

Preschool teachers' experiences of technological concepts in relation to everyday situations in the preschool

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Abstract

Communicating technological concepts in preschool is of vital importance for developing the quality of the technology teaching practice and children's language skills within the content area. The aim of this study is to describe how preschool teachers discern technology in relation to everyday situations in preschool. The study is part of a larger practice-based research and development project focusing on language development and technology teaching practice in preschool, while simultaneously developing and trying a collaborative model between preschool teachers and researchers. The empirical data for this study is generated by semi-structured interviews with preschool teachers. Data analysis employs a phenomenographic approach. Focus is directed towards how preschool teachers experience technological concepts in everyday situations in preschool. The findings include four qualitatively different ways of experiencing technology; *exploring techniques*; *exploring techniques using artefacts*; *exploring artefacts as technology* and *developing constructions using artefacts*.

Keywords

preschool education, technology teaching practice, techniques, language development, phenomenography

Introduction

Technology as content knowledge in early childhood education is an emerging field of research that has gained increasing attention, both nationally and internationally. Studies in relation to technology show that preschool teachers' content knowledge, along with their pedagogical knowledge to approach different parts of technology, is of vital importance for teaching in preschool (Sundqvist, 2016; Turja et al., 2009). A deeper understanding of the content knowledge can contribute to preschool teachers' development of capabilities and a more confident attitude towards teaching technology. Consequently, this may contribute to higher quality through an increase the number of teaching opportunities, extend the pedagogical experiences in approaching children's questions about technology, and thereby further develop the teachers' content knowledge. However, research shows that preschool teachers often lack in-depth understanding of technology as a content in the preschool context (Sundqvist & Nilsson, 2018; Sundqvist et al., 2015). This might add uncertainty among the preschool teachers regarding using and teaching adequate technological concepts, which, in turn, may have negative impact on their ability and motivation to create activities for children to learn and

discover technology (Thorshag & Holmqvist, 2018). Furthermore, it has been shown (Larsson, 2018) that scientific concepts need to be explicit within preschool activities to raise children's awareness of such concepts.

Dialogue and communication about technology between children and preschool teachers in varied situations, has proven to be important for high quality teaching (Fox-Turnbull, 2010; Larsson, 2018; Svensson, et. al., 2019). This requires good knowledge by the preschool teacher of relevant technological concepts. A high-quality preschool teaching practice is characterized by preschool teachers' competence to create conditions for children's learning and to clarify and communicate an object of learning (Broström & Veijleskov, 2009; Marton & Booth, 1997). Teaching in preschool includes supporting all children's learning experiences by relating and responding to children in dialogue, developing child-focused strategies, and to challenge children's thinking while uniting play, care and education (Sylva et al., 2010; Williams & Sheridan, 2018). Preschool teachers' content knowledge and their pedagogical knowledge are crucial for their possibilities to develop, plan and provide a high-quality technology teaching practice.

The aim of this article is to describe how preschool teachers discern technology in relation their work with children in preschool with focus on their experiences of technological concepts in relation to everyday situations in preschool.

Technology in Preschool

Research points to the importance of utilizing children's previous experiences in technology and technological concepts in the teaching practice (Mawson, 2013), as a base for children to create new knowledge. Mawson's (2013) showed that preschool children, who were exposed to technology education developed an awareness of and ability to use technological processes, establishing a purpose, planning and collecting appropriate resources and competently using tools and materials to achieve their desired outcome. To achieve this awareness and ability, preschool teachers play a central role which have been concluded in previous studies (e.g., Broström et al., 2015; Sundqvist & Nilsson, 2018). Preschool teachers' knowledge about the specific content and what learning of that content entail is of great importance for enabling children's learning. In relation to contents in the subject technology, studies have shown that this is a challenge, mainly because many preschool teachers lack sufficient knowledge both regarding the subject matter and regarding how to teach it in the preschool setting (Lillvist et al., 2014; Hellberg & Elvstrand, 2013; Sheridan et al., 2011; Sundqvist et al., 2015).

In a study by Svensson, et. al. (2019), they conclude that of great importance for children's opportunities to develop new knowledge in technology are preschool teachers understanding of the subject technology as well as children's previous experiences with technology. The study showed that when preschool children worked with the technology process, contextualized by a fairy tale, the children used sketches and experiences from everyday life to communicate technological ideas and solutions. The importance of children's past experiences and the concepts which they already had an understanding of became visible when they encountered a (for them) new technology content. In addition, the preschool teachers' uncertainty about technology as a field of knowledge and relevant technological concepts were shown to have impact on the quality support which they were able to give the children in their processes of learning technology and technological concepts.

Preschool teachers support of the children's reflections and reasoning, and communicating technological concepts in play and other everyday situations with learning opportunities in the preschool has also shown to have impact on their understanding of technology (see e.g., Axell, 2013; Stables, 1997; Turja et al., 2009). The difficulty of capturing an 'in-depth' understanding depends, among other things, on preschool teachers' and children's language use, and preschool teachers' content knowledge and pedagogical knowledge in discussing and developing technological solutions together with children. The preschool teacher needs to be aware of critical aspects of the content and their own use of language as well as the fact that the children have varying experiences of technology and might need different support to use words and technological concepts to think, understand and communicate technology (Turja et al., 2009). Children learn to use social- and content specific language by communicating in various contexts; namely, the functions of the language are linked to social practices, interests, norms, and values (Gee, 2014). In a preschool context, teaching is a matter of consciously communicating, leading, challenging and directing children's attention towards a specific content (Jonsson, 2013; Jonsson et al., 2017; Larsson, 2016). To be able to interact and communicate around a content area such as technology, children need access to the language used in the specific discourse (Barton, 2007). When children practice with different tools and models in technology it enables them to develop their language at the same time as they explore and discover phenomena in the world around them, granted that the preschool teachers introduce relevant technological concepts into the children's play and other everyday situations (Fleer, 2000; Turja et al., 2009). Essential for enabling learning is the way preschool teachers organize activities and support children with material and concepts that create a context in which they build on children's prior experiences and challenge them to understand things in new ways (Larsson, 2016).

Technology in Swedish Preschool Context

The present study is conducted in Sweden where the recent preschool curriculum (National Agency for Education, 2018) points out that the early childhood education should challenge and stimulate every child's development of *language*, *mathematics*, *technology* and *science*. Exploration, curiosity, and a desire to play should be the foundation of this education. It should be characterised by care, development and learning coming together to form an entity. (National Agency for Education, 2018, p. 14). Compared to the previous curriculum (National Agency for Education, 1998), the intention is to make the early childhood education more oriented towards learning and a teaching practice of high quality.

An important activity for children's learning in Swedish preschool is play. Play provides children with the opportunity to use experiences and knowledge to get involved in technological activities such as building, constructing and exploring. Children explore technology through construction work with toys and try out their own ideas for mechanical solutions in playful ways (Bjurulf, 2013). Building and constructing can include anything from building huts to simple construction tools, and a variety of materials is used depending on the outcome of the activity as an object. How children handle challenges in the building and constructing activities depends on how they act and make decisions based on their volition (Mitcham, 1994). Volition is defined as the process of making and acting on decisions. Even though construction technology has a long tradition in preschool (Bjurulf 2013), knowledge of technology and the technological concepts used need to be discerned and highlighted for the children. In relation to technical volition Thorshag and Holmqvist (2018) show that children viewed the constructing material in

different ways, either seeing the material as foreground or regarding it as pieces in a construction. Some children expressed volition for using the material to make a construction while others showed volition for exploring the material as such.

Early childhood education in Sweden should create opportunities for children to develop creativity as well as the ability to discover and develop technological solutions in everyday life. Furthermore, the physical learning environment in preschool is required to provide materials which invite children to build, create and construct with the help of different techniques, materials and tools (National Agency for Education, 2018). In high-quality technology education, the children's experimentation is supported by preschool teachers' interactions and dialogue with the children around different solutions and improvements, while using technological concepts. Therefore, preschool teachers need to develop their understanding of, and language for technology to identify, discover and make visible new technological solutions together with the children.

Technology Knowledge

Technology as a field of knowledge and concept has a central position in this project. Discussions about and understandings of technology inspires and guides the work. Technology is a wide-ranging concept and can be used to represent for example methods, systems, things, processes, or actions (Kline, 2003), thus, it is a concept that can be difficult to grasp, especially since there is not one specific definition, despite all the attempts, which have been made. As a way to "unpack" technology as a concept, Kline (2003) describes four different ways in which technology may be understood: 1) artefacts – non-natural objects, manufactured by humans, 2) sociotechnical systems of manufacture – all the elements needed to manufacture an artefact, the complete system such as input, people, resources, process, economy etc., 3) knowledge, techniques, know-how or methodology – information, skills, processes, and procedures for accomplishing a task, and 4) sociotechnical systems of use – using combinations of artefacts and people to accomplish tasks that humans cannot perform unaided by such systems. Another way of describing technology, widely used in the Swedish technology education, are Mitcham's (1994) fourfold characterization of technology (Fig. 1), *volition*, *knowledge*, *actions* and *objects*, as an orientation towards action aiming at a particular outcome. *Knowledge* relates to the information needed to carry out the activity. *Volition* relates to the children's own willingness and intention to design products, processes and systems. Technological *activities* are carried out to produce something or use technological solutions. *Objects* are the artifacts used or created in the activity. One conclusion of this is that technological knowledge and will, with their origins in humans, give rise to technological activities expressed as concrete technological objects.

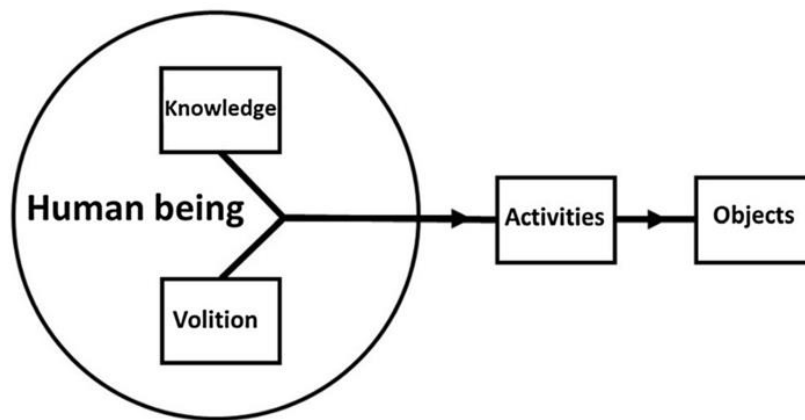


Fig. 1. The four manifestations of technology (from Mitcham 1994, p. 160)

In relation to earlier research, we want to describe preschool teachers experiences of technological concepts in relation to everyday situations in preschool.

Theoretical Framework

The theoretical framework of this study is based on phenomenography as a qualitative research approach (Marton & Booth, 1997). Phenomenography offers opportunities to investigate research questions concerning ways of understanding specific phenomenon, such as technological concepts in relation to different everyday situations in the preschool. One fundamental assumption in the phenomenographic approach is that there are qualitatively different ways of understanding a particular phenomenon or aspect of the world (Marton & Booth, 1997). Some of these ways to understand can be argued to be more powerful than others when acting in the world. The focus in a phenomenographic study is the empirical search for qualitative differences in the collective experience of the phenomenon. The essence of the phenomenographic approach as taking a non-dualistic, qualitative, second-order perspective where the aim is to identify key aspects (i.e., critical aspects) in the variation of learners' collective experience of a phenomenon, that results in a set of hierarchical categories of descriptions that are internally related (Cederqvist, 2021; Trigwell, 2006). In this study we describe how preschool teachers discern technology in relation their work with children in preschool with focus on their experiences of technological concepts in relation to everyday situations in preschool. From this theoretical perspective, the phenomenon of technological concepts that preschool teachers encounter in various situations and in different preschool activities are modified and developed through the situations in which the phenomena are experienced.

Method

This study is based on a collaborative practice-based project about teaching technology in preschool. The project as a whole is firmly rooted in the challenges and needs of the profession, as it is based on preschool teachers' own questions about technology and their use of language for teaching technology in their specific preschool practices. The preschool teachers initiated the project by contacting researchers in the field at the nearby university. The empirical data is produced by semi-structured and open-ended interviews with twelve preschool teachers in two Swedish preschools; six preschool teachers from each preschool. The preschool teachers have between 4.5 to 36 years of experience in the profession. Two researchers participated in each

interview; one conducted the interview and the other one listened and supported with the technical equipment. All interviews were audio recorded and transcribed verbatim by the researchers.

The interviews followed a piloted interview guide, which was generated in collaboration between the researchers and piloted on an external preschool teacher. To gain a shared experience between the preschool teacher and the researchers, each teacher was asked to bring a photo from an everyday situation in their preschool environment, which they considered to be in some way related to technology. The situations ranged from outdoor to indoor activities and involved children from one to five years of age. The interview started with a discussion around the technology experienced in the chosen situation of the photo. Examples of questions that the interview started with are: Why did you choose the situation? Is it a common situation? How do you describe technology in relation to the situation? Can you give examples of more situations which include technology?

Analysis

The phenomenographic analytical approach to research was used to discern variations in the preschool teachers' experiences of technology in everyday situations in preschool. Thus, the analytical approach elucidated various aspects of learning and understanding in the educational environment (Marton, 2014; Marton & Booth, 1997). The results are generated in the empirical data. The research outcome is a set of categories, which describe qualitatively different ways of experiencing a phenomenon, here how technology is experienced in everyday situations in preschool. These categories are logically interconnected in both structure and meaning. These categories do not describe how the specific individual perceive the phenomenon, rather as a set, they indicate potential ways in which individuals can perceive the phenomenon.

The analytical process was conducted in several steps (e.g., Marton & Booth, 1997). Initially the interviews are transcribed verbatim and is read repeatedly as a whole by the researchers to become familiar with it as a collective entity, following a typical phenomenographic approach to data analysis (see e.g., Cederqvist, 2021; Svensson, 2011). The analysis continued with a focus on and systematic identification of the parts of the interviews that described technology in everyday situations in different preschool activities. The relevant parts of individual interviews are seen as meaning units. The collection of empirical material was in this way transformed from a set of full-length interviews to a set of focused units of interview excerpts. These manageable units could then be compared and contrasted to each other, which consequently proposed rich opportunities to delve into how the preschool teachers described the situations and connected them to technology. At this stage, meaningful variation began to emerge between different subsets of the interview excerpts. These tentative subsets were carefully described in terms of their differences, and subsequently in terms of their defining qualities.

Since no single excerpt fully captures one category, several quotations from all interviews have been chosen to elucidate and support the main thrust of the categories, especially in terms of the meaning and structure of the understanding of the technology that preschool teachers associate with an everyday situation in preschool. All interviews are coded with a letter and a number, indicated in parentheses after each excerpt.

Ethical considerations

The design of the study follows the ethical requirements set by the Swedish Research Council (2017). The preschool teachers and the children's caregivers were informed about the purpose of the project, the requirement for anonymity and that the participants could at any time refrain from participating in the research. Written consents from preschool teachers and caregivers to the children participating in the study was collected. The photos used during the interview are the preschool teachers' own photos, which they have given us permission to use for research purposes. The photos have been anonymized and only the activity is in focus. Although it is the preschool teachers who are in focus in this study, a research study in a preschool context always includes children; hence require additional responsibility from us as researchers to create a safe context for everyone involved. Consequently, ethical considerations are discussed throughout the research process, as it is impossible to know in advance which ethical issues may arise (Coady, 2010; Larsson et al., 2019). All data was anonymized, including the names of preschools and people, coded and kept separate from the original data. The interviews and other documentation related to the project is stored at the University of Gothenburg.

Results

The analysis resulted in four, qualitatively distinct categories: a) Exploring techniques, b) Exploring techniques using artefacts, c) Exploring artefacts as technology and d) Developing constructions using artefacts. In these categories there are differences in preschool teachers experiences of artifacts as well as of technology as a skill or as a way of solving problems.

Technology is often related to artifacts (De Vries, 2016; Kroes & Meijers, 2006; Säljö, 2013). Artifacts could in the most obvious way of thinking, be understood as human-made objects. That makes them different from natural objects, which are not human-made. Artifacts as human-made objects have a certain function and have been made because of that. To be a technological artifact, the entity needs to have a function, but also to be a physical object (Frederik, et. al., 2011). Descriptions of technology varies according to techniques and/or technology. In this study we understand techniques as a particular way of doing things, where you need to learn a special skill, for example using paintbrushes in a specific way to create a certain pattern. We define technology as the knowledge needed for solving a problem or meeting a desire that someone has, for example developing an artefact that could be used to open a can.

Below, the categories are defined and illustrated by the interview excerpts. Each excerpt ends with an indication in brackets of the preschool X and Z and the preschool teacher as a number. The photos presented are the ones that the preschool teachers brought to the interview as examples of a technology related to an everyday situation in their preschool environment.

A. Exploring techniques

In this category, the preschool teachers relate technology to exploring techniques, in the sense that they as preschool teachers observe situations where children use their body to investigate objects, events and activities in the preschool environment. They give as example the best way to climb a chair, how to get the swing to move and how to roll down the hill as fast as possible, which could be expressed as an investigation of a natural phenomenon such as speed and

friction. The photo (1) exemplifies how the children roll down a small hill located on the preschool playground.

Well, it's technology almost all the time, swinging and rolling on slopes and so, yes, much is technology. (X5)

...get up on a chair, how do I lift my leg, arm, so that I can get up on the chair ... put on clothes, pull up a zipper, open a door handle, push down the handle. (Z3)

This is us on the hill [pointing at the photo] and I had an idea that we can scroll down the hill and compare ... Do you have any special technique? Is it faster if you roll in some special way? How does it feel if you scroll things up the hill, ..., making a contrast? (X1)



Photo 1. Children using their bodies to investigate the fastest way to scroll down a hill

In the category of exploring techniques, the preschool teachers' understanding of technology is connected to and represents a skill. When they are asked about technological concepts that they relate to these situations, they mention the skill in terms of verbs like; to roll, to slow down, to overturn and to get stuck. In this category, artefacts, if present, are in the background of preschool teachers' awareness and the skills used to solve the problem, for example climbing the chair, is in the foreground. In this category the preschool teachers describe techniques that occur in everyday situations.

B. Exploring techniques using artefacts

This category exemplifies how the preschool teachers relate technology to various situations in which children use artefacts such as brushes, balloons and magnetic building blocks in order to explore and learn about different techniques. In the following excerpts the preschool teachers describe technology in two different situations where children paint (photos 2 and 3)

I probably think more about technology when it comes to mixing color [looking at a photo 2, where the children are painting with different paintbrushes], in my mind, ... not that we used technology as a tool but more just the technique of mixing color, that's where I'm in my mind. (X6).



Photo 2. Children painting using brushes

Yes, but I think of this [pointing at the photo 3, with children using balloons as a tool when painting] with push and force depending on how hard you push, how big the imprint and technique of mixing colors and what happens then and what happens if I spin the balloon and so on. (X2)



Photo 3. Children painting using balloons

Artefacts and techniques are also in the foreground in everyday situations as we can see in the first excerpt (Z1) below, where the children try an old projector, but also in the daily meal situation exemplified in the second excerpt. (X3)

We have an old overhead (...) but as the children use a lot and project on the wall because we have no other portable projector and so we have (...) this child who suddenly put the tangram pieces on the overhead completely spontaneously and then discovered when it was projected that it became a new color. I thought it was just a cool moment, it was just like completely spontaneous of her nothing that we had planned. (Z1)

...to eat, to share their food, to get to the technique with a knife and fork, that I can put up food with a fork, catch food with the tips of the fork... (X3)

There are indications of the preschool teacher's emerging awareness about a difference between technological artefacts and techniques, illustrated in the following excerpt:

In another situation, perhaps more planned in the painting room, where brushes are used as a technological aid or a corrugated board or something to draw a color. You can use technology and it becomes a mixture of what can be linked together, what happens as technology and as technological tools for mixing color ...(Z6)

In comparison with category A, the excerpts in category B indicate that the preschool teachers' express an understanding of technology as something more than techniques in which the body is used to investigate natural phenomena; artefacts are in the foreground of preschool teachers' awareness and seem to have an important role in the situation. The chosen situations are planned in such a way that the preschool teachers have prepared with artefacts for the children to use.

C. Exploring artefacts as technology

Excerpts in this category indicate that technology situations in preschool are related to exploring technological artefacts, rather than to techniques. The preschool teachers' expressions put focus on the function of the artefacts and how the children can investigate these functions. In the excerpts, two situations are highlighted. In the first (photo 4), a child is holding a fruit bowl and the preschool teacher describes the bowl as an artefact with a function; the function of holding items. In the second and third excerpt the preschool teacher describes how everyday situations contribute to opportunities for children to explore and play with artefacts and try to understand how they work.

Mm, yes, because I think, it is a little technology just to be able to carry around and offer the fruit in a bowl, so that you do not drop the fruit, something like that. It's a little unclear to me what to think about technology. (X5)



Photo 4. Children carry around and offer fruits from a bowl

There is a lot of technology that young children do. It can be a button, a lamp button, it is really fun to turn on and off, on and off, it can be done twenty times. They roll cars,

they drive them on different things. They use the material in different ways on the elements and on the window frames and so on. (Z2)

It's technology, everyday technology It's technology, everyday technology, to open and close doors, light buttons are very fun when the children understand this and even at the tap you could stand for a whole day. It's like everyday technology for the little kids, yes in all situations it comes in if you think about it. (Z4)

Compared to category A and B, the excerpts from the preschool teachers in category C includes a movement from understanding technology situations as techniques, to an understanding of technology as the development, use and exploration of artefacts for specific functions.

D. Developing constructions using artefacts

To build, develop and construct an artefact or a system is phrased by some of the preschool teachers as involving technology. The excerpts below illustrate how the preschool teachers express their understanding of the possibilities for children to learn about principles for constructing, when using specific materials/equipment for example magnetic building blocks. Photo 5 illustrates the children's play with magnetic building blocks and the various solutions and constructions the play with the artifacts can give rise to.

The preschool teacher expresses that:

Yes, because they love to build with these magnets, [magnetic building blocks]. They build so many different things, ... roads, different ... platforms for airplanes ... animals, they have built turtles. Everything is possible to build with them. They learn that the building must be stable (hesitates), yes, and that, they have to have a foundation and sometimes they need a drawing. (Z5)

Another preschool teacher said that:

you can develop it a lot, especially with these magnets [magnetic building blocks] in how they build oh ..., you can have a foundation on which it can stand and if it falls you can talk to the children about how to make it more stable and so on. So, there's a lot to work on with technology around this. (Z1)



Photo 5. Children using magnetic building blocks to make constructions

In this category the preschool teachers associate to a variety of technological concepts, for example platform, stability and joining. The most significant difference from the previous categories is that in these excerpts the preschool teachers relate technology to artefacts and systems that can be used for children's learning and development, in a problem-solving activity within the area of technology. By communicating possible ways of constructing in children's play with artefacts, the preschool teachers' express that they see a multitude of teaching entrances and to make the children aware about how different techniques can contribute to constructing. In that way we interpret a potential for relating technology to problem solving activities where children investigate, construct, explore and evaluate artefacts and systems.

Discussion

In this study focus is directed towards the technology that preschool teachers discern in everyday situations in preschool. The findings emphasize four different ways of experience technological concepts, described as *exploring techniques*; *exploring techniques using artefacts*; *exploring artefacts as technology* and *developing constructions using artefacts*. The preschool teachers talk about technology situations and concepts, and they give a rich variety of examples ranging from exploring techniques to developing constructions using artefacts. In the first category (A), exploring techniques, technology is above all connected to the development of a skill, while in the last category (D), developing constructions using artefacts, is technology related to problem solving activities, embracing, and focusing both constructing, exploring, and investigating artefacts.

The results highlight the variation in which preschool teachers express their understanding of technology in everyday situations in different preschool activities. In their talk about technology, the preschool teachers put different aspects in the foreground, ranging from a focus on techniques as a skill or method, to development and construction with technological artefacts. When techniques are in the foreground as in category A, only a limited part of technology, as a subject matter of knowledge appears. This category does not connect to any physical representation like an artefact and is in that way not related to technology knowledge as described by Mitcham (1994) or Kline (2003). As we move through the categories, there is a variation from describing technology as exploring a technique, towards an integration of artefacts which connects to Kline's (2003) understanding of artefacts as non-natural objects manufactured by humans. In category D, the preschool teachers use artefacts in systems for children's knowledge development and express an awareness of the role of technological concepts when teaching technology in preschool. The last category indicates a more developed understanding of technology in relation to everyday preschool activities and can be related to Mitcham's (1994) fourfold characterization of technology as knowledge, volition, action, and object.

In the Swedish preschool education, play holds a central position and is the foundation for children's development, learning and well-being. It is interesting to note how the preschool teachers provide examples of how they identify technological concepts present in children's play. In playful activities such as turning a light on and off, rolling down a grassy slope, driving a toy car on different surfaces, or playing with magnetic building blocks, solutions and constructions are exposed to solve upcoming issues with various artifacts (Bjurulf, 2013). However, as previous research highlight (e.g., Thorshag & Holmqvist 2018; Williams & Sheridan, 2018), it is of vital importance that all children are supported to discover technology and given

rich opportunities to use technological concepts in the preschools' everyday situations. Not only the children actively exploring technology, but also those who are not, should be challenged in their learning by the preschool teacher. Being able to communicate and put words on what is happening in an activity is an important aspect of play and learning, regardless which subject area it is about and contributes to equal opportunities in the preschool education. However, this requires that the preschool teachers have sufficient content and pedagogical knowledge, are creative and play with language, and make use of different opportunities to approach aspects of technology in various forms (Sundqvist, 2016; Turja et al., 2009).

We interpret that the results from this study have implications on what preschool teachers need to develop their technology knowledge about, the difference between technique and technology, the role of artefacts and the problem solving in relation to artefacts. Being aware of different aspects of technology means understanding technology in a more complex and powerful way (Marton & Booth, 1997), which in turn gives the preschool teacher opportunities to talk about, reflect on and teach technology more nuanced. Thus, the results strengthen the importance of preschool teachers' ability to relate technology situations to artefacts and systems, as seen in category D, to child related activities where the children play, investigate, construct, explore and evaluate.

This result can be related to research (e.g., Turja et. al., 2009; Sundqvist & Nilsson, 2018) underlining that children need guidance from well-informed, supportive and challenging preschool teachers so that the children can get acquainted with different materials to develop skills regarding designing, building and constructing. Important teaching competences includes required content knowledge, related to what is reasonable to expect from children in preschool ages, together with preschool teachers' pedagogical knowledge. Furthermore, content-specific concepts are essential when communicating a content, if to raise children's awareness of such concepts (Larsson, 2018). The results also highlight that preschool teachers need to have knowledge about and consider the children's previous experiences, to deepen and expand children's understanding and meaning making within the specific content area.

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