Pramling Samuelsson & Pramling, 2016; Swedish National Agency for Education, 2016). The approach stems from the social pedagogic tradition (Bennett, 2005).

Previous research and scrutiny on how staff teach and perceive technology education

The way children's learning in technology is planned and supported varies between preschool staff. Some studies have found that staff only provide support through designing the environment (Campbell & Jobling, 2008; Hallström et al., 2015). Hallström et al. (2015) observed that preschool staff members were often absent in and did not scaffold children's technological play. For example, when meeting problems in construction play, young children were often left to solve them on their own. The authors argued children's learning in technology would benefit from supportive and interactive staff members. Campbell and

Jobling (2008) state that this approach is a result of the staff's view that children learn through their own investigations. Other studies show how preschool staff plan and provide teaching where children are active and their perspectives are regarded (Mawson, 2013; Sundqvist, 2019; Thorshag & Holmqvist, 2019). For example, Mawson observed how a teacher noted an interest in scuba diving among the children and planned a project around that. Also, in Sundqvist's study, children´s questions during a construction activity was utilized and provided opportunities to teach about the functions of the tools they used. There are also examples of staff using ready-made teaching materials (Ehrlin et al., 2015; Öqvist & Högström, 2018) or that one staff member of a preschool is appointed responsibility for all technology teaching at the preschool (Elvstrand et al., 2018). A disadvantage with the latter two, as expressed by the staff, is that the children's influence, and the teacher's possibility to catch spontaneous learning opportunities, are hindered. There are also examples of staff thinking that technology exists naturally in the preschool environment and in children's play, so they do not need to teach it specifically (Elvstrand et al., 2018). This approach stems from a view that "technology is everything".

Elvstrand et al. (2018) present two ways in which preschool staff perceive technology. One is that "technology is everything". The other one is that technology is construction. Both these views are problematic. The first because it is too broad and the latter because it is too narrow. These views can be identified in other studies and scrutiny on technology education. Benson and Treleven (2011), as well as Sundqvist and Nilsson (2018), observed technology education sometimes address science rather than technology, perhaps due to a view on technology being everything. Benson and Treleven (2011) also observed there often is a focus on "doing", without reflection or designerly thinking which they claimed caused a shallow technology education. The Swedish Schools Inspectorate (2012, 2017) observed exploration of existing technology was almost non-existing. Both these latter results may be due to a view on technology as construction. Sundqvist (2019) however, observed planned activities with three preschool teachers where the learning object was some existing technology. In 2016, the Inspectorate found that when addressed, technology was often treated as a separate subject rather than integrated in the daily practice (Swedish Schools Inspectorate, 2016). In addition, preschool staff themselves report they do not provide much teaching of technology (Öqvist & Högström, 2018).

Strawhacker et al. (2018) studied the relationship between the preschool teacher's unique teaching style and children's learning. The content was programming. They observed higher programming achievement in children whose teachers "demonstrated flexibility in lesson planning, responsiveness to student needs, technological content expertise, and concern for developing students' independent thinking" (p. 347). Mawson (2013) argues that there are many possibilities for children to learn several aspects of technology in preschool, but due to the staff's limited knowledge in and about technology, relating technology to wider societal and environmental issues is lacking.

Regarding the technological content, Sundqvist (2020) studied the opportunities given to children at two preschools. For the analysis, she used a framework developed in previous work on what preschool staff perceive as relevant content for technology education. This framework included nine categories: (1) Learning to handle artefacts, (2) Learning the application areas and adequacy of artefacts, (3) Learning the purpose of artefacts, (4) Learning how artefacts and systems work, (5) Learning about materials, (6) Learning to build and create by practicing, (7) Solving a problem by building/creating a solution, (8) Learning how something is produced, and (9) Learning what technology is. The results showed opportunities to learn about seven of the nine contents were given by the staff. The ones not taught were the purpose of artefacts and what technology is. Sundqvist points

out activities that include a technology design process as having the potential to provide especially rich learning opportunities as they included several technological contents and abilities.

A sociocultural perspective

This study takes a sociocultural perspective, entailing a view on knowledge as actively produced by the individual in a social context (Vygotsky, 1978). In a teaching practice, Vygotsky (1978) believed it was not so important to know what the child had already learnt or developed, as to know what the child is about to learn or develop. He called this *the Zone of Proximal Development (ZPD)* and described it as the zone between the child's actual development and the development he or she can reach with the support of a more knowledgeable other. As a teacher, it is evident to identify the child's ZPD and support his or her development towards ZPD by providing *scaffolds* in terms of *mediating tools*, with language being the most important tool.

Method

Sample, data generation and analysis

The research question was investigated with questionnaire and interview data analysed with inspiration from narrative analysis (Polkinghorne, 1995). The questionnaire was initially performed for another study, investigating preschool staff's views on technology and technology education. From this sample, seven individuals were chosen for semi-structured interviews (Kvale & Brinkmann, 2009) based on the variety of their background factors and their views on technology, in order to include participants with different experiences and different views on technology. The results in this study are based on data from these interviews and from a few open ended questions from the questionnaire regarding what the participants considered technology to be. In Table 1 in the Results-section, the participants are presented using pseudonyms.

Narrative analysis was chosen in order to capture and present the holistic nature of the participants' perceptions and teaching of technology (Polkinghorne, 1995). In narrative analysis data of different kinds are used and merged into one coherent whole. This "whole" is the *story*. A story is defined by Polkinghorne (1995, p. 10) as "narratives that combine a succession of incidents into a unified episode". The story includes a *plot* and elements of the data that support the plot. The plot is the point of the story and provides criteria for the elements or events included in the story. In the application of the plot as analytical concept, I have taken influence from Bjurulf (2008) and her application of the plot in regard to how technology education is characterised by the participants. This was found by seeking what was emphasised by the participants, e.g. through repetition. Then, elements of data that support the plot were sought and presented. This means elements of data that do not support the plot were not included in the story. One story for each participant was constructed, starting with the plot stated in a heading, followed by the story. Context is relevant to make comparisons (Bjurulf, 2008) and to understand human actions as they are presented in the plot (Polkinghorne, 1995). Two aspects of the context were included. First, the background, regarding technology education in the Swedish preschool. Second, each

participant's education, professional experience, age (presented in Table 1) and view on technology (presented in the stories).

In order to ensure that everyone had the same chance to describe their teaching and practice these main questions were included in each interview: On a typical day at preschool, when do children meet technology? How would you describe a successful technology learning situation from your practice? Are there any difficulties in working with technology in preschool? Follow-up questions were then formulated depending on how the participants answered. In order to enhance credibility in the interpretation of the data, interpretative questions (Kvale & Brinkmann, 2009) were also asked to ensure that I understood the participants the way they intended. The interviews lasted between 25 and 45 min and were recorded and transcribed.

Results

First an overview of the results are presented in Table 1, including the participants and the plots analysed from their descriptions of their teaching. Then the story of each participant is presented.

Technology education concerns technological objects and systems in children's environment

Oscar is a preschool teacher and educates children aged 3–6. He confidently describes technology as everything humans have invented in order to make our lives easier, and technology education as concerning everyday artefacts, systems and situations. In his teaching, he describes, he captures spontaneous moments, for example, when something needs mending or the refuse collector arrives, to create a learning opportunity. He describes what might happen when the refuse is collected.

> You can see the fascination in the children's eyes when the refuse collector arrives. […] We are going to start working more around the sorting of waste, we have done that before, and we have a shed where we go to sort the waste. I often ask what do you think will happen to this? Why do we throw this here and not there? These kinds of questions. And then the refuse collector comes to collect everything, and where does it go?

In addition, he and his colleagues also try to design the preschool environment in a way that makes learning opportunities arise naturally, for instance, by making technological objects that they want the children to learn about readily available. There is a power station at the preschool which generates electricity from solar and wind power. To help the children understand how that works, they provide different artefacts for the children to play with and explore, for instance toy cars with solar panels on.

Oscar talks about a theme they created around the sun and the wind to help the children understand how their power station works. They read stories, did drama and performed activities and experiments to show what the sun and the wind do and how they can be utilised. They also used creative activities to teach the children how the sun and the wind can be used to create energy. One way of doing this was to create pinwheels. He emphasises the importance of including a sustainable perspective on technology.

Table 1 The study participants

Participant	Profession	Age	Years in the profession	Training in technology education	Characterization of technology education (plot)
Oscar	PT	54	28	A single course day	Technology education concerns technological objects and systems in children's environment
Erica	PT	31	2	30 ECTS	Technology education concerns technological objects and systems in children's environment
Carl	CCA	26	7	None	Technology education concerns learning to handle technological objects
Catherine	PT	54	32	One lecture	Technology education is doing experiments
Greta	PT	58	24	None	Technology education involves developing abilities
Anne	CCA	39	7	None	Technology education is naturally included in children's play
Jessica	PT	38	16	7,5 ECTS including math and science	Technology education departs from digital technology

There are two professional categories of Swedish preschool staff: the university educated preschool teacher and the non-university educated childcare attendant with a care certificate or diploma from upper secondary school. In this article, when they are referred to jointly, they are described as preschool staff

The "Profession" column displays abbreviations: *PT* preschool teacher, *CCA* childcare attendant

He also describes how they work to support children's understanding of what technology is. In the daily use of technological objects he sometimes talks to the children about these objects as technology and asks the children what other things can be considered technology. The preschool unit also perform a recurring activity with a "technology case". In this activity, a member of staff who is dressed as Pippi Longstocking carries a case with the word "Technology" written on it. Different technological objects are unpacked from the case each time, which the staff member and the children then talk about.

Technology education concerns technological objects and systems in children's environment

Erica is a preschool teacher and educates children aged 3–5. She gives a wide description of what she consider technology to be including making and constructing, use and function of artefacts and systems—how does the door open and what happens when we flush the toilet? She also mentions tablets and computers. Erica characterises technology education as consisting of technological objects and systems in children's environment. At Erica's preschool, theme work runs throughout the term. The current theme is the surrounding environment. She describes an activity that consists of a walk around the neighbourhood to study different houses:

> We walked around and looked at what was beautiful and what was ugly architecture. Of course, the children didn't think like that, but if you mention the word they might pick it up. So we looked at the houses […]. We looked at the roofs, the constructions, we had iPads with us and that's also technology, how does that work. The children did the documentation themselves and took photographs.

She views this activity as successful because they managed to integrate different parts of the curriculum into one single activity, not just technology.

Erica also talks about capturing the moments when something happens, or when children show interest in something specific, such as when the heating pipes were repaired outside the preschool. The workers dug up the pavement and the children could see the pipes and ask questions about them and the heating system. She explains that this spontaneous activity provided a learning situation in technology that was not planned. According to her, they 'got it for free'.

Technology education concerns learning to handle technological objects

Carl is a child-care attendant and educates children aged 1–2. Carls' description of technology is similar to Oscar's, as things we use to make our lives easier. From Carl's statements, it is obvious that his understanding of technology education is work in progress. He says that he feels limited by his own narrow view and thinks that teaching technology is difficult. However, he finds technology interesting and fun and he strives to develop his knowledge to teach technology.

The technology education he describes regard the use of technological objects. He says the children should get to try and test how objects should be handled in order to function as intended. He names things like the tap, the light switch, zippers, the overhead projector and tablet computers. The tablet computer is stressed as the core of technology education and Carl describes it as a learning tool, which they often try to integrate in their work. When a technology theme was started, the children were interested in animals, so in order

to combine the children's interests with technology Carl downloaded an app with which the children could interact to learn about animals. He describes the app as a:

> Very child-friendly game where you click and an animal appears from the barn and you can hear the noise the animal makes and a voice that says "cow", for instance. So it's very easy for them to understand and use.

This way of approaching the subject stems from a desire to allow the children themselves to guide the way and to use their interest and curiosity as driving forces to develop their knowledge.

Technology education is doing experiments

Preschool teacher Catherine educates children aged 2.5–5. Catherine describes technology as devices, computers and how things work. However, in relation to preschool she says that technology is in everything, for instance in painting and in building techniques. She admits to feeling insecure about the subject of technology and that she has found it difficult to implement. She still expresses a joy to organise technological activities in the preschool, which in her opinion mostly are experiments, but at the same time she feels limited by the fact that they do not always have the material needed for the experiments. When describing the technology education provided at her preschool unit, Catherine is mostly concerned with experiments:

> […] so it's like, well should we do some technology next week, and then we go to these [points to the experiment books] and look something up that seems interesting and that we have the materials for.

The experiments she describes mostly relate to natural science, as they investigate natural phenomena (Hansson, 2013). When asked to describe a successful technology learning activity, Catherine says:

> I'm thinking about when we worked with this… what floated. They [the children] thought it was fun. Because we asked them first, before we dropped [the objects in the water], what do you think, do you think this will float or sink? There were many reactions. They thought it was great fun. And then we did it outside as well. We had outdoor technology and we took things outside, cones and sticks and…yeah, that was fun.

When she was asked about the technological content in that activity, she answered that it was to show the children that even big things, which you might think would sink, can float. Otherwise, her concern seem to be that the children should like the activities and have fun. No other objective is expressed.

Technology education involves developing abilities

Preschool teacher Greta educates children aged 3–6. Greta finds it difficult to define what technology is. She talks vaguely about electronics and struggles to describe the meaning of one of the technology goals of the curriculum and how she works with it. Her described technology education focuses on children developing different abilities. Often it is abilities regarding children's independence and social skills. For instance, when she talks about

children handling technological objects the implied objective is that they should develop independence. She explains:

> Some children say "I can't", it can be anything," I can't pull up my pants" or whatever. But yes, try and you can. It's like that with everything in preschool, that we don't step in and help right away but let the children try themselves.

Social skills are more accentuated in construction play as Greta views the construction room as a place for children to collaborate and discover things. Construction play is also regarded as a place for children to develop their ability to fantasise and be creative. Greta says:

> This can be used for that, the children can say when they build with duplo. […] that they themselves figure out what it can be used for […]. That's what's so great, that they think in a way that I myself maybe didn´t think about what they built, but they figured something out on their own.

Greta says her role in this is to sit next to the children when they build and ask questions about what they are building, how and why. She means children need to develop their communicative ability to describe and explain and her questions aim at getting them to train this ability.

Technology education is naturally included in children's play

Anne is a child-care attendant and educates children aged two. She admits that the task of educating children in technology has felt rather scary. She initially viewed technology as something large and difficult and did not feel she had the competence to teach technology in accordance with the curriculum. Now, after discussions with colleagues and a couple of years of implementation, she feels calmer, more confident and more at ease with the way they address the subject. She also expresses joy with working with technology with the children. She connects technology to problem solving, for instance "How can I do to create [something]?".

Anne talks a lot about the naturally occurring technological activities at her preschool, that are play activities the children have chosen themselves which include technology. She talks about the children's construction play and describes how she supports children's learning in their building work with different materials:

> If I think about the previous group [older children], where the children's language was better developed, we could sit and think together about why they [magnets] won't come together or why a high Lego tower falls if you only build with small narrow blocks, but if you build in double rows, how come it doesn't fall then? You get more of a discussion going and I think those moments, when it just happens, are really successful, when the children have chosen their own activities.

These moments include learning in several subjects. Other than technology, she describes developing children's mathematical concepts, such as when she talks about children's towers as being high or large or containing many blocks, and natural science, when she challenges children to think about why the magnets sometimes attract and sometimes repel.

She also describes situations in which children "do technology" without her needing to intervene, such as solving problems in their play by using objects in a creative way:

And we can spur each other on and say look what is happening, what they are doing. They can climb up onto the high step in the courtyard even though they really can't, because they have worked out that they can get a box to stand on, and that's technology I think, to be able to work out how to get up there.

So far the two-year-olds we have now are building very flat. They build in long rows. So that's where they are now, not standing them [blocks] up, maybe that's the next step, to build high but now they are building long and flat.

This latter quote comes from a statement in which she describes lying on the floor with the children and building with blocks. She illustrates her awareness of the children's next step in their learning process but does not mention doing anything to encourage their development towards this next step.

Technology education departs from digital technology

Preschool teacher Jessica educates children aged 4–5. Jessica describes technology as computers and tablets, construction and how things works. The way she talks about teaching technology reveals that she has knowledge to teach the subject. Despite this, she expresses her insecurity, that technology is big, that people can have different ideas about it and that she is not sure if her idea of technology is the correct one. This is apparent when she is asked to describe a successful learning situation in technology. She starts by saying: 'Yes, then you think, what would you include [when you say technology]…?'.

For her, technology education very much revolves around digital technology. Either it is used as a medium for learning something or constructing something, or it is used to create inspiration. In the following activity, it is used to inspire children to build something specific. Jessica describes an activity where she and some children built balloon rockets with inspiration from a Youtube clip. She describes this as an experiment, the purpose of which was to create a balloon rocket that would fly in the same way as that they had seen on Youtube. They had to try several times before they got it to work and Jessica expresses the value of letting children be part of the process of finding a solution.

Yes, but how can we do it? Okay that didn't work, but if we try this tape? And the next day I brought another tape and, well just to discuss it. If we make the straw shorter, will that make it better? To involve them [the children] and let it take time.

The children were also involved in documenting the activity by filming it and taking photographs. Overall, Jessica uses digital technology a lot to document, show films, search for information when the children are curious about how some technology works, the television for instance, or continue learning about something they have previously worked with. These are examples of how digital technology is used as a medium for learning. She also talks about using digital technology for creating and constructing things, such as digital games or books. She says:

To connect it, well if they [the children] have created a story, or written a story, that you have the possibility to film it or create the story in the ipad, that's really fun.

Discussion

The study has investigated how technology education is characterized by preschool staff. Now the results will be discussed in relation to previous research and scrutiny, and the theoretical perspective.

Diverse descriptions of technology education

Previous studies have showed that technology education is described with both broadness and depth by preschool staff on an aggregated level (Sundqvist & Nilsson, 2018). Observations of the practice show the teaching sometimes reflects the broadness and depth previously described (Sundqvist, 2020), while sometimes it is shallow and focuses on natural science rather than technology (Benson & Treleven, 2011; Campbell, 2010) In addition, scrutiny of Swedish preschools found they did not provide a satisfactory technology education, regarding neither content nor teaching methods (Swedish Schools Inspectorate, 2012, 2016, 2017). Keeping in mind the results of this study are based on the staff's statements, and thus cannot claim the same authenticity as the observation studies mentioned above, this study shows diverse approaches to technology education, in part reflecting the results from previous research.

Some staff members describe a conscious, deliberate teaching of technology with a clear aim, including investigating how technology works, what it is and how it relates to environmental issues. Also, when viewed collectively, the staff address many of the aspects put forward by the Swedish Ministry of Education and Research (2010). Together with the children, they identify everyday technology and how it can be used (Oscar, Erica, Jessica), examine and/or observe technological objects to see how they work (Oscar, Erica, Jessica), discuss the role of different parts of a technological system (Oscar) and consciously teach the concept of technology (Oscar), they encourage children to reflect on technical solutions in construction activities (Jessica) and on balance and stability in block play (Anne).

But there are also descriptions of technological activities that could be regarded as shallow or narrow in the sense that learning about artefacts only regard handling/using the artefacts and where the content is not always technology, even though the staff may describe it as such. For Carl and Greta, technology often appears to be a means for learning other things. This is visible when Carl talks about the computer tablet as a tool for learning and when Greta talks about construction play allowing children to develop their social skills and independence. Technology as a means for learning other things is also included in Catherine's descriptions, as she talks about experiments which she seems to view as a technological method to teach children how and why things float or sink in water. Regarding experiments, Norström (2015) explains it is used as a method both in technology and in natural science but in different ways, with different aims. In technology the aim is to "find out how to achieve certain practical ends" (Hansson, 2013, p. 22) by examining "the relation between design characteristics and function-related outcomes" (Norström, 2015, p. 323). This differs from the purpose of natural science experiments, which is to understand nature. Thus, the experiments described by Catherine and Greta are natural science experiments, while the experiment described by Jessica is a technological one. This view of technology as a means rather than content obstructs the children's technological learning, in that the content addressed is something other than technology.

The consequences for the children

To summarize, if we look at the results on an aggregated level, it very much reflects the results from previous studies (see e.g. Benson & Treleven, 2011; Elvstrand et al., 2018; Sundqvist, 2020) and show a broad education, encompassing many technological contents. However, this study contributes what technology teaching each child is offered by showing how individual staff characterize technology education, and when presented on an individual level, it is clear how the characterization of technology education, what is taught and how, differs between preschool staff. Some participants characterize technology education in a narrow way while other participants' characterization show a more broad technology education. It implicates that which teacher a child has matters for what learning possibilities that child is given. There is a difference whether the child has Oscar as teacher, who include many technological contents in his teaching, Catherine whose "technology teaching" mainly addresses science, or Anne who has the approach that technology exists naturally in the environment and in children's play, an approach that previously has been connected to a view that technology does not need to be explicitly taught (Elvstrand et al., 2018). The possibilities to learn technology is thus not equal to all children in preschool.

Implications for a holistic preschool based on a sociocultural perspective

From a sociocultural perspective, a child's possibility to interact with more knowledgeable others is crucial for his/her learning (Vygotsky, 1978). Hallström et al's (2015) and Campbell and Joblings (2008) studies showed that preschool staff seldom interacted with children to support their learning. In this study, we see several examples of staff describing how they interact in planned and spontaneous activities and participate in children's play and in this way posing as good scaffolds. Regarding spontaneous activities, the preschool education in Sweden is characterized by holistic and integrated learning (Swedish National Agency for Education, 2016) which promotes using spontaneous every-day activities as learning opportunities. However, the matter of integrating technology into the everyday practice was found lacking by the Swedish Schools Inspectorate (2016), which saw that technology, when taught, was treated as a separate area. Also, for a child to be able to learn something specific in a holistic activity, the teacher must guide the child's attention and help the child to see what the teacher intends (Pramling Samuelsson & Asplund Carlsson, 2008). Here, two out of seven participants (Oscar, Erica) describe spontaneously capturing moments and turning them into learning situations in technology. Oscar describes situations in which he captures the moment when children show interest in something specific and turns it into a technology learning opportunity, for instance, when the refuse collector arrives. Erica does the same when the heating pipes are serviced. In both these situations, the teachers act from the interest and curiosity shown by the children and interact with children to guide their attention towards something specific.

Although the use of spontaneous situations for teaching technology has shown to be scarce (Swedish Schools Inspectorate, 2016), it could be viewed as an untapped opportunity to meet one of the challenges for performing teaching in a social pedagogic preschool, which is that staff are sometimes unwilling to suggest activities that the children have not asked for, afraid of making preschool too much like school and forcing children to do something that do not interest them. In previous research of how preschool staff characterize teaching, a child-centred approach is described and shows a tendency to wait for

children to initiate an activity (Vallberg Roth, 2018). In this study we see traces of this in Anne's and Carl's descriptions, and also with Catherine as the primary objective for her seems to be that children have fun. Since our surrounding world is filled with technology and almost every situation somehow includes technology, there should be many occurrences of spontaneous situations that arouse children's curiosity and can be considered potential teaching opportunities in technology. This study has shown at least two such occurrences of events that make children curious and interested. Building on this result, it would be interesting to study what events and less common activities that occur at a preschool that can be assumed to capture children's interest and curiosity, and how prominent preschool teachers would organise teaching around these situations. This would contribute knowledge to develop a side of the teaching that is currently insufficient.

Concluding remarks

To summarize, how technology education is characterized differs between preschool staff, implying consequences for children's learning and that learning possibilities are not equal for all children in preschool.

However, regards must be taken about the study method. Because this is a qualitative study and the questions asked to the participants concerned how they teach technology, without clarifying what technology is, their answers were affected by what they consider technology to be. It seems reasonable that staff members with more knowledge about technology are better equipped to identify technology and technological learning in daily situations, than staff members with less knowledge about technology. This could mean that staff with less knowledge about technology might provide several learning opportunities in technology, but they do not consider it to be technology and therefore they did not mention it in the interviews or questionnaire. This also have consequences regarding the contribution of the study. The study does not capture the actual teaching of technology, it captures how the staff here talk about teaching technology and what it is to them. Still, this is an important contribution because the preschool staff as a profession, and especially the preschool teachers', have a task to assess and evaluate how their teaching complies with the curriculum and how this teaching provides a progression in children's learning and development (Swedish National Agency for Education, 2018). Thus, they need to be able to express and verbalise what children are given the opportunity to learn in any teaching situation. In this regard, the study concludes not all preschool teachers have this competence when it comes to technology.

material and personal data would be treated confidentially. Informed consent was obtained from all individual participants included in the study. With regard to confidentiality, all the names of the participants have been changed in the paper.

Code availability Not applicable.

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