

The early childhood scaffolding scale

Conceptual framework, operationalization and functionality

Sofia Frankenberg

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Abstract

This study reports on work undertaken to develop a framework and rating scale for the assessment of process quality in terms of scaffolding in preschool settings. The aim was to develop the Early Childhood Scaffolding Scale (ECSS) for the assessment of interaction quality in different types of early childhood teaching practices. The ECSS was developed based on the analysis of video-recorded data from 26 preschools randomly assigned to three different pedagogical practices; 1) Social and Emotional Material Learning, 2) Digital Individual Learning and 3) Practice as usual. The scale was developed in a series of iterative steps and an abductive approach to theory and video-recorded data involving preschool practice, resulting in the specification of the framework components and the formulation of items and rating guidelines. The functionality of the scale was assessed by four raters who assessed a selection of the data. Interrater reliability (Cohen's kappa) analyses indicated multiple challenges to the construction of a reliable scale. To inform the further improvement of the framework and scale, a cognitive interview methodology was used, including think aloud and verbal probes. The findings inform the further development of the scale and factors that need to be considered in order to reach satisfactory psychometric robustness and interrater reliability, including 1) intentions of different pedagogical methods, 2) the importance of a clear conceptual framework, 3) units of analysis and the selection of ecologically valid video-recorded sequences, 4) the interpretation of items, and 5) definitions of scale values. The discussion focuses on the challenges of assessing high quality scaffolding in situated preschool settings using observational ratings and video methodology, training of raters, and the characteristics of the Swedish national preschool curriculum. Directions for future research are also suggested.

Keywords: scaffolding, preschool, process quality, teaching, observational rating scales, video, inquiry-based pedagogy, direct instruction

JEL-codes: 120; 129

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1 Introduction

Preschool education is of great concern to parents, policymakers and educational professionals. Educational settings provide significant contexts for development and learning during early childhood and contribute to individual children's foundations for lifelong learning and well-being. Internationally, there is broad consensus regarding the importance and potential benefits of early childhood education for individual well-being as well as in terms of social investment (Heckman, 2000; Heckmanequation.org; OECD, 2017). High-quality preschool has been shown to have significant effects on child outcomes, in particular for disadvantaged children, both short and long term. Research also shows that universal programs have positive effects on child development (Dietrichson, Lykke Kristiansen & Nielsen 2018). However the research supporting such claims is mixed, with some studies showing no relationship between preschool quality and child outcomes and some evidence that gains may partly fade with time (Ackerman, 2021; Bailey, Duncan, Cunha, Foorman & Yeagers, 2020; Guerrero-Rosada, Weiland, McCormick, Hsueh, Sachs & Maier, 2021).

Investigations of preschool quality typically make the distinction between two interdependent aspects: structure quality and process quality (Slot, 2018). Structure quality relates to factors such as student/teacher¹ ratios, teacher education and professional development, which have an indirect impact on child development and learning, whereas process quality involves proximal processes such as teacher-child interaction and teaching practices, which more directly impact child development and learning (Slot, 2018; Slot et al., 2015).

Based on the general importance placed on high preschool quality in combination with challenges in establishing solid evidence for the associations between high quality and child outcomes, researchers are working to open up "the black box" of high quality early childhood education in order to identify what explains relations between specific teaching practices and effects on child development and learning as well as long term effects in terms of socioeconomic status later in life (Burchinal 2021; Philips et al. 2017).

A substantial amount of research has focused on the impact of sensitive teacher-child interaction as a key explanatory factor for enhancement in child outcomes (Burchinal 2020). However, research has only been able to show moderate effects on child learning in terms of language development, early math, executive functions and social skills. It has therefore been argued that quality in teacher child interactions must also take specific learning activities and learning targets into consideration, in addition to teacher-child interaction quality (Burchinal 2018; Sheridan, Garvis, Williams & Mellgren, 2019).

For that purpose, there is a need of both conceptual and methodological development in order to refine the investigation of the complex phenomenon of quality in early childhood education and care.

¹ The term "teacher" is in this report used as a generic term for all preschool staff involved in pedagogical activities with children, including both licensed preschool teachers with university degrees, caregivers with high school training (barnskötare) and others.

In fact, the question of quality in early childhood education needs to be addressed in multiple ways in relation to specific cultural conditions and situated practices (Garvis & Lenz Taguchi 2021). The focus of this report is to present a new research tool that is developed in the Swedish preschool context, where the question of the preschool teachers role in teaching and instruction towards curriculum specific learning goals has been a particular issue of concern in recent years.

1.1 The Swedish Context

Establishing high quality preschool education is a dynamic and multifactorial matter requiring collaboration and joint action between political, scientific, and educational professionals (Sheridan, Garvis, Williams & Mellgren, 2019). In 2020 85% of children aged 1-5 years, equivalent to nearly 517 000 children, were enrolled in preschool in Sweden (Skolverket, 2021, [Swedish National Agency for Education]). Swedish preschool plays the double role of care and education and it is the main institutional solution to child care. Children with parents who work or study have the right to 30-40 hours of preschool per week. This means that they spend a large part of their day in institutional care, making it a significant context for child development and learning. As a universal preschool program, Swedish preschool has the explicit role of supporting and stimulating child development and learning, to compensate for variability in children's abilities and backgrounds, and to contribute to each individual child's developmental foundation for school readiness and lifelong learning (SFS 2010:800, Chapter 1 § 4).

The general quality of Swedish preschools has been evaluated as high in international comparisons; however, there are indications of considerable variability in terms of quality between different preschools (Sheridan et al., 2019). In terms of structure quality in Swedish preschool, studies report a lack of trained personnel (Skolverket, 2021), and high levels of work-related stress and sick leave among care professionals, e.g., preschool staff (Persson & Tallberg Broman, 2019). Concerns have also been raised regarding preschool group sizes, which affect preschool quality (Williams, Sheridan & Pramling Samuelsson, 2019). The Swedish school inspectorate in 2015-18 also identified significant inequalities between preschools with regards to process quality, in particular regarding interpersonal interaction (Skolinspektionen, 2018), which is in line with international research (Slot, 2018).

One of the most widely used measures of preschool quality is the Early Childhood Environment Rating Scale (ECERS; Harms & Clifford, 1980), which conceptualizes quality in terms of *access to enriching activities, teacher-child interaction* and *environmental aspects* in terms of safety and health. Based on a longitudinal evaluation of preschool quality in Sweden with data from 2001, 2009, and 2017, using ECERS (Harms & Clifford, 1980), Sheridan et al. (2019) raised a number of critical aspects of preschool quality in Sweden. The research shows an unchanging pattern of significant unequal conditions in terms of low, good or high preschool quality, highlighting the considerable gap between practice and policy intentions. Although this comparative analysis indicates an increase in awareness of

the importance of interaction and communication, there are significant challenges in terms of “the development of preschool teachers’ didactic knowledge and how to teach young children in preschool” (Sheridan et al., 2019, p. 225).

1.2 Teaching in Preschool

In 2015-2018 an evaluation of the quality of Swedish preschool was undertaken by the Swedish national school inspection (Skolinspektionen, 2018). The Swedish School Law defines teaching as “such goal oriented processes which under the guidance of teachers or preschool teachers aim for development and learning through the acquisition and development of knowledge and values” (SFS 2010:800, chapter 1 3 §; author’s translation). However, it was found that a large number of teachers and pedagogical staff avoided the word “teaching” (undervisning) when describing their duties as preschool teachers. Both preschool teachers and heads of preschools in interviews instead used the concept “learning”, defined as following the child’s initiatives through dialogue and in a playful manner and as a process that is constantly ongoing. The report concludes that learning and teaching are not interchangeable: teaching involves the teachers’ actions to provide knowledge whereas learning refers to the result of teaching when the child learns something (Skolinspektionen 2018, p. 21). Based on observational data, the report further concluded that goal-oriented teaching in line with the Swedish preschool curriculum was often not in place. As a result of these findings the government commissioned a revision of the Swedish Curriculum for Preschool (Swedish National Agency for Education, 2019; [Skolverket, 2019]) including the aim of clarifying the teaching duties in preschool.

Learning through exploration, enquiry and free play initiated by children has traditionally been emphasized in Swedish preschool practice in contrast to teacher guided instruction (Åström et al., 2020). So what do we know about how children and teachers spend their time during the preschool day and how much of that time can be characterized as teaching? A recent study (Åström et al., 2020) based on structured observations using the Child Observation in Preschool (COP; Farran & Anthony, 2014) and the Teacher Observation (TOP; Bilbrey, Vorhaus, & Farran, 2014) in a sample of 78 preschool units including 925 children and 302 teachers showed that the Swedish preschool environment can be characterized by free play both indoors and outdoors, while whole group and small group activities are fairly rare. Children in this sample spent a third of their day “in routine-based activities, such as, dressing, eating without interaction, forced waiting time” (Åström et al., 2020). With regard to teachers, the study shows that teachers on average spent 17% of their time in some type of instruction activity. Instruction focusing on more traditional content, including reading, math, literacy, science, social studies, drama/pretend play, gross- and fine motor skills was observed in all together approximately 11% of the activities. Although this sample is not a random sample, and thus caution is necessary with regard to generalization, the findings indicate that teaching and instruction towards predetermined goals, as specified in the national curriculum, is limited, and it directs the focus toward the ability of teachers to teach and instruct. The authors conclude that teachers manage by organizing children’s

activities and materials rather than instructing. In relation to the revision of the curriculum where instruction is emphasized in relation to the identified challenges to high process quality in terms of teaching, it is important to better understand how teachers' actions in terms of teaching and instruction can be understood and enhanced.

The concept of teaching was introduced in the Swedish preschool curriculum in 2018 and defined as “stimulating and challenging the children, taking the goals of the curriculum as a starting point and direction” in the revised preschool curriculum (Swedish National Agency for Education, 2019, p. 7). The question of how to understand and implement teaching in the context of Swedish preschool initiated debate among both practitioners and researchers within the field². It was concluded that leading Swedish researchers' conceptualizations of teaching in preschool were largely grounded in socio-cultural theory and a holistic approach involving nurturing, socialization and learning through the integration of care, education and play (Sheridan & Williams, 2018). Since the revision of the national curriculum was initiated some research has been undertaken in order to clarify what teaching could entail in the Swedish preschool context (Eidevald & Engdahl, 2019; Pramling et. al 2019; Sheridan & Williams, 2018; Vallberg Roth & Holmberg, 2019; Vallberg Roth, Holmberg, Löf & Stensson, 2020). A central issue has been the concern for safeguarding children's participation, initiatives, exploration, play and creativity while at the same time strengthening the capacities of teachers to support children's learning and development as guided by the goals of the curriculum.

Preschool teachers' capacities to support the learning and developmental trajectories of individual children through interpersonal interaction in terms of balancing social and emotional skills with specific learning outcomes has in previous research been identified as a key factor for school readiness and individual educational success (Chamber, Cheung and Salvin, 2016; Persson, 2015; Blair and Raver, 2015; OECD, 2017, Taguma, Litjens and Makowiecki, 2013). This is also well in line with the assessment of critical aspects for Swedish preschool suggested by Sheridan et al. (2019) as they argue that:

“...activities in preschool cannot be based purely on the child's initiative. Children have to be taught and challenged by teachers, who go beyond their previous knowledge and extend it (Sheridan, Shiyani & Shiyani; Veraksa & Sheridan 2018). Taking the child's previous experiences as the point of departure, the teachers have to get involved and engage the children's interest in the unknown and create situations in which the child can negotiate, cooperate, reflect and develop standpoints and critical thinking.” (p. 225-226)

² At the time of data collection for this study it was the previous version Lpfö 1998/2016 that was in effect. Since then the curriculum has been revised (Swedish National Agency for Education 2019) and the concept of teaching and instruction (*undervisning*) has been included.

Sheridan et al. (2019) further argue that

“If we want preschool to become more teaching and learning-oriented in the direction of the overall goals, and at the same time not fall into the trap of formal and teacher-directed activities, new approaches to research, education and evaluations are also needed” (p. 226)

High quality is ultimately a question of creating dynamic systems (Mascolo & Fischer, 2015), which promote stimulating proximal processes between individual children and the context in terms of interpersonal communication patterns and learning materials. To suggest a new approach to research is also the focus of this project, in which a new research tool was developed for the investigation of teaching and instruction in early childhood education and care settings such as Swedish preschool.

1.3 Teaching as Scaffolding

The socio-cultural holistic approach to teaching embraced by leading Swedish researchers corresponds well with contemporary developmental science and dynamic skills theory by means of the concept *scaffolding* (Mascolo & Fischer, 2015, Eidevald, Engdahl, Frankenberg, Lenz Taguchi & Palmer, 2017). Scaffolding is a fundamentally intersubjective activity involving two or more persons, where one is more knowledgeable than the other and in a more or less contingent manner co-regulates the learner's experiences towards enhanced understanding and competence. Scaffolding can take place in everyday routine situations such as when children are supported by teachers to gradually learn to put on winter clothes before going outside. Scaffolding can likewise be applied when teaching children specific facts e.g. the days of the week or when focusing on the development of socioemotional skills during play in terms of understanding other persons' perspectives or how to solve conflicts. In this sense, contemporary scaffolding research in preschool settings has the potential to further develop the understanding of teaching and how to balance child agency and goal direction in a contingent manner in various curriculum contexts.

As described above, scaffolding is a key concept that captures the actions of more knowledgeable persons (e.g., teachers) interacting with less knowledgeable individuals (e.g., preschool children), with the intent to support learning and development (Wood et al., 1976). The concept of scaffolding is closely related to the Vygotskian concept zone of proximal development (Vygotsky, L. S., 1978). Basically, the teacher's task in pedagogical practice is to continuously provide the means to scaffold the child's feelings, thoughts and actions towards enhanced development. The concept of scaffolding originates from Vygotskian theory and involves a range of both verbal and non-verbal communication skills. Such acts include physical guidance, modeling, directives, and interpretations, explanations, holding, distancing, encouraging and prompting and continuously need to be enacted in an emotionally sensitive manner and in relation to both short term and long term goals (Mascolo & Fischer, 2015). In line with the dynamic systems perspective, high quality scaffolding is not to be understood as a universal practice

that looks exactly the same everywhere. Instead, different pedagogical traditions in different cultural and socio-economic contexts will promote different emphases in terms of how scaffolding is to be enacted. The proportions and quality of specific scaffolding actions may also differ depending on the context in which the scaffolding takes place. Consequently, scaffolding quality needs to be interpreted with specific considerations of local preschool pedagogy, organizational characteristics and socio-economic and cultural settings.

However, as van de Pol, Volman and Beishuizen (2010) concluded more than 10 years ago there is a need for research tools that can be used for the assessment and measurement of scaffolding quality and that go beyond micro analytical studies. We confirmed this need in a recent literature review of scaffolding in preschool settings (Bertell and Frankenberg, *forthcoming*). Such tools would provide possibilities for generalization claims in terms of preschool quality and methods for enhancing teaching for the benefit of positive outcomes in child development and learning for all children.

Process quality, including for example scaffolding, motivation and emotional support, is a significant aspect of high quality learning environments (Mascolo & Fischer, 2015). Yet, little attention has been directed towards understanding how such teaching practices co-vary with other individual, group and organizational features involving both children and adults in early childhood settings. In a review of structural- and process-oriented quality characteristics, Slot (2018) concludes that research on process quality has primarily focused on emotional aspects of interaction quality, while the question of how such interaction also incorporates learning content is lacking. The question of how process quality relates to different types of pedagogy also remains underexplored. Knowledge is further lacking with regard to how teaching can be fostered through evidence-based training of pedagogical staff. The fundamental importance of unpacking ‘the black box’ of implementation quality in intervention research is also increasingly being emphasized (Durlak 2016; Ashbury and Leeuw, 2010; Burchinal, 2018).

This suggests that there is a great need for research focusing on process quality in different pedagogical preschool settings in order to better understand of how teaching can be undertaken with high quality. These important research issues are directly related to the question of how teaching is to be understood in the Swedish preschool context. In order to address these issues it was necessary to develop a new research tool.

1.4 Opportunity to develop a new research tool for the assessment of scaffolding

In parallel with the focus on quality in Swedish preschool described above, the research project Enhancing preschool children’s attention, language and communication skills: An interdisciplinary

study of socio-emotional learning and computerized attention training took place³. The study was designed as a three-armed cluster randomized controlled trial (RCT) with the aim of investigating the effects of two contrasting pedagogical methods on children's attention, language, early math and socio-emotional skills. The methods were Social and Emotional Material Learning (SEMLA) and Digital Individual Learning for Body and Mind (DIL) (Gerholm et al., 2018; 2019) and were compared to each other as well as control group working with practice as usual.

SEMLA is rooted in the pedagogical tradition of Reggio Emilia, emphasizing a group-based collaborative inquiry approach, taking a point of departure in children's perspectives and initiated actions. Within this tradition, goal-directed teaching and predetermined learning trajectories have been contested to the advantage of deconstructed knowledge production based on postmodern theory (Dahlberg, Moss & Pence 1999/2013; Lenz Taguchi, 2009; Vallberg Roth, Löf & Stensson, 2020). However, SEMLA represents an amplified version of this pedagogy, influenced by cognitive neuroscience and with a stronger focus placed on learning content and scaffolding individual children's learning. The learning content in the SEMLA intervention mainly focused on science, technology, art and mathematics by means of a project where the children together with teachers explored the overarching question of "how to live and transport yourself in the future" (Gerholm et al., 2019; Lenz Taguchi & Palmer, 2017). The project involves construction activities using creative materials such as building blocks, paper, paint, strings, scotch as well as recycled materials. Digital tablets are also used for searching information and for documentation. The intention is to produce an iterative and open-ended process following paths out of multiple potential trajectories towards general learning targets such as early mathematical, language, and conceptual development and social and emotional learning (Kaneko and Frankenberg, *submitted*). For a more detailed description of the SEMLA intervention and how it was implemented see Gerholm et. al (2019) and Lenz Taguchi & Palmer (2017).

DIL represents a manualized, structured pedagogical method based on predetermined learning goals and step-by-step instructions to increasingly difficult tasks. The DIL activities involve the use of a digital early math game, Magical Garden, focused on number sense developed and administered online by the Education Technology Group at Lund University (Haake et al., 2015). This game was used in combination with playful exercises (Kropp & Knopp) with the intent to strengthen self-regulation, based on activities developed at the Brain Development Lab at the University of Oregon (Neville et al., 2013) and including pre-designed materials consisting of posters and toys (e.g., bean bags, balloons and pinwheels). The DIL sessions started with approximately 10-minute Kropp & Knopp activities during circle time followed by individual playing of Magical Garden on digital tablets using ear phones. For a more detailed description of the DIL intervention see Gerholm et al. (2019).

Both SEMLA and DIL are well in line with the national Swedish preschool curriculum (Swedish National Agency for Education, 2019), which does not specify specific teaching methods. However, in

³ Financed by the Swedish National Research Council 2015-2018.

relation to the debate on teaching in the Swedish context described above, SEMLA and DIL represent contrasting pedagogical methods, thus providing unique opportunities to investigate the balancing act of involving children's perspectives on one hand and guiding children towards specific learning goals on the other.

The third condition consisted of regular preschool practices and includes a variety of commonly-used activities such as circle time, routine situations such as getting dressed for outdoor activities, book reading and related activities, fine motor activities such as drawing, experiments as well as indoor and outdoor play.

When this project was initiated, preliminary analysis of video recorded data capturing pedagogical practice in the three conditions indicated that interaction quality in the relationship between preschool teachers and children may be an important mediating factor in specific hypothesized intervention effects. This was not included in the original project, and in order to investigate such hypotheses an additional study was initiated to develop the Early Childhood Scaffolding Scale (ECSS). Since no main intervention effects were found (Gerholm et al., 2019) the hypothesis of interaction quality as a mediator was no longer relevant in that particular project. However, the primary aim of developing a rating scale for the investigation of interaction quality in terms of scaffolding was still considered relevant.

Although there is a considerable body of research on scaffolding, there is no commonly used framework for the assessment of scaffolding quality (van de Pol, Volman & Beishuizen, 2010; Bertell & Frankenberg, *forthcoming*). Considering the strong research support for the important role of process quality and the potential of co-activated and contingent scaffolding as encompassing cognitive, emotional and action-oriented guidance towards specific learning targets, a general framework for the assessment of scaffolding quality in preschool settings in line with the current national curriculum, as well as specific pedagogical methods, would be of considerable value.

2 Aim

The ultimate aim of the project presented in this report is to develop the Early Childhood Scaffolding Scale (ECSS) in order to provide a tool for the investigation of scaffolding quality in different preschool contexts, the effects of scaffolding on preschool children's learning and development, as well as how it can be enhanced through training of pedagogical staff. The specific aim of the work presented in this report is to provide the theoretical framework and operationalization for the scale and to test its functionality.

In the following, a background to the development of rating scales will be provided followed by, methodology, the conceptual framework, operationalization of the ECSS, and preliminary evaluation of the scale. Finally, methodological opportunities, challenges and directions forward in terms of finalization of the ECSS and future research are discussed.

3 Background

The development of the ECSS is informed by research focusing on process quality and research on scaffolding in early childhood settings, two separate but somewhat overlapping research fields.

3.1 Methods in research on process quality

The investigation of process quality in educational settings is commonly undertaken by the use of observational ratings. Observational ratings have the advantages of getting direct access to proximal processes as they unfold in terms of interpersonal interaction in socio-material contexts. Observations also have the potential of capturing the complexity of interaction quality. Numerous observation scales have been developed for the assessment of instruction quality in different educational contexts (Pianta & Hamre, 2009; Pianta, Hamre & Nguyen, 2020). Some scales have a generic focus on process quality involving multiple subject matters and attending to general demands of teaching, whereas other scales address content-specific aspects of teaching and instructional quality, focusing a single subject matter and subject specific demands within a particular discipline (Charalambous & Praetorius, 2018).

Frameworks for the assessment of process quality are informed by different theories that emphasize particular aspects of interaction. Models of early childhood education quality have in particular been informed by socioecological, attachment and learning theories (Burchinal, 2018). The Classroom Assessment Scoring System (CLASS; Pianta et al., 2007) focuses *emotional support* in terms of responsiveness and sensitivity of the teacher, *instructional support* in terms of the scaffolding of in depth learning and *classroom organization*. The Early Childhood Environment Rating Scales (ECERS; Harms & Clifford, 1980; Harms, Clifford, & Cryer, 2015; Sheridan et al., 2019) focus *access to enriching activities*, *teacher-child interaction* and *environmental aspects* in terms of safety and health. As observational scales, both the CLASS and ECERS rely on training of raters in order to become reliable.

As mentioned above, research on process quality has, through the development of relatively reliable research instruments, been able to provide evidence for the associations between high preschool quality and favorable outcomes in child development and learning. However, only modest associations with outcomes of child development and learning are found in most studies, including both naturalistic and experimental and neither the ECERS nor the CLASS give a clear picture of the relationship between process quality in terms of scaffolding and outcomes of child development and learning (2018) (Burchinal 2018). Considering the complexity of early childhood development and the impact of contextual factors, multifactorial explanations are most likely needed to explain these modest associations. Based on findings from a recent study finding no relationship between process quality as measured using the CLASS, the authors argue for the need of more fine-grained measurements (Guerrero-Rosada et al., 2021). In order to advance the understanding of variability in terms of the development of individual children, more research on how teaching can be undertaken with high quality is needed as well as how process quality can be enhanced.

Burchinal (2018) further argues for the need for more research in the field of preschool quality focusing higher order skills such as self-regulation skills and language proficiency, and research indicates that the development of such skills is dependent on extensive contingent scaffolding, as opposed to uni-directional teacher initiated instruction with little consideration of children's perspectives. An additional aspect of recent interest is the promotion of child curiosity (Kaneko and Frankenberg, *submitted*; OECD, 2021). As will be described ahead, the comprehensive framework on which the ECSS is based is expected to provide a fruitful perspective as it includes a focus on scaffolding such higher order skills and the focus on capturing more fine-grained aspects of scaffolding of potential importance for all forms of teaching.

It is also noteworthy to mention that when it comes to further development of assessment tools within this field of research, reliability in ratings is an issue of concern. According to Burchinal (2018) commonly used standards for interrater reliability accept as much as one standard deviation higher or lower than the trained rater, and this wide range of variability in terms of rater accuracy is a threat to the validity of the ratings and may contribute to the lack of stronger associations between process quality and child outcomes. An additional limitation of the CLASS and ECERS that has been raised is the low levels of variability on individual items, which makes it difficult to identify more fine-grained differences between different preschool units (Burchinal, 2018).

3.2 Methods in research on scaffolding

Burchinal concludes that that “models of ECE quality should include quality and content of instruction, and the degree to which teachers actively scaffold learning...Models should also include a focus on teacher-child interaction” (2018, p. 7). Thus, scaffolding research has a potentially valuable contribution to make, since scaffolding research to a large extent focuses on specific learning content.

As opposed to research on process quality, scaffolding research has primarily been conducted in observational and descriptive micro studies focusing on content- and subject-specific learning targets and goals (Bertell & Frankenberg, *forthcoming*). A large body of research based on what has been described as a “bottom-up approach” has focused on describing scaffolding in situated contexts focusing on strategies and scaffolding of different subject matters (van de Pol et al., 2010). However, as van de Pol et al. concluded in 2010, the field of scaffolding suffers from a lack of consensus regarding the conceptualization as well as operationalization of scaffolding. In their review they identified a small number of rating scales. In the review of scaffolding literature focusing on early childhood education during the timespan 2010-2020 a few studies were identified where rating scales were used, most studies with a focus on language and literacy (Bertell & Frankenberg, *forthcoming*). One example is the Writing Resources and Interactions in Teaching Environments (WRITE) observational scale focusing on writing in early childhood settings (Gerde, Bingham & Pendergast, 2015). The scale includes 41 items focusing on writing environment, environmental print, teacher modeling of writing, teacher scaffolding of writing and independent child writing. Each item is scored dichotomously as either observed or not observed over a period of approximately three hours. Observers were trained to reliability before the ratings were undertaken. The Classroom Language Environment Observation Scales (CLEOS; Phillips, Zhao & Weekley, 2018) is another example of an observation measure including scaffolding as a central aspect, but with a focus on language in terms of general language environment, incidental language instruction, incidental vocabulary instruction, explicit vocabulary instruction, book reading quality and oral language. The scale is used for direct observation ratings and each item is coded in terms of both quantity and quality. The observers completed a self-study review of the measure and received workshop training. Reliability was obtained at 90% interrater agreement in relation to an experienced trainer.

As opposed to observational scales of process quality and the WRITE and CLEOS observation scales, which may be carried out through direct observations, research on scaffolding predominantly relies on video-recorded data (van de Pol et al., 2010). This indicates that scaffolding may be conceptualized as a more fine-grained and interactive phenomenon than generic process quality. Consequently, the investigation of scaffolding requires the ability to zoom in on fine-grained aspects of interaction such as gestures, expressions of affect and dialogic turns of co-activated actions, while simultaneously being able to assess quality in relation to the intention of the scaffolding actions.

As mentioned, critiques have been raised with regard to the reliability of measures of process quality. An alternative is rating video-recorded interaction, which provides opportunities for repeated viewing as well as providing multiple viewers the opportunity to observe the same situation. However, observation ratings are also associated with a number of problems. Rating interaction quality in natural settings is a highly complex endeavor and is usually very time consuming, which also means that only limited amounts of film can be observed and rated, in turn posing challenges in which sequences to select for rating.

One challenge in the measurement of scaffolding is selecting the grain size in terms of units of analysis (van de Pol et al., 2010). Scaffolding is a dynamic and temporal process, which raises the question of where it starts and where it ends. Additionally, there is a question of what level of detail should be in focus. Should analysis focus exclusively on verbal dialogue or should non-verbal content be included? In the preschool context it is also important to consider whether analysis should only focus on one-to-one interaction or if group interaction and teacher collaboration in scaffolding should also be part of the assessment. van de Pol et al. (2010) suggests that “measuring all key characteristics of scaffolding, i.e., contingency, fading, and transfer of responsibility, requires an analysis that makes a systematic distinction between these features. Such an analysis requires different unit of analysis of different grain sizes” (van de Pol et al., 2010). Additionally, the selection of units of analysis may be particularly challenging when assessing scaffolding in naturally occurring settings such as preschool classrooms as compared to one-on-one situations between teacher and child. Finally, there is the question of what is being scaffolded. In structured situations focusing on specific tasks, this may be fairly straightforward, whereas in naturally occurring interactions the goal of scaffolding actions may be to target multiple aspects of child development and learning in the same or interdependent actions. This taps into the recommendation made by van de Pol et al. (2010) to pay specific attention to the context of scaffolding.

3.3 Rater bias and importance of training

Rater bias has been reported as one of the main challenges in the use of observation ratings, as it risks creating disagreement between raters resulting in measurement error and posing a threat to validity of the measure. A strong moderator for rating bias is the amount and quality of training received by the raters prior to the use of the instrument (Praetorius et al., 2012).

This review of previous research on process quality and scaffolding research has highlighted the need for methodological improvement for the advancement of research on process quality in terms of scaffolding in preschool settings. A number of challenges have also been raised which need to be considered.

4 The Study: Developing the Early Childhood Scaffolding Scale

4.1 Methodology

The point of departure for the construction of the ECSS was approximately 120 hours of video recordings of preschool practice, which had been collected through participant observations from a total of 26 preschools, as part of the RCT-study. The films portrait teachers and children involved in typical preschool activities, representative of the three conditions SEMLA, DIL and practice as usual.

To develop the scale, an iterative process that can be described in four steps was followed by the principal researcher (Frankenberg) in collaboration with the co-researcher (Bertell).

The first step consisted of a literature review of scaffolding in preschool contexts (Bertell and Frankenberg, *forthcoming*). A review of existing rating scales focusing on closely related phenomenon was also undertaken, as well as selected research articles and chapters focusing on theoretical conceptualizations of scaffolding. In parallel, a sample of video recordings based on the preliminary knowledge of the content, was selected and observed multiple times in order to develop an empirically grounded strategy of how to construct the scale. Several alternative constructs of the scale were considered, emphasizing different aspects of scaffolding and how quality could be assessed, in relation to what was portrayed in the video recorded materials. The dynamic systems model of co-activated scaffolding (Mascolo & Fischer, 2015) in combination with the theoretical framework developed by van de Pol et al. (2010) was identified as the most fruitful point of departure. The dynamic systems perspective has gained considerable ground in recent years and is today considered as the most fruitful paradigm in developmental science (Overton, 2013; Dick & Muller, 2017) and the scaffolding framework suggested by van de Pol et al. is based on an extensive review of scaffolding research. When applied to the sample of video recordings and discussed by the principal researcher and co-researcher, the conclusion was that it would provide a meaningful theoretical lens. The selection of the theoretical framework was thus based on both theoretical and empirical grounds (see section 5.2).

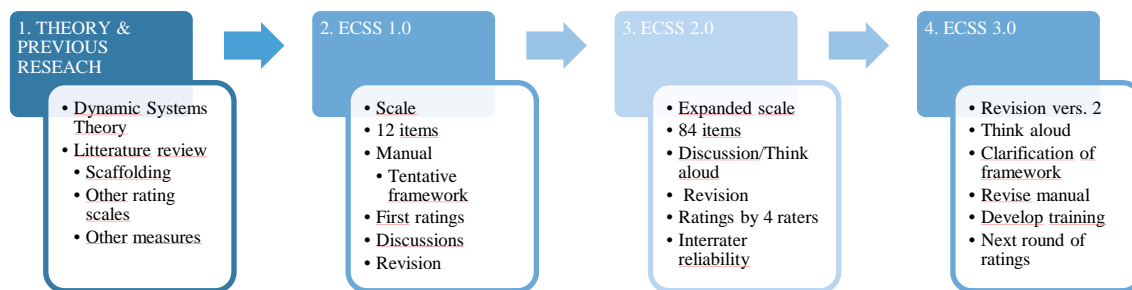
The second step involved the development and testing of the first version of the theoretical framework, rating scale and manual. The ECSS 1.0 included 12 items to be rated on a 1-5 point Likert scale and was tried out by the principal researcher (Frankenberg) and the co-researcher (Bertell) on a sample of filmed sequences. A workshop was also conducted together with two additional researchers with extensive experience in preschool didactics. In the workshop the theoretical framework and manual were discussed and three filmed sequences were analyzed and discussed. It was concluded that the dynamic systems conceptualization of scaffolding was functional but that the items needed to be more specific and detailed in order to guide the assessment of scaffolding quality in a reliable manner.

In **the third step** the second version of the scale was significantly expanded to include 84 items (see appendix). The conceptual framework was further developed and the manual revised.

Training to use the scale was provided through individual reading of the materials and a workshop, where a couple of filmed sequences were rated and discussed. Four raters (Frankenberg, Bertell+ the two researchers mentioned above) observed and rated 35 approximately 30-minute video- recorded sequences. The selected sequences were evenly distributed over the three conditions SEMLA, DIL and control and chosen to represent the three conditions in a fair way. All sequences portrayed children and teachers interacting with a focus on various types of pedagogical activities and were selected to provide fair opportunities to rate scaffolding quality in the three conditions.

Each sequence was rated by two observers. Inter-rater reliability was calculated and found to be low (further described in section 5.3.2). In order to better understand the challenges to interrater reliability, so called “think-aloud sessions” in the form of interactive group discussions with all raters were conducted with the raters (Willis, 2005) (further described in section 5.3.3).

Step four consisted of finalizing version 3 of the scale, clarifying the theoretical framework and developing a training module for raters. The next step (not included in the study reported on here) will be to assess psychometric qualities of the scale. The remaining part of this report will focus primarily on step three and the lessons learned for the finalization of the scale.



4.1.1 Video data

The recordings were collected by four researchers through participant observations with video in the 26 preschools and primarily intended to capture the characteristics of the pedagogical practices with a focus on interaction between teachers and children, groups of children as well as the material environment. A manual was developed before the data collection started and workshops were undertaken together with the researchers during the data collection, in order to make sure that the manual was followed and to discuss various issues that arose during the data collection. The manual included instructions regarding the aim of the data collection, methodological considerations related to participant observations with portable video cameras, focus of data collection, procedures for informed consent with children, data management and storage.

The filming strategies changed somewhat during the three phases of the intervention, from predominantly shorter filmed sequences in the first intervention phase to longer sequences in the second and third phases. The focus of the data also varies somewhat depending on what captured the attention of the researcher and depending on the interest of the researcher filming, in some cases prioritizing interpersonal teacher- child interactions or child- child interaction and in other cases child interaction with materials such as creative materials or digital tablets. This approach to data collection had the advantage of constructing a rich and varied dataset representing the complexity of Swedish preschool

practice. However it later appeared to create considerable challenges in terms of testing the functionality of the ECSS as well as for the validity of video content in relation to the actual preschool practices and as a consequence, the comparisons of scaffolding quality between different preschool units, as will be addressed in the discussion.

4.1.2 Ethics

The main project received ethical clearance from the Regional Ethical Board at the Karolinska Institute and a complementary application for this project was approved⁴. All data has been handled in accordance with ethical regulations of Stockholm University (Gerholm, 2018; Vetenskapsrådet, 2017; www.codex.vr.se). All data was collected after informed consent from parents, teachers and children had been obtained. Information about the project was provided both verbally during information meetings and in written form. For parents information was provided in Swedish, English and Arabic. Parents who agreed to their children's participation and teachers who agreed to their own participation signed informed consent forms. In the information it was emphasized that the main focus was on the pedagogical methods, not on individual children or teachers. Nevertheless, in order to analyze the pedagogical methods, individual actions of both children and teachers were in focus.

Multiple measures were taken to inform the children about the ongoing project (Frankenberg et al., 2019). For example, posters with information were posted on walls clearly visible to the children, with age-appropriate information. The researchers wore blue T-shirts with the print *Hjärnvägar i förskolan: Forskning pågår* (Brainways in Preschool: Ongoing research) to make the role of the researcher explicit. The children were informed about the project and researchers activities during circle time and that they at any time could tell the researcher to stop filming, or just raise their hand as an indication that they did not consent. Only children who had informed consent from their parents were filmed. At the time of filming the researcher made sure that all participants were made aware of the fact that filming was taking place and the children were continuously asked if they agreed to be filmed. If there were any signs of children not agreeing, the camera was turned off or the focus moved. Participant observations with video involve an ethical dilemma in terms of the ambition to capture as naturally occurring interaction as possible and at the same time making sure that the participants are well informed about the ongoing research and there is no way to fully avoid the risk that participants adjust their behaviour when undertaking such observations. However, for the most part, the recordings show that the participants are not bothered by the presence of the camera and the interaction appears to provide a fair representation of ordinary practice.

⁴ Project number 721-2014-1786

All possible measures were taken to not spread the film materials or reveal personal identities. All computers used were encrypted and data was only stored on encrypted harddrives. After coding was finalized, copies of the data were erased.

4.2 Conceptual Framework for the Early Childhood Scaffolding Scale

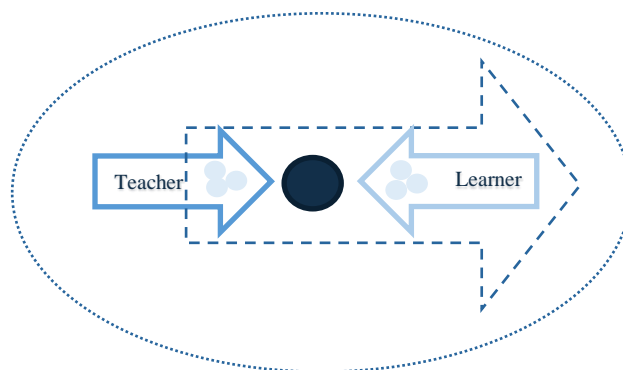
In the following section the conceptual framework for the ECSS is described in order to motivate the operationalization of the scale in terms of its structure and how it is composed of subscales and specific scale items (see appendix). As being an observational scale a condition for obtaining interrater reliability is training of raters. The conceptual framework is also intended to be used as educational material together with the scale and practical excersises focusing rating videorecorded sequenses.

4.2.1 A Relational dynamic systems approach to teaching and learning

The conceptual framework for the ECSS takes a point of departure in the foundational study by Wood, Bruner and Ross (1976) where the concept of scaffolding was first described as a

“process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts. This scaffolding consists essentially of the adult ‘controlling’ those elements of the task that are initially beyond the learner’s capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence” (p. 90)

This early definition of scaffolding is here reconceptualized within the meta theory of relational dynamic systems (Overton, 2013), dynamic skills theory (Mascolo and Fischer, 2015) and a dynamic concenptualization of scaffolding (Geertz and Steenbeck, 2005). From this perspective teaching is understood in terms of the dynamic organization of interaction between teacher↔learner/child⁵, involving the feelings, thoughts and actions of children and teachers in relation to material and discursive content focusing on more or less specified learning goals and skills. As illustrated in figure 1, interaction in terms of a *co-activated* dynamic interchange is emphasised capturing the potential contributions from both child/learner and teacher to the unfolding dynamic process.



⁵ The arrow ↔ represents the fundamentally relational perspective, in accordance with Overton (2013)

Fig 1. Teaching as co-activated interaction.

Skills represent general as well as content- and context-specific competencies and abilities to act that individuals develop as an effect of relational processes based on the individual's interaction with the environment. Child development and learning in early childhood involves a considerably wide range of skills broadly defined as motor-skills, socio-emotional skills, cognitive skills, and language skills. Examples of more specific skills are fine motor skills, literacy skills, self-regulatory skills (including emotional regulation and executive skills), problem solving skills, play skills and more (Bailey, Barnes, Park, Sokolovic & Jones 2018; Mascolo & Fischer, 2015). Skills need to be understood in relation to the situated context and in the context of early childhood education be related to the curriculum goals, which will be developed further below.

A precondition for both learning and teaching is focused attention in relation to the evaluation of meaning (thinking), which in turn is closely related to affect (feeling) and action orientation. Scaffolding as co-activated actions thus involves focused attention from both the learner and the teacher. However, the evaluation of meaning will differ as a consequence of previous experiences, neurocognitive development and the situated context. The affective coloring of experiences will also differ depending on what is perceived as meaningful from the perspective of the learner and from the perspective of the teacher, which in turn will have an impact on what actions are carried out by the teacher and learner respectively.

As human beings both children and teachers have the inherent ability to actively interact, develop and learn in situated contexts. As neuroscience has convincingly shown, the human brain is more or less malleable to environmental interaction through the proximal processes of the body interacting with context. Human development is an iterative process where early experiences lay the foundations for how future stimuli will be interpreted by the brain, providing the foundation for all forms of learning. In that sense relationships between young children and teachers are inherently asymmetrical, as the teacher is more experienced than the child. Providing conditions for children's active engagement creates the starting point for learning and development and thus also teaching. Nevertheless, in pedagogical contexts such as preschool, teachers and children have different roles as specified by socio-historically governed teaching practices, professional development and curriculums, and based on these practices it is the teacher's role to create the best possible conditions for children's learning and development. A dynamic systems perspective provides a conceptualization of teaching in which scaffolding is at the center of such interactions (Geertz and Steenbeck, 2005).

From a dynamic systems perspective social scaffolding can further be conceptualized as a form of regulatory process over time (Sameroff, 2010) where the learner and the teacher interact and adjust their actions in relation to each other in situated contexts⁶, see figure 2. Depending on the learner’s abilities and skills the teacher needs to take responsibility for more of the interaction in the beginning of the process and gradually the learner will acquire these abilities and skills, which in turn changes the dynamic regulatory interaction between the two. In a group-based context such as preschool the teacher may often interact with several children and must therefore maintain multiple regulatory processes. The children of course also interact with each other and may even scaffold each other, more or less supported by the teacher, contributing to a complex dynamic scaffolding system. However, for the sake of clarity, the teacher ↔ learner relationship is here illustrated as the basic model which, can be further elaborated in relation to the preschool context and group-based pedagogical practices.

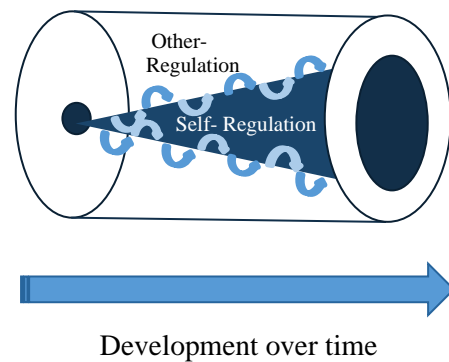
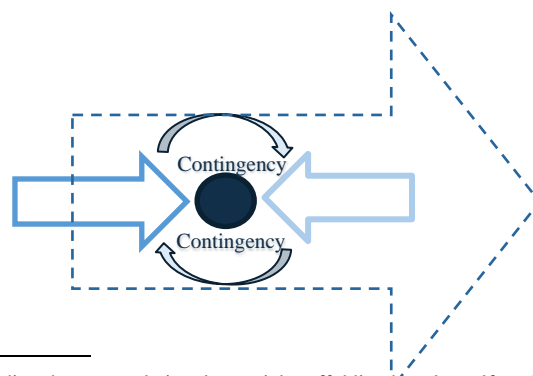


Fig 2. Transactional relations between self-regulation and other-regulation. Model modified from Transactional relations between self-regulation and other-regulation in Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child development*, 81(1), 6-22.

Based on an extensive review of scaffolding in primary school contexts, van de Pol et al. (2010) suggested three main characteristics of scaffolding: *contingency*, *fading* and *transfer*. Contingency is described as responsive, tailored or adjusted support, adapted to the learner’s level or slightly above (fig. 3).



⁶ A dynamic perspective of scaffolding does not only involve social scaffolding but also self-scaffolding, task-scaffolding and environmental scaffolding (Mascolo, 2005). Although these different types of scaffolding are interrelated and co-dependent, the conceptual framework for the ECSS focuses primarily on social scaffolding in terms of the regulation between learner and teacher.

Fig 3. Model of contingent scaffolding.

Contingency thus depends on the teacher's understanding of both the learner's current level of competence and the task at hand, in order for the support to be adapted to the learner's current skills level. This is in line with the study by Wood et al. (1976), in which a teacher and child together were given the task to solve a complicated puzzle, and where the researchers argued that effective (high quality) scaffolding depends on the teachers' understanding of both the task and the child in the specific situated context.

“The effective tutor [teacher] must have at least two theoretical models to which he must attend. One is a theory of the task or problem and how it may be completed. The other is a theory of the performance characteristics of his tutee [learner/child]. Without both of these, he can neither generate feedback nor devise situations in which his feedback will be more appropriate for *this* tutee in *this* task at *this* point in task mastery. The actual pattern of effective instruction, then, will be both *task* and *tutee* dependent, the requirements of the tutorial being *generated* by the interaction of the tutor's two theories” (p. 97).

Wood et al. (1976) in the same study took a developmental approach, showing how the scaffolding relationship between teacher and child differs depending on the developmental level (age) of the child. The youngest children in the sample were three years old and, as a group, not only required more scaffolding than the older ones, but the main function of the scaffolding with these younger children was to get them involved in the task in the first place. The younger children were also considerably more dependent on non-verbal scaffolding in demonstrating or providing interesting materials. With the four-year-old children the interaction was predominantly verbal, focusing on reminding the child about the task as well as correcting errors. With the five-year-old children the teacher intervened even less and the main function here was to confirm that the child was solving the task as intended. High quality scaffolding thus requires the teacher to tune in to the child's perspective in order to understand the child's level of understanding.

Interestingly, Wood et al. (1976) also highlight the specific challenges faced by the teacher. When the learning child was in a stage of most intensive learning (the four -year-olds in the experiment) the child's behavior was most unstructured and therefore also most difficult for the tutor to interpret and accommodate to. In line with Wood et al.'s findings high quality scaffolding thus requires the use of different regulatory strategies based on a well-developed understanding of the development of child cognition as well as what tasks are most functional at what stages of the child's development.

While Wood et al. did not elaborate on the developmental process that children go through during these early years, later research highlights how scaffolding gradually is transferred into self-scaffolding as a part of metacognition (Pozuelos et al., 2019). Holton & Clarke (2006) suggest that metacognition also plays an important role in bridging the instructional support provided by the teacher and the learner's self-control. This means that the scaffolding provided by the teacher becomes internalized as part of the child's metacognition. In this sense scaffolding aims at gradually replacing the teacher with self-scaffolding strategies on the part of the learner, corresponding to what van de Pol et al. (2010) described as a process of transfer. In line with the aim of scaffolding being to enhance skills in the learner, fading is a key characteristic of scaffolding entailing the withdrawal of support in accordance with the transfer of responsibility as the student acquires the skills in question.

In line with the importance of recognizing the child's perspective, the original conceptualization of scaffolding suggested by Wood et al. (1976) has been expanded with a stronger emphasis on the scaffolding of learners agency (Holton & Clarke, 2006), which is also a central component of the scaffolding as co-activated action construct (Mascolo & Fischer, 2015). Children learn through the active involvement with the environment, and a substantial body of research supports the importance of active learning experiences for the development of a strong sense of agency (Sokol, Hammond & Sweetman, 2015).

High quality scaffolding as a regulatory process may thus be characterized by contingency (van de Pol et al., 2010) in terms of sensitive, warm and reliable interaction aiming at transfer of skills and fading of support on the part of the teacher and an active, engaged and responsive learner gradually acquiring new skills transferred by means of the scaffolding process. In this sense the framework for the ECSS presumes scaffolding as a co-activated process where teacher and learner are interdependent of each other. High quality scaffolding is from this perspective not only dependent on the teacher's actions, but rather on how they are contingent with the actions of the child as shown by how the child responds to the teacher's actions and how the teacher adjusts his or her actions to the child's actions (van de Pol et al., 2010).

4.2.2 Scaffolding Strategies

A substantial part of the scaffolding literature has focused on teachers' actions. Focusing on these actions, dynamic scaffolding processes can more specifically be described in terms of situated scaffolding strategies (Wood et al., 1976; van de Pol et al., 2010).

Scaffolding strategies are embodied actions and make use of both verbal and non-verbal communication skills depending on the nature of the task and the developmental level and skills of the learner (Mascolo & Fischer, 2015). Scaffolding strategies direct the focus towards the teacher's actions, aiming at enhancing the learner's development and learning. Scaffolding is well documented in the research literature and a large number of scaffolding strategies have been described (Bertell & Frankenberg, *forthcoming*). Following van de Pol et al.'s definition, scaffolding strategies may be

distinguished in terms of *intentions* or *goals* characterized as what is scaffolded (2010) and *means* characterized as how scaffolding is taking place (enacted), corresponding to the didactic questions of *how* a certain content is taught and *what* it is that is being taught.

4.2.2.1 Scaffolding intentions

Van de Pol et. al. (2010) further distinguishes between cognitive, metacognitive, and affective intentions, of the scaffolding process which also corresponds to the general development during early childhood (Mascolo & Fischer, 2015). Intentions are here conceptualized as the inherent and more or less explicit goal or target of the teacher's actions, which provides a direction orientation for scaffolded interaction processes. Even though these intentions can be described separately, the relational dynamic systems perspective reminds us that these aspects of human functioning are interrelated, interdependent and not always clearly distinguishable from each other.

Cognitive scaffolding intentions are perhaps the most researched in early childhood development and care settings. Cognition involves scaffolding focused on thoughts, understandings and fact-based knowledge. Cognitive scaffolding in early childhood settings focuses primarily on learning content in terms of knowledge about the world and how to participate in society. A literature review (Bertell & Frankenberg, *forthcoming*) shows that a large body of research from multiple fields of inquiry describes teacher actions in terms of scaffolding strategies directed toward enhancing student learning and development in specific learning areas, e.g., language and literacy (Ankrum, Genest & Belcastro 2014; Cabell, Tortorelli & Hope, 2013; Copp, Cabell & Invernizzi, 2019; Englishtina, 2015; Pentimonti & Justince, 2010), play (Kleppe 2012; Adobo & Vidal, 2019), math (Robinson, 2018; McGuire & Kinzie, 2013), science (Eshach, Dor-Ziderman & Arbel, 2011; Hsin & Wu 2011; Samuelsson, 2019), environmental education (Zurek, Torquati & Acar, 2014), music (Lefebvre, Bolduc & Pirkenne, 2015) and social interaction (Izumi-Taylor, 2013). Cognitive scaffolding intentions relate to specific learning areas and function by reducing the complexity of specific learning content in order for the learner to be able to focus on the tasks which are within reach (van de Pol et. al., 2010). The Swedish preschool curriculum has a strong focus on cognitive learning goals e.g. language, early math, natural science and technology (Swedish National Agency for Education, 2019).

Metacognition can be defined as the awareness of one's own thoughts and thinking processes (Holton & Clarke, 2006) and is closely related to the concepts self-regulation and executive functions (EF). Both metacognition and executive functions are so called higher-order cognitive processes (Roebbers, 2017). More specifically, metacognitive scaffolding intentions have been described as instructional strategies intended to enhance the learner's task specific metacognition through developing a reflective dialogue between the learner and teacher focusing for example how to identify the most relevant features of a specific task and possible strategies as well as becoming aware of mistakes (Pozuelos et

al., 2019). Metacognition is also related to language as it provides a reflective space between the immediate reaction and thinking about that reaction (Zelazo, 2015).

A significant body of research today supports the claim that the early childhood period is foundational for the development of metacognitive functions and skills and that they are malleable and dependent on contingent social interaction. Metacognition, self-regulation and EF all undergo significant development between 3 and 5 years, corresponding to a time period when the PFC region undergoes considerable development (Blair & Raver, 2015; Pozuelos et al., 2019). In a randomized controlled trial, support was also found for the claim that metacognitive scaffolding can enhance both cognitive and neural functioning in preschool children (Pozuelos et al., 2019). The development of self-regulation skills is context-dependent and pedagogical practices can include more or less explicit focus on scaffolding self-regulation. Based on previous research there is also evidence that explicit scaffolding of self-regulation may contribute to child development and learning (Blair and Raver, 2015).

Metacognition, self-regulation and executive functions are keys to school readiness and related to successful long-term educational outcomes (Blair & Raver, 2015). It is worth noting that metacognition and self-regulation are not addressed in the Swedish national preschool curriculum (Swedish National Agency for Education, 2019). However, based on the science of learning and development, such domain-general skills are prerequisites for enhancing child development and learning as well as instilling a lifelong desire to learn (Darling-Hammond et al., 2020), which is a reason for the inclusion of metacognitive scaffolding intentions in the ECSS.

Affective scaffolding intentions emphasize an embodied perspective on scaffolding and highlight the role of emotion, more or less involved in all human activities. Already in the seminal article from 1976 by Wood et. al. the child's emotional involvement and motivation as a prerequisite for scaffolding was mentioned by stressing the importance of the tutor creating an atmosphere of encouragement. Learning can be joyful, motivating and emotionally rewarding. But it may also be effortful, difficult and disappointing, generating negative emotional responses which can result in more generalized feelings of negative self-worth with potential impact on identity and belonging. High quality scaffolding involves the teacher's attunement to the learner's emotional state and the management of the learner's emotions in a contingent, warm and supportive manner, in order to develop self-regulatory skills related to affect and to enhance feelings of success. An additional feature of high quality scaffolding is that the explicit actions of the teacher are characterized by engagement and interest in relation to the child's interests and curiosity, based on the fundamental role of motivation in learning. The question of scaffolding **child interest and curiosity** corresponds closely to the guidelines in the national curriculum, which states that everyone working in preschool "should encourage the children's curiosity,

creativity and interest” (Swedish National Agency for Education 2019, p 8). Interestingly, The International Early Learning and Child Well-being Study (OECD, 2021), a large-scale study with a sample from England, Estonia and the United States, showed that curiosity as rated by parents and teachers was strongly correlated with cognitive development and learning outcomes in literacy and numeracy. This provides an argument for the inclusion of curiosity scaffolding as an important component of high scaffolding quality (Kaneko *forthcoming*).

Language plays a central role in most scaffolding. In line with Vygotsky’s theory, language provides a powerful tool for the development of cognition as well as metacognition and the recognition and regulation of emotion. A significant body of research has also focused on scaffolding language development (Bertell and Frankenberg, *forthcoming*).

4.2.2.2 Scaffolding means

Scaffolding means relates to the type of actions on the part of the teacher used in relation to the scaffolding intentions or goals. Depending on the specific task being scaffolded a wide variety of scaffolding means have been documented in previous research. Based on the experimental study involving children aged 3-5 years who were tutored to solve a construction task, Wood et al. (1976) identified six functions or strategies involved in scaffolding. The scaffolding strategies, in this early conceptualization included 1) *recruitment* of the learner’s attention and interest, 2) *reduction of degrees of freedom* in terms of simplifying the task for the learner and complementing the learner’s actions in order to successfully solve the problem, 3) *direction maintenance* in line with the particular objective of the task in order to maintain the learner’s interest and focused attention, 4) *marking critical features* that are critical in solving the problem, 5) *frustration control* intended to lower the stress level of the learner and facilitate the motivation to continue the pursuit and solve the problem and 6) *demonstration* (Wood et al., 1976).

Asking questions is a central scaffolding strategy, which has been documented repeatedly in the research literature. Holton & Clarke (2006) for example suggest a number of questions to be used by the teacher teaching math: Have you seen a problem like this before? What are the important ideas here? What information is given? Tell me what you are doing here? Why is this idea better than this? Working with younger children in preschool settings teachers can ask questions like: What are you working on here? Have you done anything similar before? Why do you think this is happening? What could you do to change that? Additional examples of scaffolding means include *physical guidance, modelling, directing, interpreting/explaining, holding, distancing, restating/expanding, encouraging and prompting* (Mascolo & Fischer, 2015).

In line with a dynamic systems perspective, singular scaffolding episodes are by definition situated in context, which in turn requires the teacher to organize the activity and clarify the boundaries in terms

of what the focus of the activity is intended to be, when it starts and ends and how it relates to previous and coming activities. **Teacher structuring** captures such aspects of scaffolding and is related to reducing irrelevant or distractive activities that are not in line with the learning activity. The use of structuring will vary largely depending on the pedagogical approach followed by the teacher. In some situations, such as circle time, structure might involve making sure the individual child understands that he or she should sit down at a particular place, marking the beginning and end of the activity. Structuring free play may involve the provision and safeguarding of play time, a particular space for play, physical objects as well as guidance when play breaks down.

4.2.3 Scaffolding as co-activated actions

The conceptualization of scaffolding as co-activated actions entails the idea of scaffolding as a fundamentally co-dependent and relational process going two ways where both teacher and learner have the potential to influence the actions of the other. Contingency is hereby not only dependent on the teacher, but also on the child/children. A child explicitly engaged in the task at hand, following a scaffolding action by the teacher, is an indication that the teacher's action was carried out with sufficient contingency, that is, the scaffolding worked. As shown in the example by Wood et al. (1976) some scaffolding processes may be more difficult to support than others due to the child's understanding of the task, e.g., a four-year-old with a complicated puzzle. Starting with the child's action, the teacher needs to have an idea about how the task is to be solved as well as an understanding of the child's understanding of the task.

4.2.4 Scaffolding in different contexts

In line with the dynamic systems perspective (Mascolo & Fischer, 2015; van de Pol et al., 2010), scaffolding is interrelated with the context in which it takes place. This means that what is regarded as appropriate scaffolding may vary from context to context. Context is a broad concept involving socioeconomic conditions and the contribution of socio-historical traditions to ideology and cultural practices. In formal educational settings such as preschool, contextual factors with a potential influence on scaffolding processes are made more or less explicit through pedagogical practice and curricula. A different emphasis may be placed on cognitive, meta-cognitive and affective content. Differences may also be seen in terms of the balance between the child's initiative and the directives and guidance by the teacher, as well as in terms of material resources provided and what are considered good pedagogical environments. Consequently, scaffolding quality needs to be interpreted with specific considerations of local preschool pedagogy, organizational characteristics and socioeconomic and cultural settings.

4.2.4.1 Scaffolding and the Swedish preschool curriculum


Based on previous research and the model of scaffolding as co-activated actions, pedagogical methods can be described in terms of activities, learning objects and general goals of learning and development. The Swedish curriculum follows a Nordic curriculum tradition describing broad

guidelines for teachers to interpret and transform into practice (OECD, 2012; Vallberg Roth, 2014) and as mentioned, it was not until the year of 2018 that the concept of teaching was included in the curriculum text. The Nordic curriculum tradition has been characterized in relation to the Anglo-Saxon tradition, which consists of more detailed curricula with specific learning targets, teaching strategies and goals for specified areas of development and learning, which in turn may have implications for the definitions of high-quality teaching and scaffolding.

Zooming in on particular aspects of scaffolding as co-activated action and zooming out in order to capture a more holistic view of the dynamics of scaffolding provides the means for bridging polarized and often ideologically-based representations with regard to teaching and instruction (Billig et al., 1978; Frankenberg, 2018). The intention of the ECSS is thus to provide a comprehensive framework which does not favor either/or, but instead provides a tool for investigating dynamic patterns in early childhood educational practice. Empirical studies will be required in order to identify what patterns are most frequent and what they produce in terms of learning and development.

4.3 The Early Childhood Scaffolding Scale 2.0

Based on the conceptualization of scaffolding as co-activated action, the ECSS 2.0 is composed of six interdependent subscales focusing on teacher actions and six corresponding subscales focusing on child actions. In addition, a subscale capturing co-activated actions between teacher and child/children was included as well as a subscale capturing teacher collaboration. For the full scale see appendix.

P	PEDAGOG/TEACHER	SS	BARN/CHILD	B
P1	Uses scaffolding strategies when relevant	 Scaffolds contingently with child interest and attention in a way that promotes learning and development	Responds to teacher scaffolding in relation to learning activity	B1
P2	Structures the activity in line with specific learning goals		Conforms appropriately to learning activity	B2
P3	Scaffolds both individual children and the group in relation to specific learning goals		Both individual children and group are actively involved in learning activity	B3
P4	Expresses engagement and focused attention promoting child attention and motivation		Expresses engagement in relation to learning activity	B4
P5	Scaffolds child's metacognitive functions		Regulates their own learning	B5
P6	Scaffolds child interest and curiosity		Express interest and curiosity	B6

SS	Teachers' interaction with each other promotes scaffolding in relation to curriculum goals
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Each subscale consists of 5-6 items that are rated on a Likert-scale from 0-5 according to the following criteria:

NO = no occurrence in the film and cannot be rated.

- 1= no or hardly any apperance and/or non-contingent with the child/children.*
- 2= appears sporadically and/or to some extent non-contingent with the child/children*
- 3=appears to some extent and functionally contingent*
- 4=appears to a considerable extent and functionally contingent*
- 5=appears to a great extent and of very high quality*

The ECSS is intentionally constructed as a generic scale with the intent of focusing general aspects of scaffolding as an interactive process. As described in the conceptual framework, scaffolding strategies include intentions and means. Scaffolding intentions may be more or less related to the curriculum. The first section of the ECSS therefore requests raters to identify the *goal/goals to strive for*, as they are specified in the Swedish national preschool curriculum (Swedish National Agency for Education, 2019⁷), that the activities in the video recorded data can be related to.

4.3.1 Testing the functionality of the ECSS 2.0

The ECSS is intended as a research tool for the assessment of scaffolding quality by observing video-recorded interactions between teachers and children in preschool settings. The rater thus watches a selected sequence of interaction and for each item in the scale interprets the interaction shown in the sequence and selects the corresponding rating for that item. This means that the rater needs to be able to interpret the film content in relation to the conceptual understanding of scaffolding as it is operationalized in the specific scale items.

Before the scale can be considered fully developed and ready to be used as a research tool, it is essential to establish reliability in terms of proving that the same result, independently of who is rating, will be obtained. Interrater reliability thus reflects the variation between two or more raters who measure the same content. As part of the development of the scale, an initial inter-rater reliability assessment was carried out.

Previous research has pointed to the importance of training in order to develop rater reliability in observational ratings (Praetorius et al., 2012). However, as the ratings with the ECSS 2.0 were intended to inform the development of the scale, it was not possible to reliably test individual raters' reliability at this stage of the scale development. Therefore, the preparation for testing the functionality of the ECSS 2.0 included reading the manual, getting acquainted with the scale items and joint discussions among the raters regarding how to interpret the scale and the manual.

Once the ECSS is finalized the raters will receive training in how the scale is to be used, as a way to enhance individual raters' ability to apply the conceptual framework, as operationalized in the specific scale items, on observational data. Interrater reliability will also be assessed on a sample of video sequences in order to ensure that the rater is able to reach sufficient interrater reliability, in relation to the principal researcher.

⁷ At the time of the project, it was the 2016 version of the curriculum that was used.

4.3.1.1 Interrater reliability ECSS 2.0

The initial interrater reliability analysis involved data from four raters, rating the films in pairs. The raters were all researchers within the field of early childhood education. In addition to the principal researcher and co-researcher in the project, two of the raters were trained preschool teachers, both with extensive working experience in Swedish preschool. The team of raters thus had in-depth experience in Swedish preschool practice and were expected to have the knowledge needed to use the scale despite the fact that it was a preliminary version under development. They were also expected to have valuable input contributing to the validity of the scale.

Thirty-five film sequences 30-40 minutes in length were selected by the principal researcher based on familiarity of the film content. For each preschool a section that included SELMA, DIL or practice as usual in terms of a learning activity was selected. The length of the films was based on both theoretical and empirical grounds. The understanding of scaffolding in naturally occurring preschool practice as a complex, dynamic, multifactor phenomenon meant that the sequences needed to be long enough to capture processes from the beginning of a scaffolding sequence to the end. Most films included one or two teachers. A smaller number of films includes more than 2 teachers and in those cases the raters were instructed to focus on the 1-2 teachers most active in the activity. Each film was rated by two raters.

Interrater reliability of the ECSS 2.0 was assessed using quadratic weighted Cohens Kappa (CK) reflecting the agreement between two raters taking also the statistical possibility of chance into consideration⁸. The analysis was undertaken in steps, with the intention of investigating the functionality of the scale as well as which factors were related to high vs. low reliability. The initial analysis, showed fair interrater reliability overall with a CK mean of = 0.38 (SD=0.15)⁹. The results also indicate a wide range of interrater reliability in the rated sample, ranging from 0.62- 0.11. 5 sequences obtained slight interrater reliability, 16 fair, 12 moderate and 2 substantial. No clear patterns could be identified related to type of pedagogical condition (SELMA, DIL or Control) or rater pairs. However, the analysis indicates that it was slightly easier to obtain interrater reliability if there was only one teacher in the film sequence compared to if there were two teachers in the sequences.

Further analysis was thus required in order to better understand the difficulties involved in rating the video data using the ECSS 2.0.

4.3.2 Think Aloud Sessions

In order to improve the functionality of the scale in terms of reliability, focus group discussions were undertaken with the raters, highlighting the reasoning applied to decide how to rate specific sequences of interaction and to identify the arguments behind variability in interpretations. The methodology was

⁸ The analysis was calculated using R (R Core Team, 2017), with the additional package irr (Gamer et al., 2012).

⁹ As guidelines for CK values < 0.01 indicates poor reliability, between 0.01 – 0.20 indicates slight, between 0.21 – 0.40 fair, between 0.41 – 0.60 moderate, between 0.61 -0.80 substantial and values between 0.81 - 1 indicates nearly perfect interrater reliability (Cohen, 1960).

inspired by cognitive interviewing, including think aloud and probing, commonly used when developing different types of assessment tools such as surveys and questionnaires (Willis, 2005) in order to improve the functionality. The researcher typically reads questionnaire questions or rating items aloud one by one and the respondents are asked to describe everything that comes to mind in the process of reaching an answer. The intention is basically to get access to the cognitive processes of the respondents. Probes can focus on comprehension, interpretation, paraphrasing, confidence judgment, recall and involve both specific and general probes (Willis 2011). The data produced by the respondents can then be used in order to identify the difficulties encountered in the process of rating specific items and by that provide information about how to modify questions or items in order for them to be more functional. In the case of observer ratings, important information can also be gathered regarding the content of the training. As noted above, the reliability of observation ratings relies heavily on training in how to use the measure as intended (Praetorius et al., 2012).

In the current study a modified version of think aloud and cognitive interviewing in groups was used while watching a selected sequence of video recorded interaction. The intention was to understand the respondents' thinking processes and considerations when using the ECSS to rate the selected video-recorded materials in order to inform the development of the scale. Following the theoretical grounding of the methodology, cognition was in focus in terms of accessing the respondent's rhetorical argumentation as an expression of cognitive understandings.

Four focus group sessions were undertaken focusing on the experiences of using the scale and rating video recorded interaction. At this stage, shorter sequences of approximately five minutes (as opposed to the longer sequences above), were selected based on the results from the interrater reliability analysis and experiences of using the scale on longer sequences, in order to be able to go into depth regarding particular items.

The focus group discussions sessions were recorded, transcribed and analyzed using content analysis/thematic analysis. The analysis focused on identifying the challenges in using the ECSS as a tool for the assessment of scaffolding. The analysis of the transcripts was undertaken by the following steps: 1) identification of challenging issues, 2) identification of components contributing to specific challenges and 3) potential improvements that could sharpen the tool.

4.3.3 Findings Think Aloud Sessions

The findings from the analysis of the focus groups will be reported in detail in a separate article (Frankenberg, *forthcoming*) and a brief report is therefore presented here.

The analysis of the focus group discussions identified a number of themes in terms of challenges to the possibility of reaching satisfying interrater reliability related to 1) the intentions of the pedagogical methods, 2) the conceptual framework, 3) units of analysis and the selection of representative video-recorded sequences, 4) the interpretation of items and 5) the interpretation of quality in terms of values on the Likert scale.

4.3.3.1 The intentions of the pedagogical methods

As described above the video-recorded materials contain pedagogical practice from SEMLA, DIL and practice as usual. Both SEMLA and DIL were developed as part of the intervention study. The three raters were not part of the *Hjärnvägar i förskolan* project, did not participate in recording the films and were thus not fully informed about these different pedagogical methods. Analysis of the focus groups revealed both confusion and skepticism regarding what was taking place in the filmed sequences and discussions evolved around what was considered appropriate practices in relation to the Swedish preschool tradition, which highlights challenges of implementing specific methods in socio-historically situated preschool contexts.

The question of how to judge “good” scaffolding cannot be separated from the ideals of preschool pedagogy in general. In the context of rating preschool quality in the sample used in this study, this meant considerable challenges to interrater reliability. On multiple occasions the raters commented that both the SEMLA and DIL interventions were strange and did not fit into their understanding of what preschool pedagogy should look like. For the aim of this study, this was a major challenge in terms of the interpretation of specific items and possibility of reaching interrater reliability.

4.3.3.2 The conceptual framework

As mentioned in the previous research reported above, the concept of scaffolding has been criticized for lack of conceptual clarity. The manual for the ECSS 2.0 included a conceptualization based on the work of Mascolo & Fischer (2015), van de Pol et al. (2010) and others. A central component in the suggested scaffolding framework is the process of contingency and fading, for the assessment of scaffolding quality. The focus group discussions revealed this as a challenging issue to rate. How does contingent scaffolding look? How can it be assessed? The clarification of these variations of conceptual understanding can potentially be addressed by a combination of further elaborations of the conceptual framework and a stronger focus on the understanding of the framework through more in-depth training of the raters.

4.3.3.3 Units of analysis and the selection of representative video-recorded sequences

Yet another obstacle when rating particular items and reaching interrater reliability was the question of what is actually interpreted as an activity, which comes down to the question of what is being rated. The data, video-recorded preschool activities, was collected using an ethnographical approach, not initially intended for the development of the ECSS. The richness and variability of the content was both an asset in terms of capturing the richness of scaffolding-related interaction, but also a challenge for the raters in terms of limiting the focus of what to rate as well as determining the beginning and ending of a scaffolding sequence. The raters’ previous experience of assessing interaction seemed to play a role in focusing specific words, intonation and detailed gestures, as is the case in multi-modal discourse analysis versus more comprehensive and holistic evaluations, which are required in observational ratings of scaffolding quality. This is an issue that needs to be addressed in depth in the training of raters

of scaffolding quality in order to reach consensus about what is to be regarded as high quality and yet in line with contemporary understandings of Swedish preschool pedagogy.

4.3.3.4 Interpretation of items

The intention was to formulate the items of the scale as discrete behaviors, which would not require too much interpretation in terms of broader dimensions. The formulation of some items proved more controversial for the raters than others and thereby also open for interpretation. For example item P4.1 reads: *The pedagogue expresses positive emotions in relation to the learning activity through her/his facial expressions (smiles, looks glad or enthusiastic) (Pedagogen förmedlar positiva känslor i förhållande till läraktiviteten genom sitt minspel (le, se glad eller entusiastiskt ut) och sätt att tala).* The discussion in the focus group revolved around the question of whether it should be regarded as an aspect of high quality that the teacher expresses positive affect or if focused attention was not the main issue. This remains an empirical question and for the time being the item will be kept for the next round of ratings where factor analysis will be undertaken to investigate how this item correlates with others in the scale.

As mentioned, a quantitative factor analysis was not meaningful to undertake at this stage of scale development due to the limited number of ratings. However, the focus group discussions also focused on the raters' understanding of how different factors relate to each other. The scale was constructed so that, in addition to the assessment of a general factor (P:0, P:1, P:2, P:3 ect.), subfactors covering different aspects of the general factor were rated. The discussion in the focus group covered how this was intended and it is clear that this needs to be addressed in the training.

4.3.3.5 The Definition of Values in the Likert Scale

Rating quality on a Likert scale has pros and cons. However, for the intended use, it was selected as the most functional method to differentiate between different gradients of scaffolding quality. The focus groups confirmed the importance of training in order to develop a professional vision and frame of reference for the interpretation of specific items and grading of quality.

The focus groups discussions in particular revealed that the scale would most likely be more functional if the grade 0 was replaced by Non-applicable (NA). In the selected sequences there were in some cases items which were not possible to rate due to the fact that that item was not relevant to rate. The 0 was not interpreted in the same way by the raters and it was clear that the difference between 0 and 1 needed clarification.

4.3.4 Conclusion

Based on the results from the attempt to use the ECSS 2.0, the assessment of interrater reliability and the focus group discussions it can be concluded that the following steps should be taken in the revision of the scale:

- 1) The Conceptual framework needs to be clarified.
- 2) Structured training and test of inter-rater reliability after the training to calibrate assessments.

- 3) A more homogeneous sample in terms of activities in the films.
- 4) Shorter film sequences in order to avoid cognitive overload for the raters.
- 5) In order to make sure that the ratings for a particular teacher or preschool unit are valid in terms of representing a general level of scaffolding a series of sequences from the same teacher/preschool unit need to be rated and combined into a scaffolding mean.

5 Discussion

This working paper has presented the ECSS in terms of the conceptual framework, operationalization of the scale and a test of the functionality of the scale. The intention with the ECSS is to create a comprehensive assessment tool focusing on teaching practices based in a relational dynamic systems perspective and the enhancement of both general and specific skills through scaffolding as co-activated action.

Previous research indicates that there is a relationship between structure quality and child outcomes and that process quality is a likely mediator. However, the relationship is not robust and there is a need for better measures of process quality (Burchinal, 2018). Multiple attempts have been made to construct instruments for the measurement of teaching and instruction quality using observer ratings and there are numerous methodological challenges to the goals of creating both reliable and valid observation scales (Praetorius et al., 2012; Pianta et al., 2020). Assessing process quality in naturally occurring interaction in early childhood educational settings is thus an important but challenging endeavor.

The development of the ECSS can be understood as an answer to van de Pol and colleagues' (2010) call for the development of tools for the measurement of scaffolding. The iterative process of developing the ECSS required the development of a conceptual framework based on contemporary research that could be operationalized in terms of an observational rating scale. At the core of the conceptual framework for the ECSS lies the intention to bridge a polarized perspective of teacher directedness towards predefined learning goals vs. children's perspectives, initiated actions and interests. Scaffolding as co-activated action captures a holistic and dynamically continuous process of interrelatedness where proximal processes of contingent scaffolding contribute to the development of cognitive, meta-cognitive and affective domains important for school readiness and lifelong learning.

In terms of operationalization, the ECSS 2.0 zooms in on four aspects of scaffolding as co-activated action. When using the scale for rating the focus first zooms in on the part of the teacher, thereafter the child, followed by a focus on the interaction between teacher and child/children. In addition, teacher collaboration is addressed in the last part of the rating process. High quality is thus conceptualized as picturing active involvement and atonement as co-activated actions.

Needless to say, the dynamic and context- dependent nature of scaffolding processes poses challenges to the construction of functional measures and several of the problems encountered in this project have previously been reported in the literature. Such challenges include the issue of units of

analysis as well as grain size e.g., in terms of capturing a single interaction event versus a longer process capturing developmental and/or in terms of transfer of responsibility. Nevertheless, there is also a substantial body of research pointing towards the importance of process quality as a means to enhance child development and learning, which motivates ongoing efforts to develop measures for the assessment of scaffolding quality.

Classroom interaction is highly complex and the construction of observational measures of classroom interaction and teaching quality involve a difficult trade-off between measurement reliability and the selection of observations which represents the actual interaction naturally taking place. Shorter observational sequences, including few participants involved in activities with clear intentions are likely to be easier to rate, at the expense of capturing the highly dynamic and fluctuating nature of scaffolding as a temporal process. The entry point for the construction of the ECSS was taken in the recognition of scaffolding as dynamic and complex as portrayed in the video observations of three different pedagogical methods, capturing a multi-faceted and rich variety of interaction and as such representative of Swedish preschool practice,. This however proved to create difficulties in terms of interpretation and rating reliability. There is therefore a need to reduce contextual noise in the next round of ratings in order to improve reliability and to investigate the psychometric properties of the scale. This can be done by selecting an even more targeted sample of video sequences from the data. In addition, the collection of additional video-recorded participant observations with a clear objective to be used for rating scaffolding quality is suggested.

The raters' experiences of using the scale also proved that it puts high cognitive demands on the rater's abilities to interpret the actions taking place in the video recordings. It is therefore suggested that the scale be simplified by omitting the teacher collaboration part of the scale, at least until the rest of the main parts of the scale have been found to be functional.

For the next round of ratings, a comprehensive training module needs to be developed. Based on the findings presented above, a training module for raters can now be developed targeting the challenges identified in terms of a qualified understanding of the conceptual framework and calibrating the ratings in relation to a selection of typical scaffolding patterns.

The question of how to judge "good" scaffolding cannot be separated from the ideals of preschool pedagogy in general. As described above, the Swedish preschool curriculum has until recently not included the concept of teaching as goal directed learning. In the context of rating preschool quality in the sample used in this study, this meant considerable problems challenging the interrater reliability. At multiple occasions the raters commented that both the SEMLA and DIL interventions did not fit into their understanding of what preschool pedagogy should look like. Therefore, the training should also address implicit theories held by the raters, as previous research has shown that raters implicit theories may account for a considerable part of the variance in instructional ratings (Praetorius et al., 2012).

5.1 Future research

Applied developmental science and intervention research with the intent of producing knowledge regarding evidence-based educational practice is a new field of research in the Swedish preschool context requiring methodological development. The potential knowledge generated with the ECSS will be of significant use for future research purposes, early childhood policy and preschool program development, as well as professional development of staff.

In line with the concept of scaffolding as related to the zone of proximal development, different children will benefit from different scaffolding means at different moments in time and depending on the intentions of scaffolding actions. High scaffolding contingency is seen as a co-construction between teacher and child, where the child's responses to teachers' actions and vice versa, will provide the basis for the evaluation of scaffolding quality. However, to what extent such interactions actually happen over time, how the balance between teacher and child actions are interrelated or not and what patterns of interaction are most characteristic depending on the scaffolding intentions as well as surrounding context, are empirical questions that are yet to be explored.

Previous research raises concerns regarding the lack of high-quality teacher-child interaction in Swedish preschool (Åström et al., 2020; Skolinspektionen, 2018) which is also in line with research from other countries (Slot, 2018). Variability in terms of high vs. low scaffolding quality in specific educational contexts needs further investigation. How scaffolding fluctuates over time, which conditions contribute to contingent scaffolding and to what extent scaffolding quality differs in relation to curricula and teaching approaches are other areas of concern motivating further investigation.

As described in the introduction, the practice of teaching has been underdeveloped in Swedish preschool and it was not until the revision of the national curriculum in 2018 that the concept of teaching was defined as “stimulating and challenging the children, taking the goals of the curriculum as a starting point and direction” (Swedish National Agency for Education, 2019, p. 7). The research on preschool didactics that has been undertaken in the Swedish context has been dominated by theoretically driven approaches based in variation theory, post-structural theory and pragmatic perspectives aiming at describing different methods and practices (Vallberg Roth et al., 2020). However, investigations of the effects of different pedagogical approaches as well as the impact of process quality on child development and learning are lacking and highly needed. The intervention study *Hjärnvägar i förskolan* in relation to which this project was developed was the first intervention study with the intention of investigating the effects of pedagogical methods on child outcomes. The study found no significant effects of neither SEMLA nor DIL on the outcome measures, and more targeted research is needed in order to decipher the interdependencies of specific learning goals, individual characteristics, process quality as well as contextual factors.

Sheridan et al. (2019) argue for the importance of focusing on enhancing process quality in Swedish preschool by focusing on teachers' education and professional development, and more research is needed regarding the conditions for improving teaching quality through training. The conceptual

framework on which the ECSS is based captures continuous movement between the child's perspective and the learning targets. The conceptual framework can be used as a foundation for the development of teacher training modules and the finalized version of the ECSS could be used for the investigation of the effects of such training on scaffolding quality.

Another way of addressing the low correlations between preschool quality and children's outcomes is the investigation of specific pedagogical curricula with clear learning targets, instructional materials and professional development. Play-Based Learning is an evidence based preschool curriculum developed in Stavanger, Norway through a collaboration between researchers and practitioners and takes the point of departure of shifting the focus from an entirely play-based to a play-based *and* learning, goal-oriented approach focusing on both general skills in terms of self-regulation as well as language and early math skills (Rege, Solli, Størksen & Votruba, 2018; Rege et al., 2019). The investigation of scaffolding as a mediator for child development and learning in the use of this curriculum would provide opportunities for further investigation of scaffolding quality.

Controlled intervention research provides the means to investigate effects of interventions on children as well as teachers. Intervention research also provide opportunities of opening up "the black box" of high quality early childhood education (Philips et al. 2017) through the investigation of theories of change, mechanisms as well as interaction effects in relation to multiple factors at stake with regards to child development and learning as part of dynamic processes within relational developmental systems (Schindler, McCoy, Fisher & Shonkoff, 2019). How co-activated scaffolding as a dynamic process varies depending on structure quality, over time and depending on specific characteristics of teachers and learners needs further investigation in order to advance the understanding of process quality. In addition, how scaffolding differs depending on the developmental level of the child in terms of age and with regard to individual variability is a highly important issue to investigate in Swedish preschools if the goal of providing best learning conditions of all children is to be met.

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7 Appendix

ECSS skattningsformulär

Namnge dokumentet enligt kolumn G i Excel-filen: Förskolekod/datum/ filmsekvenser (ex. Abx20161025-(1-9))

Varje aktivt arbetande barngrupp skattas för sig.

Om det är två grupper på samma avdelning är det viktigt att vara konsekvent med vilken grupp som är vilken.

Filmtillfälle: samma som namnet på dokumentet	Skattare:
Sekvensens längd: Om flera filmsekvenser skattats tillsammans ange sammanlagd tid	
Pedagoger kännetecken: Ange tydligt igenkännbara kännetecken så att det framgår att det är samma pedagog från tillfälle till tillfälle. P1 P2	
Antal barn:	
Kort beskrivning av sekvensen vilken aktivitet pågår, vilka deltar, hur förlöper sekvensen, något särskilt som är värt att notera	

Följande (lär)aktiviteter pågår:		
1.		
2.		
3.		
4.		
5.		
Följande lärandeobjekt kan identifieras (vad pedagogen förefaller fokusera lärandet på):		
6.		
7.		
8.		
Koppling till följande strävansmål i läroplanen (LpFö 2018) kan identifieras Ange 1-5 strävansmål(siffror) enl. nedan och specificera gärna vilka ord i målformuleringen som är mest relevanta		
	Siffror	Ord i målformuleringen
9.		
10.		
11.		

12.		
13.		

1. öppenhet, respekt, solidaritet och ansvarstagande,
2. förmåga att ta hänsyn till och leva sig in i andra människors situation samt vilja att hjälpa andra,
3. förmåga att upptäcka, reflektera över och ta ställning till etiska dilemman och livsfrågor i vardagen,
4. respekt och förståelse för alla människors lika värde och de mänskliga rättigheterna, och
5. ett växande ansvar och intresse för hållbar utveckling och att aktivt delta i samhället.
6. sin identitet och känna trygghet i den samt medvetenhet om rätten till sin kroppsliga och personliga integritet,
7. självständighet och tillit till sin egen förmåga,
8. nyfikenhet, kreativitet och lust att leka och lära,
9. förmåga att fungera enskilt och i grupp, samarbeta, hantera konflikter och förstå rättigheter och skyldigheter samt att ta ansvar för gemensamma regler,
10. förmåga att lyssna på och reflektera över andras uppfattningar samt att reflektera och ge uttryck för egna uppfattningar,
11. fantasi och föreställningsförmåga,
12. motorik, koordinationsförmåga och kroppsuppfattning samt förståelse för hur viktigt det är att ta hand om sin hälsa och sitt välbefinnande,
13. förmåga att använda och förstå begrepp, se samband och upptäcka nya sätt att förstå sin omvärld,
14. förmåga att skapa samt förmåga att uttrycka och kommunicera upplevelser, tankar och erfarenheter i olika uttrycksformer som bild, form, drama, rörelse, sång, musik och dans,
15. intresse för berättelser, bilder och texter i olika medier, såväl digitala som andra, samt sin förmåga att använda sig av, tolka, ifrågasätta och samtala om dessa,
16. ett nyanserat talspråk och ordförråd samt förmåga att leka med ord, berätta, uttrycka tankar, ställa frågor, argumentera och kommunicera med andra i olika sammanhang och med skilda syften
17. intresse för skriftspråk samt förståelse för symboler och hur de används för att förmedla budskap
18. sin kulturella identitet samt kunskap om och intresse för olika kulturer och förståelse för värdet av att leva i ett samhälle präglad av mångfald samt intresse för det lokala kulturlivet,
19. både det svenska språket och det egna nationella minoritetsspråket, om barnet tillhör en nationell minoritet,
20. både det svenska språket och sitt modersmål, om barnet har ett annat modersmål än svenska,
21. svenskt teckenspråk, om barnet har hörselnedsättning, är döv eller av andra skäl har behov av teckenspråk,
22. förmåga att använda matematik för att undersöka, reflektera över och pröva olika lösningar av egna och andras problemställningar,
23. förståelse för rum, tid och form, och grundläggande egenskaper hos mängder, mönster, antal, ordning, tal, mätning och förändring, samt att resonera matematiskt om detta,
24. förmåga att urskilja, uttrycka, undersöka och använda matematiska begrepp och samband mellan begrepp,
25. förståelse för samband i naturen och för naturens olika kretslopp samt för hur människor, natur och samhälle påverkar varandra,
26. förståelse för hur människors olika val i vardagen kan bidra till en hållbar utveckling,
27. förståelse för naturvetenskap, kunskaper om växter och djur samt enkla kemiska processer och fysikaliska fenomen,
28. förmåga att utforska, beskriva med olika uttrycksformer, ställa frågor om och samtala om naturvetenskap och teknik,
29. förmåga att upptäcka och utforska teknik i vardagen, och
30. förmåga att bygga, skapa och konstruera med hjälp av olika tekniker, material och redskap.
31. intresse för och förmåga att uttrycka tankar och åsikter så att de kan påverka sin situation,
32. förmåga att ta ansvar för sina egna handlingar och för miljön i förskolan, och
33. förståelse för demokratiska principer och förmåga att samarbeta och fatta beslut i enlighet med dem.

Skatta följande påståenden på en skala från 0-5 där 0= ej relevant, 1 = ingen eller nästan ingen förekomst, 2= förekommer sporadiskt, 3= förekommer i viss utsträckning, 4= förekommer i stor utsträckning och 5 =förekommer i mycket stor utsträckning. Skatta varje pedagog separat. Om fler än två pedagoger förekommer skattas de två som har mest interaktion med barnen.

PEDAGOGFAKTORER								
P1.0	Pedagogen använder stöttande strategier när det är relevant.		0	1	2	3	4	5
		P1						
		P2						
P1.1	Pedagogen ställer frågor som vägleder barnet/barnen i riktning mot lärandemålen.	P1						
		P2						
P1.2	Pedagogen instruerar/talar om för /visar med sin kropp hur uppgiften barnet/barnen håller på med kan lösas.	P1						
		P2						
P1.3	Pedagogen uppmuntrar med ord eller i handling barnets/barnens försök.	P1						
		P2						
P1.4	Pedagogen avstår från att avbryta barn som arbetar fokuserat inom ramen för läraktiviteten o inväntar barnets behov av stöd.	P1						
		P2						
P1.5	Pedagogen strävar efter att expanderar barnets/barnens fokus för att främja ett ökat lärande.	P1						
		P2						
P2.0	Pedagogen strukturerar aktiviteten i linje med de specifika lärandemålen.		0	1	2	3	4	5
		P1						
		P2						
P2.1	Pedagogen klargör inledningsvis vad aktiviteten går ut på, påminner vid behov/klargör om aktiviteten förändras efterhand.	P1						
		P2						
P2.2	Pedagogen ser till att funktionella och inspirerade material finns tillgängliga för barnen.	P1						
		P2						
P2.3	Pedagogen introducerar specifika ord eller verbala beskrivningar för att utveckla pågående resonemang.	P1						
		P2						
P2.4	Pedagogen vägleder vid behov barnets kroppsliga position så att det kan fokusera på aktiviteten (ex. att barnet sitter stilla vid samling eller att barnet blick är riktad så att det tydligt kan se vad som pågår).	P1						
		P2						
P2.5	Pedagogen tillåter barns initiativ till lek, utforskande och fantasi och för på ett vältajmat sätt tillbaka barnet till läraktiviteten.	P1						
		P2						
P3.0	Pedagogen stöttar både enskilda barn och barngruppen i relation till de för uppgiften specifika lärandemålen.		0	1	2	3	4	5
		P1						
		P2						
P3.1	Pedagogen tilltalar och/eller ställer frågor till hela eller merparten av barngruppen i relation till lärandeaktiviteten.	P1						
		P2						
P3.2	Pedagogen uppmärksammar med ord eller handling, hela barngruppen på deras interaktion kring lärandeaktiviteten.	P1						
		P2						
P3.3	Pedagoger uppmuntrar barnen att uppmärksamma varandras arbete, samarbeta och hjälpa varandra.	P1						
		P2						
P3.4	Pedagogen adresserar enskilda barn i gruppen för att öka deras deltagande i gruppaktiviteten.	P1						
		P2						
P3.5	Pedagogen rör sig mellan olika barn och stöttar var och ett.	P1						
		P2						
P4.0	Pedagogen ger uttryck för engagemang och fokuserad uppmärksamhet som främjar uppmärksamhet och motivation.		0	1	2	3	4	5
		P1						
		P2						
P4.1	Pedagogen förmedlar positiva känslor i förhållande till läraktiviteten genom sitt minspel (le, se glad eller entusiastiskt ut) och sätt att tala.	P1						
		P2						
P4.2	Pedagogen avhåller sig från att framstå som kort i tonen/verka irriterad när barnen inte följer instruktionerna	P1						
		P2						

P4.3	Pedagogen håller kvar sitt eget fokus på barnets läraaktivitet.	P1								
		P2								
P4.4	Pedagogen tonar vid behov in barnets negativa känslor (ex. ledsen, misslyckande, ilska) i förhållande till uppgiften.	P1								
		P2								
P4.5	Pedagogen rör sig i närheten av barnen, på barnens nivå och/eller på golvet och skapar på så sätt förutsättningar till samspel som fångar barnens uppmärksamhet och intresse.	P1								
		P2								
P5.0	Pedagogen stöttar barnets/barnens metakognitiva funktioner.		0	1	2	3	4	5		
		P1								
		P2								
P5.1	Pedagogen uppmärksammar/sätter ord på hur barnet/barnen tar sig an uppgiften. Ex. hur ska du lösa det här?	P1								
		P2								
P5.2	Pedagogen uppmärksammar/sätter ord på barnets/barnens självreglering i förhållande till uppgiften.	P1								
		P2								
P5.3	Pedagogen uppmärksammar/sätter ord på hur det känns att genomföra uppgiften.	P1								
		P2								
P5.4	Pedagogen uppmärksammar/sätter ord på hur barnet tänker och/eller kommer med förslag på hur man kan utveckla eller främja sitt tänkande.	P1								
		P2								
P5.5	Pedagogen frågar om barnet kommer ihåg /kan minnas något man gjort eller talat om tidigare.	P1								
		P2								
P6.0	Pedagogen stöttar barnets/barnens intresse och nyfikenhet		0	1	2	3	4	5		
		P1								
		P2								
P6.1	Pedagogen berättar om fakta, visar föremål, bilder eller annat konkret material som för barnen är nytt, överraskande, tvetydigt eller bryter mot tidigare föreställningar och förklaringsmodeller	P1								
		P2								
P6.2	Pedagogen ställer öppna frågor som pekar mot en avgränsad frågeställning. Ex. Hur tror ni det blev? Hur stort/tungt/högt är det tror ni? Var tror ni det finns? Hur länge sen var det? Varför tror ni det är så? Varför blev det så? Hur funkar den? Kan ni gissa hur..? Tror ni att det är A,B eller C?	P1								
		P2								
P6.3	Pedagogen väntar med att direkt leverera svar eller förklaringar.	P1								
		P2								
P6.4	När pedagogen levererar svar kopplar pedagogen in nya öppna följdfrågor eller nya frågeställningar Ex. Vill ni veta svaret? Det är faktiskt så att.. Och vet ni att...hur tror ni att..?	P1								
		P2								
P6.5	Pedagogen uppmärksammar barnens spontana frågor och låter barnet komma med egna förklaringar och hypoteser innan svaret levereras, och följer upp med nya öppna följdfrågor.	P1								
		P2								
P6.6	Pedagogen uppmärksammar barnens egna uppmärksamhetsfokus och kopplar in öppna, väl avgränsade följdfrågor Ex. Jag ser att du tittar på fåglarna, tror du de kan ...?	P1								
		P2								
TOTAL P1										
TOTAL P2										

PEDAGOGSAMSPEL							
SS.0	Pedagogernas samspel med varandra främjar stöttande av barnen i relation till lärandemålen.	0	1	2	3	4	5
SS.1	En pedagog leder aktiviteten på ett ändamålsenligt sätt.						
SS.2	När en pedagog leder aktiviteten assisterar den andre så att barngruppens uppmärksamhet på aktiviteten främjas.						
SS.3	Pedagogerna turas om att leda aktiviteten på ett ändamålsenligt sätt.						
SS.4	Båda pedagoger är aktivt involverade i samspel med barnen.						
SS.5	Pedagogerna har verbal eller icke verbal kontakt som tyder på samförstånd .						
SS.6	Pedagogerna kompletterar varandra på ett funktionellt sätt som främjar lärandet för hela barngruppen						
	TOTAL Pedagogernas samspel						

BARNFAKTORER							
B1.0	Barnet/barnen svarar på pedagogens stöttande i relation till läraktiviteten.	0	1	2	3	4	5
B1.1	Barnet/barnen svarar på pedagogens frågor.						
B1.2	Barnet/barnen lyssnar uppmärksamt och följer eller svarar på pedagogens förslag och eller instruktioner.						
B1.3	Barnet/Barnen visar engagemang och tillför egna tankar i relation till lärandeaktiviteten.						
B1.4	Barnet/Barnen arbetar fokuserat i relation till lärandemålen/uppgiften.						
B1.5	Barnen tar nya initiativ mot ett vidgat lärande.						
B2.0	Barnet/barnen förhåller sig på ett ändamålsenligt sätt till ramarna för läraktiviteten.	0	1	2	3	4	5
B2.1	Barnet/barnen bibehåller uppmärksamheten på läraktiviteten, kontinuerligt eller återkommande.						
B2.2	Barnet/barnen utforskar material och idéer på ett konstruktivt sätt.						
B2.3	Barnen lyssnar uppmärksamt och svarar på pedagogens verbala kommunikation när nya ord eller verbala beskrivningar introduceras.						
B2.4	Barnet/barnen skapar förutsättningar för sitt eget lärande genom att reglera sin kropp (ex. sitta stilla, flytta sig så att de ser bättre, ta ett djupt andetag)						
B2.5	Barnet/barnen tar initiativ till lek utforskande och fantasi						
B3.0	Både enskilda barn och barngruppen är aktivt involverade i läraktiviteten.	0	1	2	3	4	5
B3.1	Hela eller merparten av barngruppen är aktivt involverade i samtal med fokus på läraktiviteten.						
B3.2	Hela eller merparten av barngruppen är fokuserade på läraktiviteten .						
B3.3	Barnen visar intresse för varandras aktiviteter, samarbetar för att lösa/ genomföra läraktiviteten och hjälper varandra .						
B3.4	Enskilda barn behöver hjälp och vägledning av pedagogen för att delta i gruppaktiviteten.						
B3.5	Enskilda barn söker stöd hos pedagogen när hen behöver.						
B4.0	Barnen ger uttryck för engagemang och fokuserad uppmärksamhet i förhållande till läraktiviteten.	0	1	2	3	4	5
B4.1	Barnen förmedlar positiva känslor i förhållande till läraktiviteten genom sitt minspel (le, se glad eller entusiastiskt ut) och sätt att tala. Barnen bibehåller uppmärksamheten på läraktiviteten, kontinuerligt eller återkommande.						
B4.2	Barnen utmanar pedagogens handlingar, initiativ och försök att styra läraktiviteten (ex. genom att avbryta, prata i mun på varandra ej följa instruktioner)						
B4.3	Barnet fokuserar uppmärksamt på läraktiviteten.						

B4.4	Barnet/barnen uppvisar inte negativa känslor och/eller frustration i förhållande till läraktiviteten.						
B4.5	Barnen rör sig i närheten av pedagogen och tar initiativ till interaktion.						
B5.0	Barnet/barnen reglerar sitt eget lärande i förhållande till läraktiviteten.	0	1	2	3	4	5
B5.1	Barnet/barnen talat om hur de genomför uppgiften .						
B5.2	Barnet/barnen reglerar sitt eget lärande i förhållande till läraktiviteten.						
B5.3	Barnet ger uttryck för hur det känns att genomföra läraktiviteten						
B5.4	Barnet ger uttryck för hur det tänker/ använder tänkandet för att lösa läraktiviteten.						
B5.5	Barnet berättar om något som skett tidigare i relation till läraktiviteten (ex. vid tidigare tillfälle på förskolan eller en association till händelse utanför förskolan)						
B6.0	Barnen uppvisar intresse och nyfikenhet	0	1	2	3	4	5
B6.1	Barnen känner på, undersöker och manipulerar föremål och vänder och vrider på det eller tittar länge på objekt eller bilder.						
B6.2	Barnen lyssnar uppmärksamt på pedagogens förklaringar						
B6.3	Barnen kommer med egna förklaringsmodeller , funderingar, och frågor.						
B6.4	Barnen vill veta svaret .						
B6.5	Barnens samtal rör ett specifikt område som de spekulerar kring .						
	TOTAL BARN						

SAMAKTIVERAT STÖTTANDE							
S.0	Ped. stöttar i samklang med barnets/barnens intresse och uppmärksamhetsfokus på ett sätt som främjar lärande.	0	1	2	3	4	5
S.1	Syftet med lärandeaktiviteten är tydligt och barnen tar sig an uppgiften på ett ändamålsenligt sätt.						
S.2	Pedagog och barn samspelar på ett sätt som gör att både gruppens och enskilda barns deltagande i läraktiviteten främjas .						
S.3	Samspelet i rummet karaktäriseras av engagemang från både barn och pedagoger.						
S.4	Pedagogen stöttar barnets/barnens metakognition och barnet/barnen svarar genom ökad uppmärksamhet på uppgiften.						
S.5	Pedagogernas samspel med barnen leder till att barnens nyfikenhet främjas .						