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Mapping Children's Actions in the Scaffolding Process Using Interactive Whiteboard

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Abstract
This study aims to examine children's actions in relation to the preschool teacher's scaffolding action in a context where an interactive whiteboard (IWB) is used. Over five months, 22 children aged between 4 and 6 years old, along with their five preschool teachers, were video observed. The study of these teaching moments has provided a rich seam of evidence that details the ways children act in relation to their teacher's scaffolding. The results show that children manifest 12 distinct actions including: Giving short responses, Approaching the IWB to engage in the teaching activities; Explaining, Experimenting; Smiling and laughing; Pointing and showing; Working together; Challenging each other; Solving a problem; Using language in meaningful contexts; Expressing emotions; and Comparing the similarities and differences. By mapping children's actions in the scaffolding process, which are often undermined or ignored in the existing research, the findings of this study have expanded and deepened our understanding of the scaffolding process and the notion of scaffolding itself. The findings, further, exemplify how just providing support can contribute to early childhood education, since early interventions, such as the ways preschool teachers scaffold children's actions, are particularly crucial for children's learning and development.

Keywords Scaffolding · Children's actions · Preschool teachers · Interactive whiteboard · Scaffolding actions

Introduction

The Swedish national curriculum for preschools highlights the importance of using digital technologies to support children's learning (The Swedish National Agency for Education, 2018). It states that young children should be given the opportunity to use digital tools in a way that stimulates their learning and development. When addressing the importance of developing children's adequate digital skills (2018, p. 10), the document stresses that early childhood education should provide children with the opportunity 'to develop a critical, responsible attitude towards digital technology, so that eventually they can see opportunities and understand risks, and also be able to evaluate information'.

As a result, preschools have experienced an exceptional increase in the availability and use of digital technologies. The increasing availability and growing use of these technologies, such as computers, tablets, and large screen devices such as Interactive Whiteboards (IWB), is placing new demands on preschool teachers to support children's development appropriately (McFarlane, 2019; Otterborn et al., 2018). However, teaching artefacts like IWBs also bring together a wide range of possibilities and have the potential, arguably, to extend preschool teachers' opportunities to support children's learning (Hvit Lindstrand, 2015).

The findings of numerous reports, however, show that the use of digital technologies for educational purposes has been limited and highly scattered (Selwyn, 2012; Skolinspektion, 2012; The Swedish National Agency for Education, 2016). On the one hand, findings show there are clear educational benefits to using digital technologies in the teaching and learning process (Fridberg et al., 2017; Johnston et al., 2018). Using these technologies to their full potential, as Collins and Halverson (2018) argue, can enhance the effectiveness and efficiency of the teaching and learning process.

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It is also claimed that integrating digital technologies into classroom teaching can ensure no child is 'left behind in the rush for technological expertise' (Cuban, 2001, p. 12).

Most of the claims made about the positive effects of digital technologies on children's learning, however, have not been grounded on robust or rigorous methodologies (Kjällander, 2011; Marklund, 2022). There is a general lack of evidence to show that digital technologies are effectively integrated into preschool practices (Johnston et al., 2018; Vidal-Hall et al., 2020). For instance, the findings of a study about how digital technologies are integrated in Swedish preschools shows that digital technologies were mostly used to document and keep children busy and 'may not have any defined relevance to the designated curriculum' (Masoumi, 2015, p. 12). Thus, providing a variety of technological artifacts into educational settings may not transform the learning process, as 'how digital technologies are used is as important as whether they are used' (McFarlane, 2019, p. 3). Furthermore, some of the claims made about the role of digital technologies in preschools and schools are aligned with commercial interests (Lantz- Andersson & Säljö, 2014). What is, however, becoming increasingly clear is that it is teachers and the roles they ascribe to the technology, which plays a key role in the ways digital technologies are used to support and scaffold children's learning and development (see Masoumi, 2021; McFarlane, 2019).

Despite the increasing number of studies about the use of IWBs in preschools (Ahlbäck, 2018; Camilleri, 2018), there is still relatively little research that examines how preschool teachers' actions (in other words, their teaching practices) can contribute to children's learning through IWBs. In our earlier study (see Bourbour et al., 2020) we found that preschool teachers, when using IWBs, demonstrated 21 different actions that scaffolded children's learning. In our current study, our aim is to examine this activity still further, by investigating how children act in relation to their teacher's scaffolding efforts when using an IWB.

Early Childhood Education in Sweden

Preschool education is voluntary but is an important part of the Swedish educational system which lay the foundations for life-long learning. According to statistics from the National Agency of Education (2022), in 2021, 86% of Swedish children between the ages of *one and five* attended a state funded preschool. The educational approach in Swedish preschools is based on a model called *educare* which posits that the concepts of care and education should be integrated. In this model, children's fostering and learning are seen as part of a balanced whole and cannot be separated. Preschool teachers, according to the national curriculum, are responsible for developing a stimulating learning environment to support children's learning and development (The Swedish National Agency for Education, 2018).

Teaching in a preschool context is a relatively recent development in the Swedish preschool curriculum, which forms the balance between education and care in early childhood education. As a goal-driven process, teaching in early education refers to a range of activities, steered by preschool teachers, that are designed to guide and stimulate children's learning and development (Bourbour, 2020). The point was to make preschools more learning-oriented spaces that would be built around children's needs and interests. The curriculum describes these educational activities within the structure of defined content areas, such as language, mathematics, technology, and science as well as by the educational concepts of documentation, evaluation, and didactic concerns.

Theoretical Framework

Drawing on socio-cultural theory, the theoretical perspective of this study is built on an assumption of the cultural–historical nature of social practices and the idea that interactions with more capable others can enhance children's learning and development. Informed by Vygotsky's (1978) seminal ideas of activity in the 'zone of proximal development' (ZPD), scaffolding is a metaphor which refers to the ways that adults, more capable peers, or even an artificial intelligence machine, can identify the children's (younger, less educated, different social background) level of knowledge or ability and provide individualized support that enables less capable individuals to act in a certain context (Bruner, 1985; Wells, 1999). Research shows that providing such individualized support by competent adult or teacher can promote the children's level of thinking and action (Pentimonti & Justice, 2010; Salminen et al., 2021; van Kuyk, 2011).

According to Vygotsky (1978), scaffolding can be more helpful when the individualized support in the ZPD is calibrated to the skills that are just above those that a child already possesses and that which they could achieve with the help of others. Bruner (1978), when addressing scaffolding in a practical setting, defines it as a 'vicarious form of consciousness and control'. Scaffolding, accordingly, can be seen as 'the steps taken to reduce the degree of freedom in carrying out some tasks so that the child can concentrate on the difficult skill she is in the process of acquiring' (Bruner, 1978, p. 19). This signifies that scaffolding should be based on an individual child's ZPD, a place where, in a preschool context, teachers play a key role.

Scaffolding is adopted by Wood et al. (1976) to explain the role that teachers play in realising and defining children's ZPD within a constantly changing set of circumstances. Teachers are instrumental in first developing scaffolding

actions and then later removing them when children start to master a given task or problem and accomplish tasks on their own. Bourbour et al. (2020) have discerned 21 different types of actions whereby preschool teachers scaffold children's learning and development. These are: Concretising, Questioning, Instructing, Providing space, Affirming, Providing feedback, Inviting, Watching, Laughing together, Approaching, Standing/sitting beside, Simplifying, Filling in the blanks, Confirming, Participating, Challenging perception, Challenging thought, Explaining facts, Displaying, Explaining solutions, and Referring back. These scaffolding actions serve as the conceptual framework for understanding the relationship between the actions of preschool teachers and the actions of children in the context of teaching activities that take place at or around IWBs. In summary, the theoretical framework of the socio-cultural perspective places a focus on children's actions in response to the different actions that teachers take to scaffold children's learning.

Data Collection and Analysis

This empirical study was conducted through observations of the teaching activities carried out by preschool teachers using an IWB. The fieldwork lasted for five months and involved observations of five preschool teachers and 22 children aged between four and six years old in a single preschool located in the middle of Sweden. In order to create a teaching environment in which the scaffolding process could be compared, teaching sessions in mathematics were chosen. From these the objective was to explore, within the context of activities involving an IWB, the ways in which children acted to preschool teacher's scaffolding actions.

The video observations were carried out throughout 2017 and 2018. One of the researchers collected the empirical material. The preschool teachers observed in this study designed and conducted their own IWB activities and lessons. A camera was placed three metres away from the IWB in a back corner of the classroom where the activities of both teachers and children could be recorded. Apart from recording the activities that took place around the IWB in a preschool, the video recordings also provided additional information about children's body language and facial expressions. These physical signs were transcribed and included in the analysis (cf. Creswell, 2012). All together, eighteen teaching situations comprising a total of 306 min, were video recorded. The participating teachers were named A, B, C, D, and E. All of them were qualified early childhood education teachers. One was male and four were female and all of them had extensive experience of working in preschools. While each of them had different levels of pedagogical and technological expertise, none of them had any special in-service training in the use of IWBs.

The analysis was conducted in the following steps. Initially, the empirical data was transcribed in detail, which resulted in 274 pages of text. To ensure the trustworthiness of the findings, the transcribed material was read and reread by the first two authors to explore children's actions before codes were added to label chunks of the data. In total, 859 meaning units were identified for further analysis. The identified meaning units consist of either an excerpt referring to what the child says or what the child does in relation to the teacher's scaffolding actions in the ongoing teaching activity next to the IWB. These meaning units were chosen on the basis of teacher's scaffolding actions characterised by Bourbour's, et al. (2020).

Second, the identified meaning units were then examined to determine what the children's actions (i.e., what they say, do, and combination of talk and a particular physical action) were in relation to the teacher's scaffolding actions next to the IWB. In this step, correspondingly, the children's actions in relation to the teacher's scaffolding action were described in the given teaching activities using IWB.

Third, the central verb that was used in the previous step of descriptive analysis was extracted and regarded as a summary of the children's action. These initial actions were then reduced wherever overlapping actions were observed in the teaching situations. All the verbs discerned were then, in the fourth step, evaluated in relation to teacher's scaffolding actions (Bourbour et al, 2020). A detailed outline of analysis process addressing meaning unite, description of activity, children's action and teacher's scaffolding action is illustrated in Table 1.

The validation process in qualitative studies takes place in different stages. Kvale et al. (2009) suggest seven stages, including thematization, planning, interviewing, printing, analysis, validation and reporting. In this study, a detailed account of the data collection, ethical issues, and data analysis process are provided. Through providing a detailed description of the data collection and data analysis, we demonstrate that the collected empirical data has been generated and processed appropriately and, as a result, is reliable (Creswell, 2012). The results of this study are built on a small number of preschool teachers in a single preschool; the statistical-probability generalisation is neither applicable to this qualitative study nor is it an aim of the study. However, the rich detail provided in the results section can bring new knowledge to the research field as well as have implications for preschool practice.

Ethical Considerations

Ethical issues related to this research were considered in accordance with the guidelines for ethical research published by the Swedish Research Council (The Swedish Research Council, 2017). Accordingly, the written consent

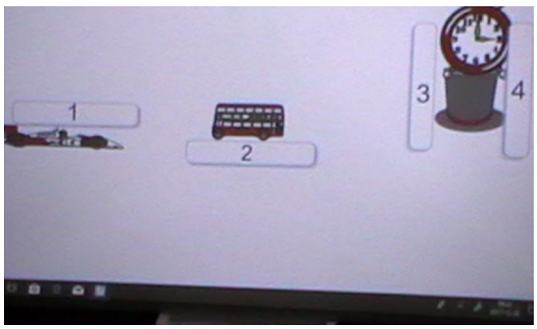
of both teachers and the children's guardians were sought and received. Addressing the aim and design of the study, a protocol document was developed and distributed among participants. This protocol provided a framework for participation in the study; what it would involve and the terms and conditions surrounding the recording, storing, analysing and reanalysing, disseminating and future use of the video-recorded data. Aside from receiving written consent from the children's guardians, the children were also informed that they could withdraw from the study at any time. During the recording of the formal observations, whenever a child appeared uneasy or displayed an unwillingness to be recorded, the video recording was halted.

Results

This section maps how children acted in relation to teachers' actions in the scaffolding process. The following 12 actions were identified that map children's actions in the scaffolding process.

Giving Short Responses

In a number of the observed teaching situations, children provided only a short response to teachers' direct questions. Their response was either a simple non-verbal nodding or shaking of their head, or a short verbal 'Yes', 'No', or 'Hum'. Children in these teaching situations respond without explaining how they came to such a conclusion or why. In the following excerpt a child is asked a specific question about the positioning of an object.



Excerpt 1: Teacher B: Position of the object.

Teacher: Where is the bus now?

Child 1: Over the number two.

Teacher: [nods and looks at Child 1] Yes, over the number two.

In this excerpt, the child's response is limited to the short phrase 'Over the number two'. The teacher simplifies the given activity by asking 'Where is the bus?'. The child is not challenged or encouraged to explain how and why s/he think the way s/he does.

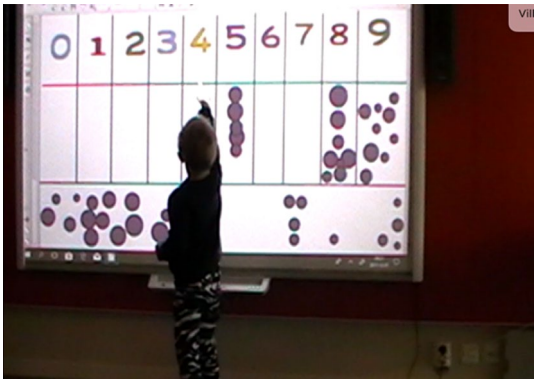
Approaching the IWB Email: To Engage in the Teaching Activities

In all of the observed teaching situations, children approached the IWB to engage in the teaching activities. By inviting a child, and in some cases two or three children, the teacher can scaffold their participation in the activities

Table 1 The data analysis process step by step

Choice of meaning unit	Description of activity	Children's action	Teacher's Scaffolding action
Child 1: Is approaching the IWB and tries it	The child is approaching the IWB when the teacher invites him to participate in the activity	Approaching the IWB to engage in the teaching activities	Inviting, Questioning
Child 2: The fish because the fish is not an animal	The child classifies objects on the IWB and explains which object should be removed and why	Explaining	Challenging, Concretising

designed. In the example below, the teacher gives a child space to participate in the current activity.



Excerpt 2: Teacher A: Numbers.

Teacher: Child 3, it's your turn.

Child 3: [comes to the board and stands against the board and looks at the numbers].

Teacher: What number do you want to take then?

Child 3: [moves in front of the board. Looks at the numbers and points to the number four].

As shown in excerpt two, the child comes to the board in order to participate in the teaching activity about numbers when a preschool teacher addresses the child and invites the child to come up to the board. In some of the situations, children not only engage in the given activities, but they have opportunities also to decide what they want to work with at the IWB.

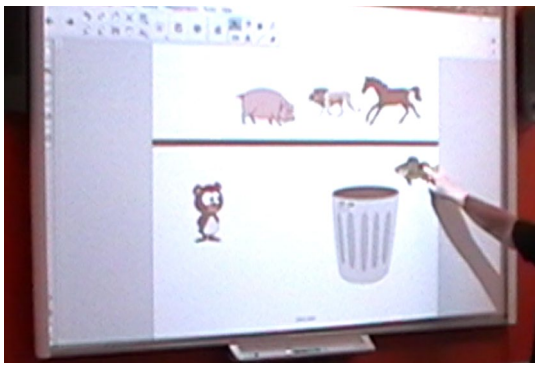
Explaining

In several cases of teaching involving an IWB, children explained their thoughts about the questions their teacher asked them. By challenging children's perceptions through questions, teachers motivate children to share their understandings and reflections. In the following example the teacher creates a space for the children in their group to classify the given objects and explain their choices.

Excerpt 3: Teacher B: Classification of objects

Teacher: Can you think more about which one we should remove from there? You have to think, then answer, and finally explain how you are thinking.

Children: [are quiet and look at the board].



Teacher: You can have different answers. The objects here are different and you can think differently about them. There is no wrong answer but there can be different answers. Look at the board and then see if you can explain it.

Teacher: [addressing Child 2] Which one do you think should be removed? Is there anything that you think is different from the others which should be removed?

Child 2: The fish, because the fish is not an animal.

Teacher: [raises the eyebrows] Is a fish not an animal?

Child 2: [shaking her head, says firmly] No.

Teacher: [looks at Child 2:] No, why? What is a fish then?

Child 2: [looks at the teacher] It is a fish.

Teacher: [looks at the board and then looks at Child 2] Ok, you think the fish should be taken out. There may be other answers too. You can look at the pictures in different ways. I can see in a completely different way [pointing to the board]…

Here, children explain how they think and provide the reason why they came to their conclusion about how different animals should be classified, when Teacher B addresses, challenges and provides feedback to them. In this way, children are given an opportunity to not only solve problems but also to motivate their reasoning behind their answer.

Experimenting

In the observed teaching situations, children were provided with opportunities to try out the given tasks in a physical way. In these situations, preschool teachers, through the actions of challenging, approaching, standing beside the board, providing space, explaining, pointing, confirming, displaying, and providing feedback, created the conditions that allow children to experiment and handle the given tasks on the IWB. For instance, in a teaching activity about measurement, children are asked to choose an object in the classroom which they can then measure by using building blocks. Further, they are going to show the amount of building blocks on the IWB by dragging and dropping squares on the board.

Excerpt 4: Teacher D: Measurement

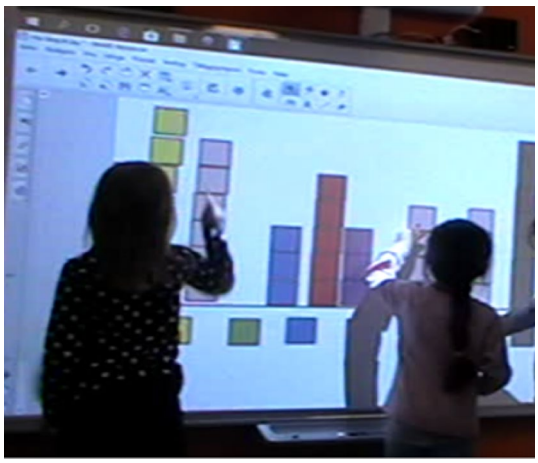
Child 4: [chooses a bicycle wheel from the choices available on the IWB screen and begins to measure its circumference by putting building blocks around the wheel. Places 22 building blocks around the wheel and drags 22 squares on top of the blocks] I had the longest.

Teacher: Yes, you have the longest. But what happens if you put the building blocks in this way from this side [pointing to the top side of the wheel] straight down to the other side [pointing to the bottom side of the wheel and indicating its diameter]. Maybe you want to try and see how your measurement might be different?

Child 4: [looking at the teacher].

Teacher: [comes close to Child 4, takes the building blocks and shows the child what s/he means. They put together the building blocks, so they measure the diameter of the wheel] How many building blocks are there?

Child 4: [counting] Six.



Teacher: Yes. It was 22 pieces around and this is six pieces across. Now you can see the differences. Now you can put a square on the board to see how long your staple can be.

This example shows how children measured an object in different ways using building blocks and then represented their findings digitally on the IWB. The child initially measured a wheel's circumference by putting building blocks around it. Then experiments new approach to measure the wheel by addressing its diameter based on the teacher's scaffolding actions.

Smiling and Laughing

In some instances, children and their preschool teachers are observed laughing together during their activities around the IWB. It was clear that they both find the given activity enjoyable. Laughing can signify teachers' interest in the way children are thinking or acting within a given teaching activity. Children's smiling or laughing can be seen as a non-verbal response to a teacher's actions. In some instances, smiling and laughing can also signify **c**hildren's interest in a task and their emotional involvement in it. In an observed activity involving a shopping application on the IWB, children are able to choose, count, buy, pay, and argue about items that are 'for sale' in a shop. The children can select the items they wish to buy and place them on the table next to the cashier. In one example, Child 7 is invited to come to the board. The preschool teacher asks them what they want to buy from the store. Child 7 selects an apple and a banana and drags them, not to the table, but on top of the cashier's face. Child 7 then looks at the teacher and friends, who are watching nearby, and all three of them burst into laughter.

Pointing and Showing

In several cases, children act by pointing to the IWB and showing the right answer. The pointing gestures—mostly using their index finger—are frequently used to indicate the objects, actions, relations, or locations of other children. In one teaching situation about mandalas and geometric shapes, for instance, the teacher asks the children which shapes they can see on the board. One child says they can see a straight line. The teacher then asks which one of the shapes is the straight line. In response to the teacher's challenging question, the child comes to the board and points to the line.

Working Together

In some instances within the collected empirical data, children are provided with opportunities to collaborate with each other and to explore their mutual interests, strengths and capabilities. In most of these instances, such as the one illustrated by excerpt 5, below, the preschool teacher takes an active part in the activities on the same terms as the children.

Excerpt 5: Teacher E: Measurement

Teacher: Now it's my turn. Now, you guys will measure me. You can use these plastic cubes to measure with. [points to a pile of numbered cubes] You should measure me from my toes to my head. And hey, you'll all be working together. We should help each other. Ok [teacher lying on its back on the floor].

Child 5: Me then.

Teacher: Yes, we'll measure you afterwards. I can go in between. [looking at Child 5] You all need to work together.

Child 6: I think we'll need more plastic cubes to measure you.

Teacher: We'll start with the six cubes we have, then we'll see if we need more.

Teacher: [sits up again and looks at the children] There are so many of you that you can take a plastic cube each…. Ok, I'm lying back down again. Which one [of the numbered cubes] are you guys going to start with?

Children: [cube numbered] One.

Child 6: [has the cube with the number three in their hand].

Child 5: We won't put the number three. Well, the number two comes after one. [looking for the numbers on the plastic cubes]. Here's the number two.

Child 6: [takes the number cube three and puts it beside the teacher].

Teacher: [raises its head to see how the children are getting on].

Children: [line the plastic cubes up in correct number order alongside the teacher].

Child 9: We just need one more.

Teacher: Do you need another one?

Child 5: I'll go get it [running to pick up one more square. Child 6 runs after Child 5].

Teacher: [raises its head] You should be looking for the right number on the cube.

Child 5: [picks up the number eight].

Teacher: [to the whole group] But what comes after the number six?

Children: Seven.

Teacher: Yes.

Child 6: [finds the number seven and comes up and places it next to the teacher].

Children: [addressing the teacher] You are seven cubes long.

Teacher: Is it seven? Is that enough? So, now I know how tall I am. [sits up and looks at the squares] Wow, how tall I am. I'm actually a little taller than you guys. [turns to the IWB] Now let's see what colour I should have. Are you guys going to help me? Now, let's have green on my staple.

As this excerpt illustrates, children work with each other when they are provided opportunities to fulfil an activity together. Teacher E's scaffolding, in the form of challenging

questions, active participation, encourage children to help each other, share their ideas and collaborate with each other.

Challenging Each Other

In the observed data children had the opportunity to challenge each other's thoughts and actions, particularly during problem-solving situations. For instance, in a teaching activity about the classification of animals, children are asked to classify the given animals according to their physical characteristics (see excerpt 6). The conversation suggests children are given a broad brief 'What makes these animals different?' so that they can explore the different ways of classifying things.

Excerpt 6: Teacher B: Classification of animals.

Teacher: Child 10, which one should be removed?

Child 10: Actually, the fish should be removed.

Child 11: [looks at Child 10] But how do you know that? Can you see something in the fish that the other animals don't have? Maybe something else should be removed.

Teacher: It can have several answers. We can see these pictures from different perspectives.

As this excerpt shows, Child 10 answers shortly to the teacher's question saying 'The fish'. Child 11, however, goes further and challenges Child 10's thoughts and actions. The teacher's comment about seeing pictures from different perspectives is then followed by additional challenges and discussion.

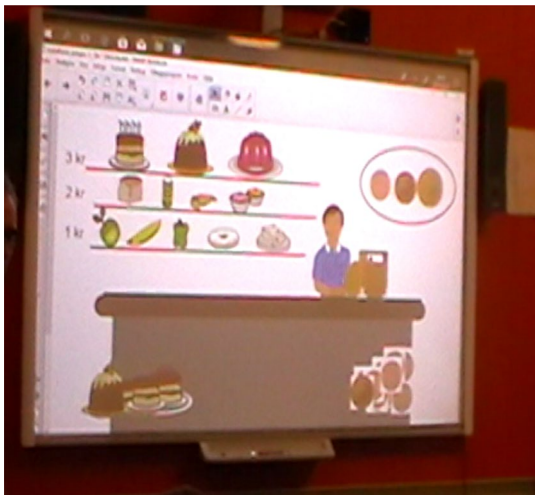
Solving a Problem

Through their challenging questions, the preschool teachers, in a large number of the situations observed here, encourages children to define a problem and identify potential solutions for it. There are several different examples where teachers introduce different scenarios involving everyday problems as a way of motivating children to think about and solve problems. In the following excerpt, a teacher is using the shopping application on the IWB to challenge a child to identify and solve a given problem.

Excerpt 7: Teacher A: Numerical values of money

Children: [playing shop on the IWB. Sitting on the floor, the teacher invites Child 12 to do the activity on the IWB].

Teacher: [addressing Child 12] If you want, you can buy several things at the same time.



Child 12: [looking thoughtfully at the IWB and the items that they could possibly choose, takes a cake].

Teacher: Do you just want a cake?

Child 12: [nods].

Teacher: Do you want to buy something more?

Child 12: [nods].

Teacher: Well, what does it cost then?

Child 12: [looks at the teacher and uses the term 'crowns' to denote the Swedish currency 'kronor'] Three crowns. [walks slowly toward the IWB and drags three one-crown coin towards the bottom of the board].

Teacher: [addressing the IWB where one, two, five, and ten-kronor coins are displayed] Is there another way you could pay? If you use coins that are different from the one-crown coins, you can pay those three crowns you are supposed to pay differently.

Teacher: How do you do this? If you take a two-crown coin first. How much is still missing to pay the three crowns then?

Child 12: [looks at the board and puts their hand on the coins].

Teacher: [gets up on its knees and simultaneously points to the two-crown coin and puts it at the bottom of the board. Then the teacher points to the cash register] I mean, if you take a two-crown coin, then how much more do you need to pay three crowns?

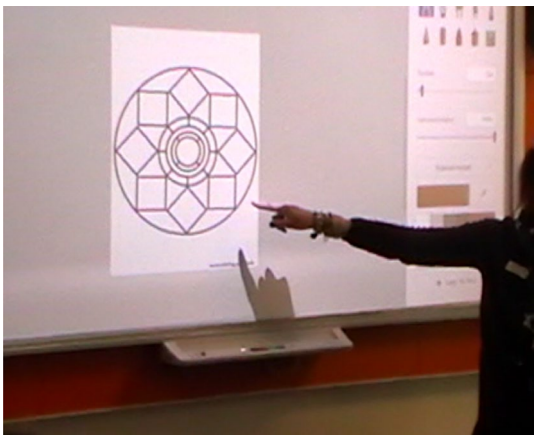
Child 12: One more [points to a one-crown coin at the same time].

As this excerpt indicates, children not only get the opportunity to explore a problem that is related to their daily lives from a different perspective, but also get to solve the given problem. The range of different scaffolding actions—i.e., inviting, asking, challenging, and pointing—the teacher uses makes children define their problem more clearly, reflect on their way of thinking and understand how to contrast this with a qualitatively different way of thinking and reasoning.

Using Language in Meaningful Contexts

The data collected for this study shows that children get opportunities to develop their vocabularies and broader language skills when preschool teachers challenge them and provide feedback within the context of a teaching situation that uses an IWB. The following excerpt highlights one instance where a child is able to react to a teacher within a whiteboard context and talks and uses language in a meaningful context.

Excerpt 8: Teacher C: Partial and whole geometric shapes



Teacher: [addressing Child 13] Which forms do you see?

Child 13: [looking at the IWB]. A circle, a th-kare (In the observed activity the child mispronounced the Swedish word for square – kvadrat – as krobat).

Teacher: [leans his head forward a little] What?

Child 13: Th-kare.

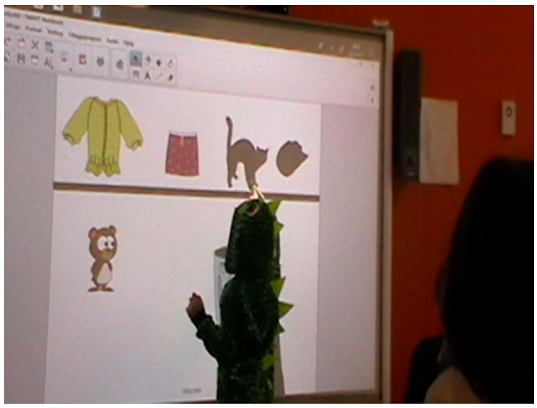
Teacher: [looks at Child 13 for a second and opens up his hands] What is a th-kare? Which one of those pictures do you think is a th-kare? Or do you mean square?

Child 13: [nods] Yes, square.

The excerpt here is a clear example of how Child 13 expands their vocabulary and conceptual knowledge in relation to the teacher's scaffolding actions, (i.e. providing a point of feedback on a mispronunciation and 'silently' correcting it.

Expressing Emotions

In a number of situations that take place at the IWB, children are observed expressing the emotions of strong approval or disapproval of different actions. The following excerpt about classification, for example, demonstrates the ways children expressed their emotions to support an argument.



Excerpt 9: Teacher D: Classification.

Four objects are displayed on the IWB: a pair of shorts, a jumper, a pair of socks and a cat. The activity involves sorting these on the basis of a shared feature or characteristic.

Child 15: The cat has to be taken away because it's an animal. [Child 15 draws the cat towards the trash bin on the IWB screen].

Child 16: [in a sad voice that sounds as if she is about to cry] No, no, the cat shouldn't be thrown into the trash bin.

Child 15: [continues to drag the cat's picture into the trash bin].

Teacher: Yes, the others are clothes. What are you dragging?

Child 15: Animals.

Teacher: Yes, it's an animal.

Child 16: [When Child 15 completes the placement of the cat into the trash bin] Not cat [with a voice full of sadness].

Teacher: [in a soft voice] Why do you say no? Do you have another solution?

Child 16: I don't want to throw the cat in the trash bin [she shakes her head].

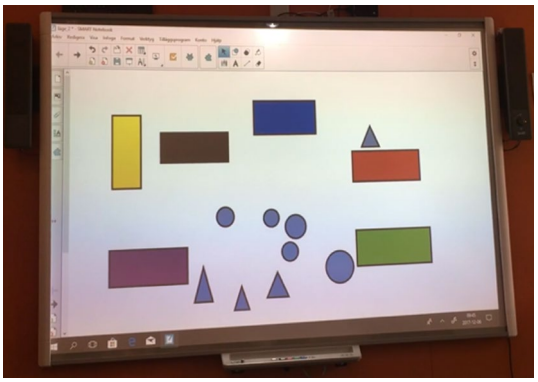
Teacher: [nodding and smiling] No, we shouldn't throw animals in trash bin.

When Child 16 realises that a cat will be thrown to the trash bin, she expresses her sadness strongly and argues that animals should not be thrown away. The teacher realizes her distress, provides her with verbal feedback, affirms her concerns, and offers her emotional feedback in the form of listening, nodding, and smiling. Without denying the accuracy of Child 15's actions when completing the activity, the teacher tries to sympathize with Child 16 and confirms the

validity of her key concerns by saying 'no, we should not throw animals in the trash bin'.

Comparing the Similarities and Differences

The children in the teaching situations observed in this study often had the opportunity to discern and compare similarities and differences of the given objects. In one teaching situation, for instance, children are invited to identify how the given shapes and patterns on the IWB are related to each other. In the following excerpt Teacher C is working with geometric shapes.



Excerpt 10: Teacher C: Geometric shapes.

Teacher: [sitting on the floor next to the IWB] … then I want to hear first, which shapes do you see on the IWB and on the floor? [Teacher C rises to sit on her knees, looking at the children].

Child 17: Circle.

Child 18: Four-sides, three-sides.

Teacher: [looking at the children] Can anyone say another name for four sides? What is it?

Child 17: Rectangle.

Teacher: [looks at Child 17] Yes.

Child 18: Square.

Teacher: [looks at Child 18] Yes, a square has four sides and four corners. These are corners and these are sides [points to the sides and counts them, then points to the corners and counts them]. What is a three-sides then? [at the same time points to a triangle displayed on the IWB].

Child 18: With three sides.

Teacher: Can we say it has three sides and three corners? [points to a triangle object on the floor and then to the board].

Child 18: Yes [points to the board] One, two, and three.

As illustrated in excerpt 10, children have the opportunity to compare how shapes and patterns are differentiated and how they relate to each other. The preschool teacher concretises this process by filling in some information and drawing children's attention to the fact that the geometric shapes have certain criteria, including a specific number of sides and corners. The children compare different objects, then explain and demonstrate how shapes can vary in size and rotate without losing their traits.

Discussion

This study, with reference to the identified gaps in the literature, aims to expand and deepen our understanding of the ways children act in relation to teachers' scaffolding actions when a particular digital technology, the IWB, is being used to mediate preschool teachers' teaching in preschools. The findings of this study show children demonstrate 12 different actions in relation to their teacher's scaffolding. These are: Giving short responses, Approaching the IWB to engage in the teaching activities; Explaining, Experimenting; Smiling and laughing; Pointing and showing; Working together; Challenging each other; Solving a problem; Using language in meaningful contexts; Expressing emotions; and Comparing the similarities and differences.

Part of the actions were simple non- or short verbal answers informed by teachers' direct questions. Some of the identified actions, however, were detailed verbal responses or took a set of actions including verbal answer combined with a physical action. The findings suggest that children's actions are limited to a range of responses, such as saying a single word or short phrase whenever teachers use direct instructions, question, or sit beside children without participating in the given activities. These findings are consistent with prior studies suggesting that using more directive scaffolding actions (which partly refers to high-support strategies in the literature) can reduce the cognitive demand placed on children and hinder children's initiative works (Pesco & Gagné, 2017; Smidt & Embacher, 2020; Vygotsky, 1978).

Children get actively engaged in higher-order activities (i.e explaining, solving problems, and comparing), when teachers use a set of scaffolding actions including challenging, providing feedback, confirming, and co-participation. This encourages children to dare trying new things on their own and build more complex and higher-order skills. In addition, using a range of scaffolding actions can help children feel more confident in solving problems, which can lead to increased motivation to learn and tackle new challenges.

The result is in compliance with findings of Bourbour et al. (2020); Copp et al. (2019); Loizou et al. (2019); Pentimonti and Justice (2010); Smidt and Embacher (2020); van Kuyk (2011) disclosing that using proper sets of scaffolding actions can help children to develop higher-order problem solving. This signifies the teacher's key role in identifying children's zone of proximal development and taking

appropriate action to scaffold children's learning and development (Bruner, 1978; Wells, 1999). Thus, special emphasis should be placed on empowering preschool teachers to assist children on an as-needed basis, and thus removing assistance as the child's competences increases.

The findings show that discussions among children were enhanced, when children and teachers explored and challenged each other's thoughts and actions based on what happened on the IWB. The study, further, exemplifies how preschool teachers' active participation and emotional support inform children's interactions with their peers to fulfill the given activities. These kind of teacher-led activities, however, as Smidt and Embacher (2020) put forward, can negatively inform children's interactions with peers when compared to child-initiated activities.

Considering that scaffolding in early childhood education is a dynamic process, it is important to use a set of scaffolding actions that encourage children's more sophisticated skills and capacities. We would consequently argue for using unstructured and semi-structured platforms and digital applications where these tools can provide teachers opportunities to develop an active and exploratory learning environment for children.

Limitations

There are several limitations that need to be acknowledged. First, the study was limited to a small number of children taught by five preschool teachers who were known to be actively using the IWB in their teaching and were willing to participate in the study. As a result, these teachers, may have had a more positive outlook on the use of digital technologies than other possible subjects, which might have had an influence on the findings of the study. Second, the presence of the researcher in the classroom during the video observation may have influenced the ways the children acted in relation to the teachers' actions when using the IWB.

Conclusions

This study has added rich details about the children's actions in relation to teachers' scaffolding actions when a particular digital technology, the IWB, is used. By characterising children's actions in the scaffolding process, which are often undermined or ignored in the existing research, the findings have expanded and deepened our understanding of the scaffolding process and the notion of scaffolding itself (see Bourbour et al., 2020; Bruner, 1985; Wood et al., 1976). The findings show how providing appropriate support and guidance can inform children's learning and development. We believe that mapping of children's different actions, when digital technologies are employed, can further contribute to a relatively distinct approach, which can help us gain an improved understanding of the scaffolding of children's learning.

The results indicate strengthening teachers' pedagogical, technological, and content knowledge can further support teachers in their skills to scaffold children's learning, especially given that digital technologies are becoming an important part of preschools' educational practice (Siraj-Blatchford, 2009; The Swedish National Agency for Education, 2018). We believe it is necessary to conduct further studies in other contexts, such as primary schools, with other digital technologies in order to gain a better understanding of how children's actions are informed by teachers in the scaffolding process.

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