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Didaktik attention: Preschool teaching from a didaktik and variation theory perspective using examples of mathematical aspects of programming

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This article is based on a study of an R&D programme with various theory-informed teaching arrangements aimed at describing and further developing knowledge of what characterizes preschool teaching. The aim of this study is to contribute knowledge about how teachers and children can create attention in relation to an example when teaching focuses on mathematical aspects and programming from a didaktik and variation theory perspective. The guiding question is: What can characterize attention-forming acts of teaching in preschool? The analysed material in this article consists of an example with just over ten minutes of audio-visual data – videos of teaching. An abductive analysis has been carried out. Preschool teachers' interactions with children while teaching is studied and analysed based on didaktik questions and with a didaktik triangle as the didaktik model and based on three dimensions representations of attention: sharing, creating and alternating attention and attention-forming acts. Concepts of variation theory is connected to the didaktik questions and didaktik triangle. Overall, the representations of sharing, creating and alternating attention and attention-forming acts of teaching can be summarized in the concept of didaktik attention.

Keywords: attention, Didaktics, mathematics, preschool teaching, variation theory.

1. Introduction

Preschool is the first form of school in the education system and education aims for children to acquire and develop knowledge and values as well as to prepare children for a democratic society (SKOLFS 2018:50). Teaching is a new concept in the Swedish curriculum for preschool (SKOLFS 2018:50) since 2018. Even though preschool teaching was written into the Education Act in 2010 (SFS 2010:800) and is a part of the curricular history of preschool (e.g., Vallberg Roth, 2011), the concept of teaching has been viewed as problematic (e.g., Vallberg Roth, 2020).

In a research and development (R&D) programme, where the example for this article is included, the question "what can characterize teaching in preschool" has been studied. In the program preschool teachers in eight Swedish municipalities have tried out theory-informed teaching arrangements based on didaktik[1], such as didaktik questions and the didaktik triangle in different phases of teaching (plan, conduct and evaluate). Preschool teachers in the example for this study try to teach from a didaktik and a variation theory perspective (see Vallberg Roth, Aasa, Ekberg, Holmberg, Sjöström & Stensson, 2021). The content of the example for this study is mathematics with a focus on programming. According to the curriculum for preschool (SKOLFS 2018:50), education should also strive to "give children the opportunity to use mathematics to investigate and describe their surroundings and solve everyday problems" (p. 9). A large part of what is around us is programmed, small built-in computers are found in, for example, telephones, toys, machines, and tools. The education should also give the children "the opportunity to develop an understanding of the digitalisation they encounter in everyday life" (SKOLFS 2018:50 p. 9). A National Digitization Strategy for the school system (Swedish Ministry of Education and Research, 2017) states that:

[1] We use the German word didaktik (with the k letter), which is common in continental Europe and the Nordic countries, and not the Anglo-Saxon word didactics.

> Digital competence is basically a matter of democracy. In school, we learn to understand the world in order to change it.
>
> All children and students need to gain an understanding of how digitalisation affects the world and our lives, how programming controls both the flow of information we are reached by and the tools we use, as well as gaining knowledge about how technology works in order to apply it ourselves. (Swedish Ministry of Education and Research, 2017, p.3)

Knowledge of programming does not necessarily mean programming a computer. In preschool, it can be about following instructions, or commands, in the correct order. Instructions can be given orally or more abstractly through symbols in the form of arrows, pictures, or other symbols. Failure to follow instructions will result in an error, or bug, that needs to be fixed, or debugged as expressed in programming languages. Teaching programming is related in research to Computational thinking, a concept that became popular through Wing 2006 (Lye & Koh, 2014; Palmér, 2017). By computational thinking is meant that everyone, not just computer scientists, should be given the opportunity to learn and use programming in an appropriate way. Mathematically, programming can mean problem solving, understanding patterns, sequences, or order in, for example, everyday routines such as hand washing.

Preschool teachers and their teams are tasked with fostering and promoting the conditions for the development of knowledge, understanding, ability and interests of each individual child with the aim of achieving the knowledge targets specified in the curriculum. As per the curriculum (SKOLFS 2018:50), preschool teachers have a particular responsibility for "leading the goal-driven processes and during teaching, a responsibility for […] developing pedagogical content and environments that inspire development and learning and which challenge and stimulate children's interest and curiosity while also retaining their *attention*" (SKOLFS 2018:50, p. 19; emphasis added). *Attention* in relation to teaching is a concept that is frequently used in both preschool practice and research (e.g., Doverborg, Pramling & Pramling Samuelsson, 2013; Eidevald, Engdahl, Frankenberg, Lenz Taguchi & Palmer, 2018; Sheridan & Williams, 2018; Vallberg Roth & Tallberg Broman, 2018) without being defined specifically. Attention in the broad sense is often

interpreted as important and obvious in the teaching process but it often seems as if it presumed that everyone knows what is involved and how it should be managed (Rytzler, 2017b).
By clarifying a concept that is taken for granted and not defined in the curriculum for preschool, this article can support teachers[2] in planning, conducting, and evaluating their teaching.

An online search of the word *attention* reveals synonyms such as alertness, concentration, consideration, and interest, among others. Briefly, attention is defined as directing perceptions and/or mental activity towards something specific. Attention is described as being either focused generally on a situation, or held over a longer period, a form of concentration (Egidius, 2021). Furthermore, attention is described as selective, meaning that some aspects are focused on, and some are disregarded. According to Egidius, shared attention can be understood as distributed attention similar to an individual's capacity for simultaneity or multitasking. Additionally, alternating attention is described as when focus switches between various external phenomena or between different internal thoughts and feelings, as well as between these two.

Theoretically, *attention* frequently lands in the cognitive and psychological field, which is pointed out by Rytzler (2017b). Attention is often discussed in texts that focus on neuropsychiatric disabilities (Aronsson, 2021; Arvidson, 2006; Mole, 2011; Parasuraman 2000). There are additional examples of research that highlight the philosophical and metatheoretical aspects of attention in general that are common to all forms of education (Rytzler, 2021).

To summarize, the practice-theoretical concept of *didaktik attention,* that is tried out in this article, can increase precision and finesse [finstämdhet] in relation to each child being taught. As pertaining to teachers' aim of creating the opportunities that enable every child to learn and create meaning, didaktik attention can bring about more equitable conditions – for every child.

[2] Preschool teachers are referred to as teachers because my foundational point is that preschool teachers are teachers in preschool, just as primary school teachers are teachers in primary school.

2. Literature review

This literature review focuses on the key term *attention* in connection with teaching in preschool. Teaching is summarized by Sheridan and Williams (2018) as intersubjective – when two or more people share attention, more specifically, when the preschool teacher and child(ren) share attention. towards something specific. Additionally, teaching is described as interactive and communicative – by intentionally directing children's attention towards a shared learning target, area of knowledge, or focus, different perspectives communicate with each other and are integrated (cf. Catucci, 2018; Doverborg, Pramling & Pramling Samuelsson, 2013; Eidevald, Engdahl, Frankenberg, Lenz Taguchi & Palmer, 2018: Hildén, 2021; Sheridan & Williams, 2018; Vallberg Roth & Tallberg Broman, 2018). In recent years, research on preschool learning and teaching has increased in Scandinavia (Furenes, Reikerås, Moser, & Munthe, 2021), but it is still more learning than teaching foci in this research.

Historically, attention has been a recurring question for thinkers on education, such as Plato, Comenius, Rousseau, Herbart, Montessori, James and Dewey (Rytzler, 2017b). Rytzler places the concept of attention in a pedagogical-philosophical context and discusses attention as a relational phenomenon in teaching, using the terms *create*, *form*, and *share* attention. Teachers and children (pupils) come together in relation to content during teaching situations that, from a relational perspective, can be viewed as attention formation in practice. There is a lack of research on attention in preschool from a pedagogical-didaktik perspective, which is focused on attention formation practices in empirical studies. Further, there is a need to examine the concept of attention on action and theoretical levels (cf. Kansanen, 1993; Vallberg Roth et al, 2021), particulary in relation to teaching in preschool.

3. Aim and research question

The aim of this study is to contribute knowledge about how teachers and children can create attention in relation to an example when teaching focuses on mathematical aspects and programming from a didaktik and variation theory perspective. The guiding question of this article is: What can characterize attention-forming acts of teaching in preschool?

4. Theoretical framework

In a R&D programme, the concept of teaching was jointly studied by participants and researchers in a collaborative study (Vallberg Roth et al., 2021). Participating preschool teachers tried out theory-informed teaching arrangements. This article proceeds from this collaborative research focusing on didaktik in teaching arrangements in which variation theory concepts are examined.

4.1 Didaktik

Didaktik is a complex field that can be viewed as a practice-theoretical base of knowledge for teaching (Bengtsson, 1997; Comenius, 1657/1989). Practice and theories meet in didaktik models, which can be used both as support in teaching and as analytical tools (Vallberg Roth, 2021).

4.1.1 Didaktik questions

A classical didaktik model deals with didaktik questions, that are directed towards learning. These questions are, for example in connection to content (the *what* question), formulated in terms of "what should be learnt?" (e.g., Jank & Meyer, 2006, 2019; Selander, 2010; Uljens, 1997). Then the didaktik questions become focused on learning and learning outcomes, rather than on teaching. In the Swedish preschool curriculum, there are goals and guidelines for children's development and learning. There are no goals to achieve and no specific learning outcomes for each child, but rather goals to strive towards during a child's preschool years (Vallberg Roth, 2021). This article includes several didaktik questions that are directed to teaching, such as what, how, who, where and when. The didaktik *how*-question takes a centre stage in relation to *what*, *who*, *where* and *when* questions connected to attention.

4.1.2 Didaktik triangle

Didaktik involves both teaching and being taught. Teaching concerns the relationship between someone draws someone´s attention to something. A classic model for this is the didaktik triangle, with the child(ren), teacher and content, which represents the vertices of the triangle. Rytzler (2017a) refers to Herbart (1908), Sobe (2004), and Stiegler (2010) to explain that the challenge of teaching lies in handling two simultaneous relationships.

> On the one hand, teaching is directed towards content that is shown, formed, or communicated as a (presumed or prospective) common interest for teachers and pupils. On the other hand, teaching is directed towards pupils and/or their engagement with the content. Both relationships presuppose that a certain amount of attention is available at the outset, but these relationships can also form and develop attention (Rytzler, 2017a, p. 215).

Jank and Meyer (1997) describe how difficult it is to realise theoretical assumptions in practice. Planned teaching does not happen by itself – teaching must be *led*, which in the following citation is aimed at school.

> You need to create a learning environment and try to capture pupils' interest in the theme you have chosen for the teaching. (Ibid, p. 37)

Capturing children's interest and attention can be related to both interaction between teachers and children and to making it possible for children to discern the content that is the subject of the teaching situation. The vertex, in the didaktik triangle, between teacher and content focuses on the teacher's treatment of and co-action with the content. Acting in the role of the teacher to demonstrate content while interacting with pupils/children can be interpreted as a co-action between teacher and child(ren). Whoever leads, or is led, and how the process of feedback occurs are significant in relation to the didaktik question of *how*.

4.2 Variation theory

Variation theory is a theory that is aimed at learning, which can be interpreted as building upon intentional learning. Metatheoretically, variation theory has its roots in phenomenography (cf. Marton, 2015; Marton & Booth, 2000). Variation theory has been tested in Swedish preschool (cf. Björklund 2007; Björklund 2013; Ljung-Djärf 2013; Pramling, 1983; Stensson, 2021).

The core concepts of variation theory are objects of learning, critical aspects, and patterns of variation in the form of contrast, generalisation, and fusion, as well as variation – discernment – simultaneity. Learning is always the learning of something (Marton, 2015), and the object of learning is viewed as a well-defined object which learners are given the opportunity to develop

their understanding of knowledge about. Variation theory studies focus on a variety of qualitatively deepened experience of a certain object of learning and are interested in what creates possibilities for discernment in teaching and learning situations (Holmqvist Olander & Ljung-Djärf, 2013). When we try to help someone to learn something, our starting point should be what can be learned (i.e., the object of learning). For every object of learning there are aspects and for each child there are critical aspects (aspects which the learner has not yet seen), which the learner is given opportunities to discern (Marton, 2015).

The critical aspects become the object of teaching. Marton (2015) argues that all objects of learning have many meaningful aspects, many of which we do not think about, quite simply because they are not critical or because we have not noticed them. That which is a critical aspect for one person is not necessarily so for someone else. To be able to notice, perceive and discern a critical aspect, there must be variation (differences). There must be two aspects that can be experienced simultaneously for differences to be noticeable. Experiencing similarities and differences is not only a result of what there is to experience, but rather what can be experienced simultaneously. Our awareness, what is perceived in relation to what, stems from the simultaneity of differences, the variations (Marton, 2015). From a variation theory perspective, learning is viewed as the ability to discern various aspects of an object of learning. Variation is a necessary condition for a learner to be able to perceive a relevant aspect of an object of learning (e.g., Marton, 2015). The critical aspect is kept invariant (unchanged) or is varied dependent upon which pattern of variation is used. Patterns of variation and invariance are designated as contrast, generalization or fusion (ibid).

4.2.1 Contrast

When using contrast, we allow critical aspects to vary while other aspects are kept invariant – to make discernment possible in something which has not previously been apparent. This involves using variation with the aid of contrasting examples in order to make clear what something is in relation to what it is not (e.g., Marton, 2015; Stensson, 2021). To understand, for example, the number two, it needs to be varied with other numbers that are not two, such as the numbers three and four. Other aspects, an example of which in a concrete situation could be marbles, are

kept invariant. In other words, the number is what is varied, and the object is invariant. Then the learner can learn to discern what "two" is and what "two" is not with the aid of contrast and counter-examples.

4.3 Didaktik in relation to variation theory

In this article didaktik and variation theory is combined. While didaktik mainly corresponds to teaching, variation theory mainly corresponds to learning in this study. Variation theory can be interpreted as being closely linked to the didaktik questions of *what* and *how*. The *what* and *how* questions are related to the teacher's presentation of content, in terms of learning object and how the child could be given the opportunity to discern the content in terms of patterns of variation such as contrast.

In the didaktik triangle the angel of content is related to objects of learning and the contrast as attention power. The relation between teacher, child(ren), and content focuses on co-action with the content. Attention is related to all questions including who, where and when. Overall, the didaktik questions, the didaktik triangle and the concepts of variation theory can be synthesized in a relational power field [kraftfält] of attention.

4.4 Attention

Attention, one of the most complex processes in the brain, aids in filtering stimuli, processing information, and focusing on a specific thing. Focused attention, where extraneous stimuli are disregarded, requires a high level of alertness. A lack of motivation, fatigue and boredom can create obstacles to retaining attention on a specific activity, task, or object of learning. Attention may also alternate between various tasks that need to be focused on simultaneously, where it is necessary to both listen and act, for example. From a psychological perspective, attention involves directing perception and/or thought processes towards specific phenomena – attention takes conscious effort (Egidius, 2021). However, in this article attention is viewed as a relational/context-dependent phenomena rather than something that goes on in the brain. According to Rytzler (2017a), attention is highly coloured by instrumentalism, psychology, and psychiatry.

However, Rytzler poses his questions in a pedagogical-philosophical context and discusses attention as a relational phenomenon in teaching. Rytzler (2017a; 2017b) places himself in the borderland between didaktik and pedagogy to highlight how the content can be born and emerge and, above all, study teaching as an attention-building practice. This article draws a connection with the pedagogical field to show, in a similar but empirical manner, "how relational and pedagogical perspectives of attention contribute to making attention a qualitative question for the teaching practice" (Rytzler 2017a, p. 183).

The didaktik triangle according to Rytzler (2017b) functions as a way of framing and constructing the relational dynamics between pupil, teacher, and content. This model creates a structure in which teaching becomes an attention formation activity.

Rytzler (2017b) can be interpreted being oriented towards primary or secondary school, but the empirical evidence for this article revolves around preschool. In one line of argument inspired by pragmatism and pedagogical philosophy, Rytzler develops "an idea of pedagogical thinking as a practice-oriented language that attempts to unbind the dual nature of pedagogy as both practice and theory" (p. 183).

In relation to pedagogical thinking, I can draw a connection to Kansansen (1993). Here an action-level can be related to policy documents and planning teaching in practice, conducting and evaluating teaching using didaktik questions. The dual nature of pedagogy as both practical and theoretical can be related to the practical and theoretical sides of didaktik.
Rytzler (2017b) argues that it is necessary to "clarify what is meant by attention in a teaching context" (p. 184) and shows "how attention can be understood as a complex of relations that brings forth a becoming of an attentive subject" (p. 184). Teaching can be expressed as an "summons to self-activity that invites both teacher and pupil to practise and shape their attention" (p. 185).

4.4.1 Teaching and attention

Relational and pedagogical perspectives on attention contribute to setting attention as a qualitative question in the practice of teaching according to Rytzler (2017b). A content becomes relational in relation to others. The content is dependent upon being known, appreciated, and respected by others to develop self-assertion and self-efficacy. On the other hand, a content needs to acknowledge others. A content needs to be summoned to independent self-activity and this requires receptivity, the capacity to learn and a spontaneity, in order to orient oneself in the world. Pedagogical actions, in the form of acknowledgement and based upon an individual's previous experiences to support development, can be seen as a summons to self-activity. In the practice of teaching, contents gather round a common language, a common practice and share experiences, which involve reciprocal and simultaneous experiences of each other through their embodiment (Rytzler, 2017b; Uljens, 2017).

4.4.2 Shared attention

Björklund and Pramling Samuelsson (2013) posit that one of the three critical aspects of the teaching act is shared attention: "One of the greatest challenges for teachers working with young children is probably to capture the children's attention and direct it towards a specific learning object" (ibid., p. 1346). In the example that Björklund and Pramling Samuelsson analyse, the object of learning is *one half*. The children were asked to divide the animals in half based on an experienced event, farm visits. The teacher tells a story connected to the experienced event where the children are allowed to be the main characters in the story. In this way, the teacher catches their attention and can direct it towards the object of learning.

Siraj-Blatchford, Sylva, Muttock, Gilden and Bell (2002) emphasize the verbal interactions between adults and children. If learning takes place in cognitive construction, a process that is only achieved when children are motivated and involved, it is entirely logical to assume that the teacher also needs to be motivated and involved. Cognitive construction in that case is mutual, where each participant engages in understanding the other and learning is achieved through a reflexive process of "co-construction". A necessary condition is that each participant is involved, and that the content should be instructive in some way.

Persistent and long-lasting "shared thinking" expands children's thinking according to Siraj-Blatchford et al (2002) and increases opportunities for child-initiated interactions.

The English word *attention* is a noun from the verb *attend* (*delta* in Swedish), which comes from the Latin word *attendere*. Attendere is formed of the prefix ad- (to) and tendere (stretch) (Rytzler 2017b). Attention can be interpreted as stretching or drawing out, which can bring together "shared thinking" and "shared attention". Through capturing, directing, sharing, and retaining children's attention, opportunities for expanding their thinking are also created. In teaching, attention is related to acting just as showing is to observing – in other words, it involves reciprocal interaction just like breathing in and out, or just as thoughts that are expressed or reflected upon (Rytzler, 2017b).

4.4.3 Create, form and share attention

Attention in the broad sense can be interpreted as important and obvious in the educational practice as a whole, but it is often presumed that everyone what is involved and how it could be managed. "Attention is captured, formed and created in the present flow of teaching, but it can also escape or be destroyed" (Rytzler, 2017a, p. 226). Rytzler (2017a; 2017b) uses the terms *create*, *form* and *share* attention. In relation to the terms retain, direct and share attention (see Introduction), Rytzler's terms create, form and share attention can supplement how teachers can didaktically view attention when teaching is planned, conducted and evaluated. The article focuses on attention in conducted teaching. The concepts create, form and share attention includes in the concept attention-forming acts of teaching in this study.

5. Research methodology

In this section design, data collection, analytic method and ethical considerations are described.

5.1 Design

Participants in the research and development programme tried out various theory-informed teaching arrangements (Vallberg Roth et al., 2021). The theory-informed teaching arrangements were tried out in a collaborative research design in which participating preschool teachers and managers from 44 preschools/preschool departments in eight different municipalities in Sweden collaborated with researchers. Participants initiated questions about teaching, tried out teaching arrangements, and generated materials without the presence of researchers in the preschools. Researchers initiated the theory and content of teaching arrangements that the participants tried out. The selection of theories was done based on traces that was expressed in completed questionnaires in which participants answered what may characterize teaching in preschool (see Vallberg Roth, 2021). This article focuses on teaching arrangements in which didaktik and variation theory were tried out and the content was mathematics with a focus on programming.

Before participants tried out the theory-informed teaching arrangements that this article is based upon, they were presented with lectures on theory and examples of how teaching arrangements could look like. On this input occasion, a didaktik teaching arrangement was exemplified with variation theoretical terminology and mathematical content with a focus on programming. In the arrangement didaktik brings didaktik questions connected to concepts like objects of learning. Theoretical concepts and possible teaching arrangements were discussed by preschool teachers and managers from the various municipalities (Vallberg Roth, 2021). Based on input, the participants then tried out the theory-informed teaching arrangement in the municipalities without the presence of researchers in the preschools. This design of collaborative research could be connected to democratic aspects (see position papers in this themed issue).

5.2 Data collection

Preschool teachers at preschools filmed their teaching. Documents and videos were uploaded to a digital platform that was accessible to researchers and one person at each preschool/section. As a whole, the materials consist of examples from 31 preschools/preschool departments in eight municipalities.

Empirical data of this article are derived from preschools by preschool teachers and involve children directly in teaching, and indirectly by necessary staff team in the process. For this article, a 10:35 minute-long filmed teaching has been used as the basis for exemplifying analysis and results. In brief, the example that is analysed is of a teaching situation with a focus on mathematics and programming. In the beginning, two children and a teacher are sitting at a table ordering pictures into a sequence. The pictures depict different actions associated with handwashing and are to be set in a mathematical sequence from first to last on a premade template with five boxes arranged vertically. The template and pictures together create an algorithm. After the children and teacher have discussed and experimented to create the algorithm, they go to the lavatory to check out the algorithm by playing a game, a robot game.

The selection of this example of teaching makes variation and distinguishing characteristics explicit in the material in the most illustrative, clearest, and least unwieldy way. The analysis and results are related to the aim and guiding question of the article.

5.3 Analytic method – how traces were found

This article employs an abductive analysis which alternates between empirically and theoretically based analytical paths (cf. Peirce, 1903/1990; Tavory & Timmermans, 2014; Vallberg Roth et al, 2021). In the alternation between empirically and theoretically based analytical paths, the transcribed material had been analysed in relation to didaktik questions, variation theoretical concepts, and the concept of attention, which has resulted in various traces (see Table 1). The traces were then connected to previous research.

To conclude the study, there is a discussion about the ways in which analysis and results can contribute to knowledge of how preschool teachers and children can create attention around mathematical aspects when teaching focuses on programming (see *Discussion*).

In the analysis the term "trace" is used instead of, for example, "category". Trace is a term which from an analytical standpoint may be consistent with various grounds and perspectives (see Vallberg Roth, 2020). The term "category" may misdirect thoughts to something more rigid with sharply defined limits. Category may create the semblance of something that is more or less complete to search for and capture and in which the material is arranged based on concrete and static classifications. Traces can be associated with both fixed and temporary determinations and constructions that can be related to various scientific grounds and be capable of capturing the variation in the material (Vallberg Roth et al., 2021).

The material, in the form of filmed teaching, has been transcribed and processed in relation to the aim and guiding question of the article. Recorded material was transcribed by the researchers. The transcription makes no claims that all sounds and actions were transcribed. Rather, this represents a partial transcription (cf. Duranti, 1997). Italics represent verbal communication. Nonverbal communication includes facial expressions and body movements (see examples in the presentation of results).

5.4 Ethical considerations

The research has been reviewed and approved by the regional Ethics Review Board in Lund (10 January 2018). The participants in the collaborative study complied with the principles of research ethics applicable to research in the humanities and social sciences (Swedish Research Council, 2017).

6. Results

As mentioned previously, this article is based on a video of teaching with a total length of 10:35 minutes, used as a foundation for exemplifying results and analysis.

The teaching arrangement begins with a teacher and two children sitting on chairs at a table, and they are sitting so that they can easily see each other and the pictures that the teacher has placed on the table. The materials that are being used in the teaching situation consist of a laminated sheet of A4 paper with five boxes arranged vertically and five pictures that are to be fastened to the boxes to create an algorithm of the order of in which events happen while washing one's hands. The pictures consist of both pictures and words illustrating "turn on water," "use soap," "wash hands," "turn off water," and drying hands with "paper towel." The aim of the teaching situation is to put the pictures in the correct order, and in that way create an algorithm.

When the children are satisfied with the order of the pictures, the teacher explains that they have now programmed a sequence and that they are going to try out their sequence by playing a game, a robot game. In the game, one of the children will be the leader and direct the other child, who is the robot. They go to the basin in the lavatory where the robot is meant to follow the leader's instructions.

In the following, the teaching situation will be analysed based on didaktik questions of three representations of attention: *sharing attention*, *alternating attention* and *attention-forming acts of teaching*.

6.1 Traces – attention-forming acts of teaching

The traces of attention-forming acts, stemming from didaktik questions are all related to the didaktik *How* question (see Table 1 below). Teachers and children *share* attention concerning the object of learning. For example, to put pictures in order and then try out following the algorithm for washing hands. They are challenged by disorder that form more intense attention. *Share attention* is one trace that is examined in the analysis. Shared attention in the analysis refers to attention that is shared by the children and the teacher, the gaze, the conversation and the action are di-

rected towards a common content. This does not mean that they see the same thing; thoughts and actions about and with the content may differ between individuals. The empirical traces in the abductive analysis challenge the theory and concepts create, form, and share attention. For example, the teaching begins at the table by putting the pictures in sequential order, and then it *alternates* to try out the sequence at the basin in the lavatory. *Alternating attention* is a trace that also is examined in the analysis.

Teaching usually means that the teacher has an intention to create attention about the content of the teaching. The analysis emphasizes a trace, *attention formation acts in teaching*, that include shared attention between children and teachers and how attention alternates in teaching.

The representations of attention make no claims of being entirely distinct but can rather overlap and converge. The main point is that certain representations can be interpreted as being in the foreground, while others are in the background (cf. Rytler, 2021)

Table 1. Overview of traces stemming from didaktik questions that are related to the *How* question.

Attention formation in relation to the didaktik *What* question: The teacher has a clear picture of what the task could lead to and create attention around contrasts	
Share attention: Attention is shared through object of learning and critical aspects.	Alternate attention: Attention alternates from the contrast of order and disorder through different forms of teaching (conversation – play).
Attention formation in relation to the didaktik *How* question: The teacher keeps the attention around the object of learning and invites the children to give suggestions for solutions within the framework of the learning object and the material	
Share attention: Attention is shared when problems to solve arise (bugs)	Alternate attention: Attention alternates between previous experiences and following a jointly determined order
Attention formation in relation to the didaktik *Who* question: The teacher communicates with both verbal language and body language to create attention, sometimes it involves ignoring one´s idea in favour of another	

Share attention: Attention is shared in a didaktik triangle relation. The teacher is the main actor, the children are co-actors and the pictural material is both attention-forming and a support in the teaching.	Alternate attention: Attention alternates through different roles, leading and being led. The pictural material is an attention support as the place and form of the teaching alternates.
Attention formation in relation to the didaktik *Where* question: The teacher choose places for teaching that do not constitute the usual place for the activity, thus creating attention both through meta-conversations and a game that puts everyday actions to the test.	
Share attention: The place allows attention to be shared about the content	Alternate attention: The place of attention alternates between different rooms
Attention formation in relation to the didaktik *When* question: The teacher draws attention to time in the teaching by linking to previous events, what could happen here and now, summarizes the teaching through retrospect but also as a future look in the form of "Think if"	
Share attention: Attention is shared around events in the past, present and future	Alternate attention: Attention alternates between events in the past, present and future

In the following, attention formation is first analyzed in relation to how attention is shared and how attention alternates, and then summed up in attention-forming acts of teaching in relation to the current didaktik question. First, we study attention-forming acts in relation to the didaktik what-question.

6.2 The What question

In relation to the didaktik *what* question, the object of learning for the teaching situation is to place the pictures in sequential order, and by doing so an algorithm for hand washing is created which then is tested.

The critical aspect of the teaching situation can be interpreted as putting handwashing steps into sequential order, where values of the aspect are the key terms *first* and *last*.

6.2.1 Sharing attention

The teacher uses key concepts throughout the teaching to show order and disorder. Initially, the children's and the teacher's attention are shared by creating an algorithm consisting of pictures for the steps in hand washing. The object of learning, sequential order, is common throughout the entire teaching, first at the table and then at the basin in the lavatory. The algorithm is the sheet of paper with boxes onto which the pictures are placed.

> The teacher lays the sheet on the table in front of the children: So, you are going to help put them in order here. Look, here is "turn on water," "wash hands," "paper towel," and "turn off water" and "soap". What should we do first? [the author's emphasis] Child 1: Turn off water. Teacher: Should we turn the water off first?

The teacher emphasizes the word *first*, and naturally, uses the words *after* and *then* before arriving at *last*. Attention is shared around the mathematical aspects of *first* in contrast to *after*, *later* and *last* in a sequence.

> Teacher: Do we wash our hands, and then [the author's emphasis] use the soap? Child 1: Mmhmm. Teacher: Okay, what do we do after [the author's emphasis] using soap?

6.2.2 Alternate attention

While the children and teacher are sitting at the table placing the pictures in order, the children seem to guess that there is something that is not quite right. They have placed the pictures "wash hands," "use soap" and "paper towel."

> Teacher: Paper, okay. When do we turn on the water and when do we turn the water off then? Child 1: You start (leans back), you start by turning on the water. Teacher: Turn on the water, should you do that after you've dried your hands? Child 1: Yes.

The children cannot get rid of the feeling that something is not quite right.

> Teacher: So, we should wash our hands… use soap… use a paper towel… turn on the water… and turn off the water? The children make "mmhmm" sounds of agreement after every step the teacher mentions, and they finally say: Yes. Teacher: Are they in the right order? Child 1 and Child 2: Nah. Teacher: They're not? What's wrong then? Child 2 picks up the "turn off water" card: This one… Teacher: Shouldn't that one be there? Child 2 strikes out with the arms with the palms facing up.

Child 2 has discovered disorder, a bug, which arose from contrasting order with disorder; something that should come first has been placed last. The teacher allows that which has become a critical aspect for the children during the teaching to remain critical until they test the sequence out with a game.

Child 2, make a gesture that can be interpreted as, "I don't know." There is a nagging feeling that bothers them, making the children realise something is not quite right, which creates intensified attention in relation to the object of learning.

The learning object changes in degree of abstraction from a more abstract form at the table to a more concrete form when they go to the basin in the lavatory to play a game. The game is a robot game, where they will test out the sequence. The robot (Child 1) is meant to follow the leader´s (Child 2) instructions, who is holding the algorithm.

> Child 2 instructs: *Wash hands.* The teacher clarifies: *Yes, since Child 1 is the robot, you have to do it.* Child 1 stands on a footstool, turns towards the basin and is about to turn on the water. The teacher interjects: *ah-ah-ah!* Child 1 stops and looks at the teacher and steps down from the stool… The teacher reminds the robot: *You are supposed to wash your hands*… Child 1: *Uh-oh.*

The issue Child 2 noticed at the table has been put to the test with the robot game. Following the order they put the pictures into does not seem so simple and straightforward. The teacher draws the children's attention to the critical aspect – that which comes first – and by doing so the teacher creates attention.

> Teacher: You were supposed to wash your hands. I think there's a bug here, because what should you do first (pointing at the top of the sheet)? Child 2: Wash hands! Teacher: Yes, that's what we have written here, but they can't wash their hands until they've done something else first. Child 2: Use soap. The teacher turns to look at the sheet of paper with the pictures: Okay, then we should move the soap. Look, Child 2, now we have to have the soap first.

6.2.3 Attention-forming acts of teaching

The teaching focuses on programming and the order becomes important when an algorithm is to be constructed and then tested. Attention is shared around the mathematical aspects *first* in contrast to *after*, *then* and *last* in a sequence.

Disorder creates attention and different solutions are tried both in a more abstract context when the children are sitting at the table and more or less concretely when the order is tested in a game depending on the role of the children. As mentioned earlier, attention alternates between abstract and concrete, order and disorder and the aspects first, then, after and last.

6.3 The How question

In the teaching, the child is given the opportunity to create and try out a sequence for hand washing. In relation to the *how-question*, order in contrast to disorder seems to be of particular importance. The preschool teacher uses both verbal language and body language in communication with the children to explain, ask, confirm, and give room for action to the children.

6.3.1 Share attention

At the table, the teacher asks questions, shows and points at the materials to draw their attention to sequential order. The children make suggestions and seem to make connections to their previous experiences of what should happen in the lavatory when they wash their hands.

> Teacher: What do you do first when you go to the lavatory? Child 2: Pee! Child 1: Wash your hands! Teacher: Wash our hands, so we put "wash hands" first.

The teacher sticks to the materials and the pictures that are to be placed in the algorithm. The materials do not provide the scope for tangents, so the teacher does not pay attention to Child 2's suggestion about what to do first when going to the lavatory. While they are sitting together at the table putting the pictures in order, the children figure out that the first thing they should do in the lavatory is to wash their hands. That picture can be interpreted as the most logical choice since it is the main task. However, the teacher has not yet mentioned that the sequence involves washing their hands. After the "wash hands" picture, they think that the picture of soap should come next, but then they become unsure of the next step.

> Teacher: Okay, what do we do after we use soap? Child 1: Umm, pee? Teacher: We have "turn off water," "turn on water," or "paper towel." Child 1 and Child 2: Paper towel!

Once again, the children seem to make a connection to their previous experiences. The teacher uses the pictures in the materials to draw the children's attention to their available choices and the children decide on "paper towel," which is also familiar to them in washing their hands. How and when the water is turned on or off seems to be something that the children have not considered.

6.3.2 Alternate Attention

Attention alternates through different forms of teaching. At the table, they have a *conversation* about which order the pictures should come in the sequence or algorithm. Two pictures that are especially tricky are the "turn on water" and "turn off water" pictures.

> Teacher: […] When do we turn on the water and when do we turn the water off then? Child 1: You start (leans back), you start by turning on the water. Teacher: Turn on the water, should you do that after you've dried your hands? Child 1: Yes. Teacher: Okay, and after

> you've turned on the water, what should you do? Child 1: You have to turn it on and turn it off. Teacher: Should we turn it off then? Child 1: Yeah, or turn it on.

After they have had a conversation to decide where to place pictures for each step in handwashing, the teaching moves on to a game. The game is a robot game, where they will test out the sequence. The robot (Child 1) is meant to follow the leader´s (Child 2) instructions, who is holding the algorithm. The robot turns to the basin and is about to open the tap when the preschool teacher exclaims "upupup!". Child 1 stops, looks at the preschool teacher and goes down from the stool. The preschool teacher pays attention to child 1 on the instruction "You should wash your hands, after all…". "Wow" says child 1.

> Teacher: You were supposed to wash your hands. I think there's a bug here, because what should you do first? Teacher points at the top of the sheet. Child 2: Wash hands! Teacher: Yes, that's what we have written here, but they can't wash their hands until they've done something else first. Child 2: Use soap. The teacher turns to look at the sheet of paper with the pictures: Okay, then we should move the soap. Look, Child 2, now we have to have the soap first.

Child 2 suggests that the robot should first use the soap and Child 1 puts some soap on their hands. Meanwhile, Child 2 and the teacher move the pictures in the algorithm so that the soap picture comes first. The robot now has soap on their hands and is waiting for instructions from Child 2.

> Teacher: But what should they do now? Child 2: Wash hands. Teacher: Mmhmm, but what do the robot need to do to be able to wash its hands? Child 2: Pull up its sleeves. Child 1: …turn on the water.

Something needs to be done before the robot can wash their hands. Child 2, who is holding the algorithm, seems to think about what is missing and to think back to previous experiences of washing their hands – to pushing their sleeves out of the way. This can be interpreted as the child discovering a bug. Simultaneously, Child 1 (the robot standing at the basin), has a more here-and-

now experience of what needs to happen. The robot needs water and therefore suggests, "turn on the water." The teacher sticks to the object of learning, that the pictures should come in a particular sequence, and doesn´t respond to Child 2's suggestion of pulling up sleeves, but rather asks Child 1 to repeat what they said.

> Teacher: Ah, what did you say again, Child 1? What did you need to do? Child 1 repeats: Turn on the water. Teacher: The robot says it need to turn the water on… In that case, there must be a bug because we have "turn on water" here. The teacher points to the last picture.

Turning on and off the water is something that seems to be done without consciously thinking about it, a sort of embodied, automatic experience that is challenged in a game in which a sequence is to be followed. The attention alternates between following the order in which the children put the pictures together and the previous experience the children have of washing their hands. For Child 2, who lead the robot by instructing, it is a more abstract process to think about what should happen when the pictures don´t seem to be correct. Child 1's, the robot's, need water to wash hands which creates a more concrete attention.

6.3.3 Attention-forming acts of teaching

The preschool teacher explains, asks, points and shows to take the teaching forward. The teacher allows the children to make choices that may later need to be re-evaluated and follows up the children's actions so that they pay attention to problems that arise. When a problem arises, attention intensifies. The robot knows from previous experiences of washing their hands that they need water, but the robot is supposed to follow the instructions, but the instruction to "turn on water" is missing from the sequence that the child has for the robot. An error, known as a bug in programming lingo, has been detected and needs to be corrected. Using the word *bug* seems to have an attention-forming effect, by creating a fun and engaging environment for solving the problem.

> Teacher: Well, you see now, now we've made a sequence and when you don't put things in the right order, what happens then? Child 1: It's like that robot… Teacher: We've found a

> bug. Child 1: A bug. Teacher: that means that something silly has happened. Child 1, with a smile: Silly stuff.

Describing the error as *silly* seems to ensure that it is not taken personally, but rather as a fun puzzle that needs to be solved together.

6.4 The Who question

The preschool teacher, the two children and the visual/pictural material contribute to an attention-forming teaching process in a didaktik triangle relationship.

6.4.1 Share attention

The teacher is the primary actor in the teaching but allows the children's suggestions to lead its development. At the table, the pictures contribute to share attention. What is first and last on the A4 sheet with squares in the vertical direction is not entirely obvious. The preschool teacher holds up the picture "turn off the water" and asks where it should be.

> Child 1 points to the "last" box: *Turn off the water*. Teacher: *Should we turn the water off first?* Child 1: *Yes*. The teacher replies in a neutral tone of voice: *Okay*. The teacher attaches the "turn off water" card to the uppermost box and asks a follow up question: *What should we do after we've turned off the water?*

When the children together with the preschool teacher try out the order for hand washing, an example was previously given of when the robot has soap on its hands and is waiting for an instruction.

> Teacher: But what does he do now? Child 2: Wash your hands. Teacher: Mm, but what does he need to do to be able to wash his hands? Child 2: Pull up their sleeves.

Something needs to be done before the robot can wash its hands. Child 2 who hold the algorithm, seem to think about what is missing and seem to go back to previous experiences of wash-

ing their hands - pulling up the sleeves of the shirt. Child 2 takes the initiative for a new possible step in the order that is not included in the algorithm.

> The teacher points and explains: We have "use soap," we have "turn on the water," we have "paper towel," we have "wash hands." Which one should we do first when we go to the lavatory? Child 2: Pee. Child 1: Wash our hands. Teacher: Wash our hands, so we'll put "wash hands" first.

The teacher does not allow the teaching to deviate from what the materials allow. From a variation theoretical perspective, this can be interpreted as the teacher persisting with the object of learning: to create a sequence; "pulling up the sleeves" is not included in the sequence for washing hands. From the children's perspective, the pictorial materials can be interpreted as being abstract; they do not really understand the purpose of the pictures and they are basing their suggestions on their experiences of going to the lavatory. The answer can be interpreted as logical because children probably usually pull up their sleeves before they wash their hands.

6.4.2 Alternate attention

The preschool teacher leads the teaching partly by letting the pictorial material constitute an attention support both at the table and afterwards in the robot game.

> Teacher: Okay, now I want to test this sequence, so now we're going to play a game (claps hands together). Child 1: Mmhmm. Teacher: Now, Child 2 is the leader, they are going to direct you, because you (turns and points at Child 1's arm) are the robot. Now we're going to go to the lavatory, and Child 2 is going to tell you what to do. You have programmed this in the sequence […] so now we're going to check if your sequence is in the right order. Child 1: Mmhmm. Teacher: So now Child 2 is going to hold this and (lifts up the sheet / algorithm towards Child 2), we go into the lavatory, and then Child 1 will listen and be a robot.

The game is a robot game, where one child is a programmer and leads the other child by reading the sequence in the algorithm. The other child, acting as a robot, follows, or tries to follow, the

programmer's instructions and then they switch roles. When both children have tried to be both programmers and robots, they want the teacher to be a robot.

> The teacher concludes: And now you've, now you have both been robots and programmed each other and acted out the sequence. Child 1: And now you have to… Teacher: Should I do it now, okay, are you going to program me now? Child 1: Yes!

6.4.3 Attention-forming acts of teaching

The teacher is the main actor for attention-forming teaching processes. The children create attention through their own ideas about how the order can continue. The pictural material is an attention support in teaching and when changing places and rooms. Attention also varies in relation to roles where teachers and children are the main and co-actors in conversation and play.

6.5 The Where question

In relation to the where-question, the preschool teacher has chosen places where the children try, shape and reshape the order for washing their hands.

6.5.1 Share attention

The *Where* question concerns the room or place in which teaching can be conducted. The place chosen by the teacher to initiate teaching is at a table with suitable chairs for children. The table and child-size chairs enable them to share attention during the teaching. This is interpreted as a calm place and the children seem to be used to and feel safe in. It is also a place that is relatively near the lavatory where they test out the sequence of pictures in the algorithm. The place sparks a new direction for attention that involves concrete interactions, moving from words and pictures to washing hands in a basin.

6.5.2 Alternate attention

Attention alternates between different places and rooms. First at the table, where the children may not usually talk about how to wash their hands. Then at the basin, where they wash their

hands in concrete action but in the teaching, or the robot game, they must follow instructions for different elements of the order.

6.5.3 Attention-forming acts of teaching

The chosen places for teaching enable attention in conversations and interaction about washing hands in a certain order and to concretely test the order.

6.6 The When question

Attention in relation to the when-question can be related to *when* teaching can be carried out. In teaching, the when-question can also be linked to the past – events and experiences, present and future.

6.6.1 Share attention

Attention is shared through the teacher's introduction of the topic by linking it to previous events:

> Do you remember that I asked you questions yesterday?

After a brief recap, the teacher continues and directs the children's attention to the here and now:

> […] and today I thought we could make an algorithm where we put things in order,

The "things" refer to the steps involved in washing the hands. The preschool teacher clarifies "that is, what to do first and what to do last. The activity, washing the hands, thus involves a lapse of time in itself. Then the preschool teacher asks the question "What should you do first?". At this moment, the children and the teacher are sitting at the table talking about something that the children have experienced, they have a meta-conversation about washing their hands. As support, they have a picture material that they arrange in an order.

6.6.2 Alternate Attention

Attention alternates between the past, present and future, previous events and experiences – looking to the future, the robot game, and summarising.

Initially, the teacher directs the children's attention to the past by asking, "Do you remember … yesterday?" Then the children's attention is directed towards the present by explaining, "… and today I thought we could…" After putting the pictures in order in the algorithm for a while, the children's attention is redirected at what is going to happen next when the teacher explains, "now we're going to play a game." The children and the teacher continue the teaching at the basin in the lavatory where they play a robot game. One child leads and programs the other child who plays the role of the robot.

The concept that is in focus for the teaching also contains an aspect of time that contributes to alternating attention between what comes *first* in the sequence, what comes *next* or *after*, and what comes *last* in the sequence. The teaching, both at the table and in the lavatory, is summarized afterwards and attention alternates between the process and results.

> Teacher: Is that right, is it in the right order now? Wash hands, use soap, paper towel, turn off water, turn on water? Child 1: Ye-es. Child 2: No.

The summarization makes alternating attention possible for the children because they switch between paying attention to the completed sequence to then going back to continuing to put the pictures in order for the algorithm. Summary also enables a reflection on what it would have looked like if the children did not correct the order.

> Teacher: Yes, because what if you had taken the soap last, it is not the right order, then it will be crazy because you cannot walk around and have soap on your hands

Reflection in the summation enables the children to switch between the present and the future, where the children can use their imagination and imagination.

6.6.3 Attention-forming acts of teaching

Didaktically, the when-question means that in addition to planning for when teaching can be carried out, planning for how time aspects can be woven into the teaching and what it can lead to for attention-forming teaching actions.

7. Discussion

This article focuses on how teachers and children can create, share attention and how the attention alternate in the teaching. In the *Results* section, the relationship between the didaktik *How* question and other didaktik questions were placed in the foreground for analysis in relation to attention. Here, in the discussion section, attention is highlighted further based on how teaching can be interpreted as an attention-forming acts.

Inspired by Rytzler's (2017b) philosophical and pedagogical research, the concepts *create, form* and *share* attention have been examined to analyse them in terms of each didaktik question. The empirical and theoretical aspects have been challenged and have developed each other in the abductive analysis, resulting in representations of attention: *share attention*, *alternate attention and attention-forming acts of teaching*. To form and share attention can be related to Rytzler's previous research (e.g., Rytzler, 2017a; Rytzler, 2017b; Rytzler, 2021), which has now been carried out in concrete, didaktik, planned and conducted teaching in preschool. The additional representation, alternating attention, emerged from the empirical material. The overall representation, attention-forming acts of teaching, is more like a result of the two others, but can also relate to Rytzler´s terms – create and form attention.

7.1 Shared attention

The representation of *share attention* can be related to the didaktik triangle relation. The teacher in the example communicates using both words and gestures as the main and co-actor in the attention-forming teaching process, and the children carry the teaching forward as main and co-actors, using both words and gestures. Attention is shared regarding object of learning and the critical aspect *first* in contrast to *after*, *then* and *last* in a sequence. In the example used for the article, the

pictorial materials constitute a co-actor that the teacher and children share attention around during the entire teaching (cf. Rytzler, 2021). Shared attention can be related to what Siraj-Blatchford et al. (2002) describe as *sustained shared thinking* when they highlight interactions between adults and children. Persistent and prolonged "shared thinking" expands children's thought processes, and a necessary condition of "shared thinking" is that both the child and teacher are involved. Björklund and Pramling Samuelsson (2013) argue that one of the greatest challenges for teachers is to capture and direct children's attention. The teacher in the example used for this article does not deviate from the material or from placing the pictures in the algorithm. The pictorial materials do not provide space for siding. Marton (2015) points out that when we try to help someone learn something, we need to take what can be learned as the starting point. Because the teacher has been informed by a variation-theoretical perspective on teaching, the critical aspects, in order to gain order, seem to be of great importance in maintaining the children's attention.

The children are challenged when problems arise. The teacher uses problems as an attention-forming component. The teacher does not correct the order when the pictures are first placed in the sequence, even though the children seem to have an idea that something is not quite right and try out other solutions. A nagging feeling arises that bothers them, and that feeling creates intensified attention in relation to the object of learning. Or more precisely, that which possibly constitutes a critical aspect for the children to be able to understand the object of learning; proper order can be interpreted as being a critical aspect in the teaching. To be able to discover, experience and discern a critical aspect, there must be a variation, a difference, and here the nagging feeling seems to show the children that there is a difference – order contrasts with disorder (cf. Marton, 2015). When the teaching continues in the lavatory with a robot game, attention is created deepened when the sequence does not align with the children's previous experiences of handwashing. An error in the sequence, or algorithm, arises, which in programming lingo is called a bug. When a bug, a difference, is encountered in the algorithm, the intensified attention surrounding it can be interpreted as a critical aspect.

7.2 Alternate attention

The representation *alternate attention* emerged in the analysis of the example used for this article. The mathematical aspects of *first*, *then*, *after* and *last* resulted in attention that alternated between order and disorder when a bug was detected. The children's previous experiences, or experiences of embodied automation, seem to flow into the attention-forming process, where they were challenged and revealed to be a critical aspect in the context of programming. During the practical parts of the teaching, the children come together via a common language, a common praxis, and they share experiences to mutually and simultaneously perceive and discern the object of learning (cf. Marton, 2015; Rytzler, 2017b; Uljens, 2017). The teaching alternates in both form and place, first in conversation and experimentation at the table, and afterwards with the robot game at the basin. Attention alternates between putting pictures in order at the table, which can be viewed as being more abstract, to the more concrete activity of experimentation during the game. The children take turns being the programmer, the one who uses the algorithm to instruct the robot, and being the robot, the one who carries out the instructions to the letter. Attention is also intensified when the children suggest that it is the teacher's turn to be the robot. Perhaps this is a result of the children now understanding the sequence in this context and that the bugs have been fixed. An interesting aspect of the teaching is that using the word *bug* seems to have an attention-forming power and creates an enjoyable atmosphere for solving the problem. Describing the error as "silly" seems to ensure that it is not taken personally, but rather becomes a puzzle they need to solve together.

7.3 Attention-forming acts of teaching

The *attention-forming acts of teaching*, can be related to how to create attention in the teaching and answer the question for the article: What can characterize attention-forming acts of teaching in preschool? For example, the attention is intensified when the children face problems with the order of the pictures. The teacher retains the attention around the nagging feeling the children experience at the table when they place the pictures in order by letting the children then try the order at the basin and at that time find the solution. The teacher does not come up with the solution but leads the children through teaching to a solution. Attention is also maintained through

the children's suggestions that they should change roles: that the teacher should play the robot and the children should guide the teacher.

Another example of attention-forming acts of teaching is the pictorial material which accompany both the form and the place of teaching. The material has been interpreted in this example to be meaningful for sharing, creating and alternating attention during the teaching. Rytzler (2017b) argues that during the act of teaching, attention can be formed and created, but the opportunity to discern and capture it can also be dispelled. The teacher in the example captures attention through the use of the materials. In the space created from the rise of nagging feelings that something is wrong, the alternations between the abstract and concrete, and the alternating forms and places of teaching, didaktik attention-forming teaching processes flourish. Rytzler (2017b) points out that a teacher is not merely responsible for teaching, but also for bringing about teaching. Contrast, as defined in variation theory, between order and disorder, between first and last, and also a didaktik contrast between the abstract and concrete seems to exert attention-forming power in teaching. The knowledge contribution may be expressed as follows: Didaktik questions and representations of attention along with the didaktik triangle relation between teacher, children and content apparently function as multivocal, dynamic and powerful grounds for attention in teaching.

The place of teaching is chosen with care. Washing your hands is a recurring routine in preschool. Spontaneous teaching probably often takes place at the washbasin, conversations, and questions about how to do it, what steps are included in washing the hands and why washing the hands are carried out while hand washing is in progress. In this conducted teaching about hand washing, the conversation is moved to the table to draw attention to the order, which leads to a meta-conversation about hand washing. At the washbasin, the children are challenged to follow the order they have decided. What is usually a routine situation becomes a game where previous experiences are challenged by the order and the instructions that co-actors in the game give. In teaching, the time aspect is in focus, partly by planning when the teaching is to be carried out, and partly as a focus for the learning object. In this specific teaching the aspect of what happens first and last in hand washing. The time aspect also connects previous events "Do you remem-

ber…?" with ongoing teaching "…and today we…" and when summarizing teaching, they reflect on future scenarios "…what if …". The alternate between past, present, and future is meaningful, retain and directs the children's attention.

8. Conclusions

The aim of this study is to contribute knowledge about how teachers and children can create attention in relation to an example when teaching focuses on mathematical aspects and programming from a didaktik and variation theory perspective. The guiding question: "What can characterize attention-forming acts of teaching in preschool?", can be considered to have been answered.

Overall, the representation of sharing, alternating attention and attention-forming acts of teaching from the perspective of didaktik questions can be summed up in the concept of *didaktik attention*. This concept can support teachers in planning, conducting, and evaluating their teaching. By putting a concept that is taken for granted into words, the nuances of *attention* can be clarified. An awareness of didaktik attention can increase precision and finesse in relation to each child being taught. As pertaining to teachers' aim of creating the opportunities that enable every child to learn and create meaning, didaktik attention can bring about more equitable conditions – for every child.

Furthermore, this concept could be examined in additional didaktik studies, in terms of each dimension, both individually and as a whole since they seem to flow into each other, where one is foregrounded while others are in the background.

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