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The effects of PedaSens intervention on early childhood professionals' emotional availability

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ABSTRACT: The aim of this study was to investigate the effects of a pedagogical group sensitivity (PedaSens) intervention on early childhood professionals' (ECPs) emotional availability (EA) in group interactions. A total of 61 ECPs and 264 children 1–6 years of age were included in the follow-up study. To measure the effects of the intervention, participants were randomized to intervention and control groups. The intervention consists of raising ECPs' knowledge of PedaSens both with theoretical information and video observations collected from the study groups. The quality of interaction was assessed with the Emotional Availability Scales before the intervention and the following assessments were approximately 6 and 9 months after the first assessment. Statistical analyses were used to test the differences in EA between the study groups. According to the results, intervention had a positive effect on ECPs' EA sensitivity and non-intrusiveness. The results suggest that PedaSens intervention is effective in supporting the emotional availability of ECPs. In-service training for ECP teams aiming to enhance interaction skills and reflective processes offer an effective way to improve the quality of early childhood education and care.

Keywords: *emotional availability; quality of early childhood education and care; professional development; intervention study*

Introduction

Several international studies are unanimous about the importance of the quality of adult–child interaction in early childhood education and care (ECEC) (see e.g., Burchinal et al., 2009). In most studies, the focus is on the professional interaction that aims to support children's socio-emotional learning and, above all, on improving children's learning outcomes (Burchinal, 2018; Hamre, 2014). For example, relationship-focused interventions can offer an effective way to promote the quality of teacher–child interactions in ECEC groups (Pianta, et al., 2008; Pianta, et al., 2012). Egert et al. (2018) used meta-analysis to evaluate the impact of in-service programmes for ECEC teachers on standardized quality ratings. According to the results, higher effects were found in training interventions that evaluated teachers' behaviour and interaction with children. The intensity of intervention predicted higher quality improvement. In addition, Egert et al. (2020) used a meta-analysis to survey experimental studies evaluating professional development using the Classroom Assessment Scoring System (CLASS). With a sample of 15 studies, they found that a teacher's progress was equally high on areas of emotional support, classroom organization, and instructional support.

In recent research there has been an increasing number of interventions with video-interaction guidance. These studies aimed to help ECEC teachers reflect on their interactional behaviour with the use of video clips and through discussion with the trainer (Fukkink & Tavecchio, 2010). For example, the professional development intervention "My Teaching Partner" is designed to strengthen teacher–child interaction in ECEC using the CLASS framework. This intervention utilizes video material that teachers have recorded themselves as well as video clips demonstrating best practice. Study results showed an improvement in the emotional support of the teachers in the intervention group but no improvement in other dimensions. In addition, teachers found professional development activities more valuable than control group teachers (Early et al., 2017).

An attachment-based programme, "Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline for Child Care" (VIPP-CC), sought ways to improve the quality of early childhood professionals' interaction. With the use of video feedback and discussion, intervention had a positive effect on professionals' sensitivity in structured play situations in small groups (Werner et al., 2018).

These studies usually focus on the areas of interaction of the early childhood professional (ECP) without considering the child's side of the interaction. However, it is important to bear in mind that children also have a significant role in interactions. To understand the whole complexity of interaction patterns in ECEC environments, it is essential to observe both parts of the interaction simultaneously (Biringen & Easterbrooks, 2012). In order to

explore the reciprocity between the professional and children in ECEC groups, we used the theoretical framework of emotional availability (EA) (Biringen, 2000). Moreover, the intervention described in this study was designed to enhance EA to create an emotional environment that supported togetherness between every member of the ECEC group. We describe the ECPs' emotionally and pedagogically supportive interaction using the concept of "pedagogical group sensitivity" (Harkoma et al., 2021; Nislin, 2016; Sajaniemi et al., 2015).

The aim of our PedaSens intervention study is to support professional–child interaction and pedagogical practices in a group context. In addition, the ECPs' emotional availability is used to evaluate the effects of the PedaSens intervention in ECEC. By focusing on group interaction in the EA framework, this study offers a new perspective on high-quality interaction in research and policy-making in the field of ECEC.

Quality of interaction in early childhood education and care

The quality of early childhood education and care does not have a single definition, but it is usually related to policies and practices that can improve conditions to support children's learning, development and well-being in both cognitive and socio-emotional areas (OECD, 2019). The definition of ECEC quality is usually divided into the structural and process characteristics (Slot et al., 2015). Structural characteristics refer to child-staff ratios, the size of groups, the age of the children and EPCs' training, as well as pre- and in-service education and professional development (Burchinal et al., 2002; Slot, 2018). Process characteristics consist of dynamic aspects and everyday experiences in ECEC settings, such as adult–child and peer interactions in play, activities and routines (Edwards, 2021; La Paro et al., 2012). Structural and process characteristics of quality are in constant dynamic interaction with each other, and should be considered and evaluated in relation to each other (Vlasov et al., 2021).

The quality of interaction is related to a combination of many structural characteristics that interact with each other (Slot, 2018). For example, children's interaction in ECEC is affected by long-term staff continuity, group size, professionals' education level, and their capacity to adapt to individual children's needs and interests, engage in different group activities, and the ability to interact with children of different temperaments, as well as considering their individual characteristics (Harkoma et al., 2021; OECD, 2021; Slot et al., 2015). Furthermore, ECPs' possibilities for in-service education and professional development can also affect the quality of interaction in child groups (OECD, 2006; Taguma et al., 2012), and affordances for these can vary depending on how the ECEC services are organized within municipalities. We argue that high-quality interaction as a process characteristic of ECEC quality depends on many structural characteristics. In this

study, we focus on the quality of adult-child interaction and professional development in ECEC settings.

Early childhood professionals' ability to engage in sensitive interaction with children is one of the most important quality factors in ECEC, and it can be used to promote preschool children's intellectual, social and behavioural outcomes in school (Karila, 2016; McNally & Slutsky, 2017; OECD, 2015; Sylva et al., 2004). According to Sylva et al. (2006) the quality of interaction predicted pre-school children's cognitive and socio-emotional development. In addition, consistent emotional support and close teacher–child relationships provide social competence and fewer problem behaviours in ECEC (Brock & Curby, 2014). Additionally, high-quality interaction predicts higher levels of social skills and lower levels of behavioural problems for low-income children (Burchinal et al., 2010).

The Finnish national guidelines and recommendation for quality evaluation in ECEC highlights, for example, the staff's positive and caring interaction, their sensitivity and responsiveness to children's initiatives, as well as the ability to consider all the children in the group regarding their individual ways of expressing themselves (Vlasov et al., 2018). Several studies have indicated that the quality of teaching practices and teacher–child interaction, measured by the CLASS, is relatively high in Finnish ECEC. This is explained by the fact that Finnish ECEC teachers are highly qualified, and only skilled and motivated students pass the application process (OECD, 2012; Pakarinen et al., 2010; Salminen et al., 2012; Slot et al., 2015). However, Kalliala's (2011) study indicated that the quality of interaction, especially the ECEC teacher's sensitivity as a capacity to understand children's verbal and non-verbal signals, can appear surprisingly unstable in classrooms of children under three years of age. More comprehensive research needs to be carried out to clarify and improve the quality of interaction in ECEC.

Emotional availability (EA) in group interaction

The EA framework was applied in this study. The framework draws from the original attachment theory (Bowlby, 1969, 1973), and sensitivity of the mother in perceiving the child's signals and communications, as well as responding to them to maintain positive emotional interaction with the child (Ainsworth et al., 1974; Ainsworth et al., 1978). Instead of the original interpretation of maternal sensitivity, the concept emotional availability (EA) describes the affect and behaviour of the adult–child interaction in relational perspective (Biringen & Easterbrooks, 2012). It refers to the emotional signalling in reciprocal interaction between the early childhood professional and the child.

Previous research in ECEC shows that EA intervention can enhance the ECP's structuring and children's responsiveness in dyadic interaction. The attachment security of children

to their professional increased during the intervention (Biringen et al., 2012). EA intervention has proved to be an effective way of supporting dyadic interactions in ECEC, but its possibilities in supporting group interactions are still less known. Ereky-Stevens et al. (2018) studied ECP sensitivity during one-to-one and group interactions, and the results showed that the quality of group-related sensitivity predicted the secure attachment of the children during the first four months in a new childcare environment. Group-related sensitivity refers to the ECP's behaviour towards the group of children as well as behaviour directed towards the individual child in a group (Ahnert et al., 2006).

Based on the theoretical framework of emotional availability, PedaSens combines the theoretical aspects of high-quality interactions and practical components, including pedagogical practices used to support children's age-appropriate development and learning (Nislin, 2016; Sajaniemi, et al., 2015; Suhonen & Sajaniemi, 2012). We argue that high-quality interaction requires ECPs' engagement with individual children as well as with the whole group. According to Singer (2017, p. 209), "educators need to be attuned to each individual child, and at the same time, they have to spread their attention between the children." In the context of ECEC it is extremely important that ECPs have enough knowledge to observe and be aware of both the individual child's and the whole group's emotions and to co-regulate their emotional and behavioural states in different and challenging events. Co-regulation refers to the ECP's attunement to the children's emotions with an attempt to enhance adaptive behaviour and to help the children regulate themselves in day-to-day situations (Fogel, 1992; Murray et al., 2019; Nislin, 2016).

For example, if an individual child is repeatedly disconnected and withdrawn from the group during play, the child needs co-regulation. In this situation, co-regulation could be described as the ECP's ability to remain emotionally available and respond to the child's behaviour and emotions in a way that brings him/her back to group interaction (Sajaniemi et al., 2015). In addition, the child may benefit from gentle and supportive guidance without putting too much pressure on the child (Biringen, 2008; Harkoma et al., 2021). At the same time, the ECP usually needs to guide and encourage other children during an ongoing activity and share his/her attention with the entire group.

Research questions

The present study employed an experimental design to explore outcomes associated with PedaSens intervention. More specifically, the aim is to produce more comprehensive knowledge about group interactions and the development of professionals' emotional availability in the context of ECEC. The guiding question for this research is:

To what extent can PedaSens support the development of early childhood professionals' emotional availability in group interactions, while also taking into consideration of background characteristics related to the professionals, child groups and the municipality of the ECEC centre (such as professionals' age and education level, and age group of the children in the group)?

Methods

Randomization and characteristics of participants

The recruitment targeted four cities, and all ECEC centres and professional teams had equal possibilities to participate in the study. The information about the study was provided to the management of the ECEC services and ECPs, including information sessions arranged by the research team and invitation letters that were sent to ECEC centres. After the early childhood professionals in the child groups expressed their willingness to participate, they were randomized in the intervention (IG) and control groups (CG). Random selection and assignment took place at the child group level, allowing the different child groups within the same centre to be in different study groups. This allowed us to ensure that there was approximately the same number of ECPs working in the intervention and the control groups. In addition, the age of the children in the child groups could be taken into consideration in randomization, so that approximately the same number of different-age child groups would be included in both study groups. This randomization procedure had the threat of spillover—there was the possibility that the ECPs in the control group would hear about the intervention from the professionals taking part and, consequently, improve with this information. This has been discussed further in the limitations of the study.

A total of 16 ECEC centres and 24 child groups were included in the randomization and considered to be an original pool. One of the control child groups was eliminated from this study due to missing follow-up data; consequently, the final pool consisted of 23 child groups (15 groups in the IG; 8 groups in the CG). The imbalance between the intervention and control child groups is due to the fact that four of the groups only wanted to participate as an intervention group, which was allowed in the sample. Majority of the centres were public and one of the centres was private. Child groups with different age groups were included in the study; an intervention group (nine 1–3-, three 3–5-, one 5–6-year-olds' child groups and two mixed-age child groups) and a control group (four 1–3-, three 3–5- and one 5–6-year-olds' child groups). According to the centre staff, every child in the study participated in ECEC at least 20 hours per week, except children in round-the-clock care (response rate 91%).

The children's parents received consent forms and letters introducing them to the intervention and research. The original pool of children, who participated with their parents' written consent, included 274 children; of these children, 264 were included in the final pool with follow-up measurements (174 in the IG and 90 in the CG). A minimum of 2 and a maximum of 20 children in every child group were included in the study. Children ranged in age between 9 and 80 months, and the mean for children's age in months in the IG was 38.77 (SD = 19.92) and in the CG 37.61 (SD = 14.69). There were children with special needs in 10 of the 23 child groups. The need for special support was based on pedagogical assessment and a statement from an expert.

In the original pool, 74 ECPs participated in the study with written consent. The final pool of the study was 61 ECPs (41 in the intervention group and 20 in the control group). ECPs ranged in age from 23 to 62 years, and they spoke the Finnish language. A majority (96.7%) of the ECP participants were female. The ECPs were working in the ECEC centres as early-childhood education teachers with university training (Bachelor's degree in Education/Master's degree in Education) and social pedagogues in ECEC (Bachelor's degree in Health and Social Services), nursery nurse/group assistant with vocational school (VS) training. Specific details of the ECPs and child group characteristics are described in Table 1.

ECPs in the intervention group were instructed not to share any content of the intervention to outsiders of the team and/or the ECEC centre. ECPs in the control group did not receive any supervision during the research period, but it was offered to them after the study. According to the directors of the ECEC centres, there were no other intervention programmes or studies in the professional teams or child groups that might have had any impact on the quality of interactions in the participating groups.

TABLE 1 Characteristics of professionals and child groups

VARIABLE	*OVERALL (N = 61)*	*INTERVENTION GROUP (N = 41)*	*CONTROL GROUP (N = 20)*	*p-value*
Mean (SD) age in years	46.59 (10.18)	45.27 (10.28)	49.30 (9.65)	.15
Mean (SD) years working in ECEC	21.23 (12.71)	19.54 (12.77)	24.70 (12.17)	.14
Mean (SD) size of a child group	16.8 (5.93)	17.05 (6.65)	16.30 (4.19)	.60
Mean (SD) ECPs in the team	3.34 (.83)	3.44 (.98)	3.15 (.37)	.10
Level of education %				.37[a]
B.Ed./M.Ed. University	23%	19.5%	30%	
Bachelor of Health and Social Services	19.7%	24.4%	10%	
Nursery nurse / Group assistant (VS)	57.4%	56.1%	60%	
Children with special needs in the child group %				.13[a]
Yes	42.6%	48.8%	30%	
No	57.4%	51.2%	70%	
Children's age group %				.06[a]
1–3 years	57.4%	58.5%	55%	
3–5 years	21.3%	17.1%	30%	
5–6 years	8.2%	4.9%	15%	
Mixed age	13.1%	19.5%	0.0%	
Municipality of the centre %				
City 1	52.5%	53.7%	50.0%	.12
City 2	14.8%	9.8%	25.0%	
City 3	21.3%	19.5%	25.0%	
City 4	11.5%	17.1%	0.0%	

Note. Independent samples T test, [a] Fisher's Exact Test . **p* <.05, ***p* <.01, ****p* <.001. For some variables, more than 20% of the expected values in cells are less than 5.

Ethical considerations

The study was approved by the Ethics Committee on Human Studies (November 17th, 2017), and written consent forms were received from children's parents and early childhood professionals. All participants were informed of the research protocol including the intervention, data collection, and follow-up measurements. Participants were allowed to cancel their participation during any phase of the study without any specific reason for leaving, and have their data removed from the study.

Ethical principals were carefully considered regarding the video observations of the participants and especially children in the study groups. ECPs and their supervisors had specific instructions for the video observations, and they were instructed to observe child-participants' willingness to participate in the filming, based on their verbal and nonverbal expressions. If any of the child participants felt uncomfortable or disruptive during the video observation, the filming had to be paused, and if possible, re-scheduled.

Data collection and EA Scales assessments

Data collection was conducted by filming and observing professional–child interactions in the research groups. The focus of the video observations was on the group interaction between the early childhood professional and several children present in the child group. After the pretest, the video material was assessed and edited concerning the supervision that was implemented for the intervention group. Post-test measurement and video observation was completed in the IG six months after the beginning of the intervention, and half (51.2%) of the professionals in the IG received an extra supervision session based on this video material. The similar measurements and video observations were completed in the CG at the same time, in both study groups approximately six months after the pretest measurement (*range* 5–7.2 months, *M* = 6.17 months). The delayed post-test measurement and video observation were completed in both study groups approximately nine months after the pretest measurement (*range* 7.43–13.50, *M* = 9.36).

In most ECP teams, video observation was conducted by an expert working in the field of ECEC and/or child psychiatry, and this expert also had an important role as a supervisor for the teams. The experts were instructed in the observation protocol beforehand. They were instructed not to interfere with the activities or engage with either the ECPs or the children. During the video observations, ECPs were encouraged to go about their daily activities and to interact as they normally would with all of the children. One to 11 children were included in the interactions with one ECP at a time, and the mean of the children present in the video observations was 3.6 (*SD* = 1.38). Only two (1.1%) of all videoed interactions (from a total of 183 video observations) were dyadic. Group composition of the children varied at different measurement points.

The video observations were analysed in the frame of the Emotional Availability (EA) Scales to investigate the emotional features of adult-child relationships (Biringen, 2008). The EA scales have been validated for children from 0 to 14 years of age (Biringen et al., 2014; Easterbrooks & Biringen, 2009). Early childhood professionals' EA dimensions comprise sensitivity, structuring, non-intrusiveness, and non-hostility (Biringen et al., 2000). *Sensitivity* refers to ECP's ability to create a generally positive, genuine, and authentic affective climate. It focuses on the emotional sensitivity of the professional by using verbal and non-verbal expressions congruently and by exhibiting appropriate responsiveness to the child's emotional expressions. Sensitivity also includes awareness of timing, flexibility, and creativity of play, as well as the ability to remain calm and negotiate in conflict situations (Biringen, 2000; Biringen et al., 2014). *Structuring* is ECP's ability to adequately guide, scaffold, and set limits to the child's activities while at the same time allowing his/her autonomy. *Non-intrusiveness* refers to interaction that steers clear of over-direction and over-stimulation, interference, and over-protection. This means that the child should be treated according to his/her age and level of development and should be allowed autonomy in his/her activities. *Non-hostility* is defined by the absence of covert or open hostile responses in the ECP's interaction to the child. The child dimensions of EA consist of the child's responsiveness to and involvement with the ECP. *Child responsiveness* to the ECP refers to emotional and social responsiveness, namely how the child responds to the professional's invitation to interaction in both a behavioural and emotional manner. In addition, *child involvement* describes the child's ability to involve the ECP in his/her activities and play. This requires a wide range of verbal and non-verbal initiatives that the child uses to involve the professional in his/her activities (Biringen et al., 2014).

Each EA dimension is operationalized into subscales, and the subscales are rated on a 7-point scale or a 3-point scale. The highest possible total score from the subscale is 29, and 7 as a direct score from each assessed EA dimension. In most studies, the EA Scales are used to measure dyadic interaction between the adult and child (Biringen et al., 2012). The focus of the current study was to assess the ECPs' EA in group interactions. As a result, every dyadic interaction between the ECP and the child present in the video observation was assessed separately, and the mean of these assessments in every EA dimension form an analysing unit for the quality of the ECPs' interaction with the group of children. The descriptive statistics for mean values of emotional availability are presented in Table 2.

The assessment using EA Scales required 20–30-minute episodes of the interaction between ECP and children (Biringen et al., 2012). The mean duration of the one EA assessed video was 25.16 minutes (*SD* = 5.24 minutes), and the range in the duration of these videos was 10.07–55.07 minutes. The total amount of video material collected for the study was approximately 76 hours. Due to both technical and practical reasons, a

small number of the videos (7%) were less than 20 minutes long, and these videos were included in the study due to their coverage of the research data. Reliability of the video observations is enhanced if the duration of the videos is 20–30 minutes. It is possible to achieve reliability with 10-minute videos but there is limited confidence and validity in the results (Biringen, 2005).

TABLE 2 Descriptive statistics for Emotional Availability variables of ECPs

VARIABLE	*INTERVENTION GROUP (N = 41)*			*CONTROL GROUP (N=20)*		
	Pretest	*Post-test*	*Delayed post-test*	*Pretest*	*Post-test*	*Delayed post-test*
Sensitivity						
Mean	5.34	5.84	5.77	5.42	5.28	5.44
SD	0.46	0.64	0.47	0.57	0.53	0.54
Range	4.50–6.67	4.33–7.00	5.00–6.75	4.25–6.75	4.13–6.38	4.50–6.50
Structuring						
Mean	5.28	5.85	5.74	5.51	5.30	5.51
SD	0.55	0.70	0.51	0.65	0.51	0.66
Range	4.00–6.50	3.83–7.00	4.25–6,75	4.75–7.00	4.25–6.25	4.21–6.67
Non-intrusiveness						
Mean	5.51	5.88	5.98	5.51	5.28	5.60
SD	0.51	0.67	0.55	0.68	0.68	0.75
Range	4.17–6.75	4.50–7.00	5.00–7.00	4.25–6.63	4.13–6.58	4.17–6.75
Non-hostility						
Mean	6.32	6.38	6.42	6.30	6.16	6.33
SD	0.28	0.28	0.20	0.28	0.43	0.36
Range	5.50–7.00	5.17–7.00	5.50–6.67	5.67–6.50	5.25–6.50	5.50–7.00
Child responsiveness						
Mean	5.42	5.90	5.80	5.50	5.46	5.62
SD	0.45	0.59	0.39	0.52	0.52	0.57
Range	4.25–6.83	4.33–6.83	4.88–6.75	4.75–6.75	4.33–6.50	4.57–6.50
Child involvement						
Mean	5.13	5.67	5.74	5.28	5.32	5.47
SD	0.46	0.68	0.46	0.53	0.46	0.68
Range	4.00–6.17	3.83–6.75	4.88–6.75	4.38–6.38	4.25–6.13	4.07–6.63

Note. Means and standard deviations for EA values without adjustments.

PedaSens intervention

In this section we describe the implementation and contents of the intervention used in the PedaSens study. The study was piloted during the years 2013–2016 to test the intervention design in ECEC child groups. The first phase of the intervention consists in raising the early childhood professionals' knowledge of pedagogical group sensitivity, using theoretical and practical information, and video material demonstrating the best practice of group interaction. Theoretical and practical information included, for instance, knowledge about the importance of secure attachment relationships and children's individual characteristics. Emotional availability dimensions (sensitivity, structuring, non-intrusiveness, non-hostility and child responsiveness/involvement) were explained to the ECPs by considering their practical use in group interactions. In addition, video material was also collected from the study groups, and after the assessment of the EA Scales, it was used in the feedback that was given to every ECP in the team. Supervision sessions were designed to support individual and team reflection, as it allowed ECPs to participate in the conversation and express their own perspectives related to the children and to practices.

Theoretical aspects and video material were used in five 90-minute supervision sessions between the ECP team and a trained supervisor (7.5 hours). The first supervision session was a theoretical lecture of pedagogical group sensitivity including discussion related to the subject and to children in the child group. The second session was one week after the first, and it included video examples demonstrating best practice of sensitive ECP–children interaction in the group context. Three (session 3) and six weeks (session 4) after the first session, the ECPs watched videos recorded in the child group and discussed their individual interaction with the children. While watching the videos, the supervisor was instructed to highlight the strengths and successful practices of every ECP. Finally, the fifth session was approximately three months after the first session. During the final session, the successes and challenges of the entire three-month process were discussed. According to the supervisors and ECPs, the sessions were held on schedule, and only two of the professionals were absent from one supervision session (response rate 92.7%). Intensive supervision made it possible to inform absent ECPs afterwards about the contents of the sessions.

After the final session, the ECPs were introduced to the idea of a written diary, including reflective questions about their personal interaction and teamwork in the child groups (session 5). The questions were also linked to the theory and dimensions of the professionals' EA. The first part of the diary offered information about the ECPs' personal interaction style. The second part of the diary was for the ECPs to reflect on the questions at least once a month during the rest of the study period. At the individual level, the questions concerned the ECPs' personal interaction linked to the concepts of Emotional

Availability Scales, and at the team level, the questions were designed to support teamwork and reflection after a challenging or somehow meaningful event with the children. The instruction was to write the diary at least once a month and send it to the supervisor and research staff (phase 2).

Approximately 7–8 months after the beginning of the intervention, 21 (51.2%) professionals in the intervention group received an extra supervision session (90 minutes) based on the video material collected at the post-test measurement (phase 3). This extra supervision session was provided to support the ECPs' participation and group interactions in the child groups. In addition, it was meant to provide more knowledge about the importance of long-term support for professionals' development in the intervention group. The session was similar to sessions 3-4 and, according to the supervisors and ECPs, one professional was absent from the sessions (response rate 66.7%). The phases of the intervention described are in Table 3.

Intervention fidelity

In this study, special attention was given to the instruction of supervisors working with the early childhood professional teams. The supervisors' instruction was provided by the first author, and they were trained in accordance with the theoretical framework of the intervention. For the individual feedback, supervisors had a written checklist to make sure that adequate video-based feedback was given to every ECP. In addition, during the intervention, supervisors had the possibility of discussing the challenges they encountered with the researcher by phone and/or email.

The reflective diaries for individuals and teams were used to intensify the fidelity of the intervention. The diary was used to support the ECPs' individual and team reflections in relation to their everyday interaction with a group of children, and also to follow and support their professional development during the research period. According to the data analyses, 86% (35 entries) of the ECPs in the intervention group returned the written reflection after the first phase of the supervision. The data analyses revealed that a total of 63 (25.6% of the required) diary entries from individual ECPs and 34 (52.3% of the required) diary entries from the ECP teams was returned during the study period.

TABLE 3 Phases of the intervention

PERIOD	*MEASUREMENT*	*CONTENT*	*CHANGE METHODS*
Phase 1 **(first three months)**	Pretest—video observations before the intervention	Supervision sessions with the professional teams (five 90-minute sessions within three months after the pretest measurement)	Theory of pedagogical sensitivity Video examples representing the sensitive interaction in group interactions Video episodes and positive feedback for the ECPs about their personal interaction style with the children Reflective discussions with supervisor and the professional teams
Phase 2 **(months 3–9)**	Post-test – video observation six months after the beginning of the intervention	Reflective diary (at least once a month until the delayed post-test measurement)	Reflective questions for the individuals about their personal interaction style Team reflection and discussions about good practices in relation to group characteristics Sharing positive feedback for other members of the professional team
Phase 3 **(month 7–8)**		Extra supervision session with the professional teams in the intervention group. Half of the ECPs received (51.2%).	Video episodes and positive feedback for the ECPs about their personal interaction style with the children Reflective discussions with supervisor and the professional teams

Note. Delayed post-test—video observations nine months after the beginning of the intervention

Statistical analyses

The descriptive data were used to characterize the sample, presented in mean, standard deviation, and percentage. The Shapiro-Wilk test was used to test the normality of the main dependent variables between the study groups for the pretest, post-test, and delayed post-test measurements. The EA dimension of non-hostility did not satisfy the normalcy assumptions ($p < .05$) in any measurement points, and it was removed from the statistical analyses. This was to be expected, as the non-hostility dimension is designed to capture specific types of negative behaviour and emotional expressions that should be uncommon in the ECPs' interaction with children. Finally, the EA dimensions of adult sensitivity, structuring, non-intrusiveness and child responsiveness/involvement were mainly normally distributed, and the assumptions of data normalcy were uncertain only for a small percentage (10 %) of the EA dimensions between the study groups.

At baseline, comparisons between the study groups in background characteristics and EA dimensions were made by using independent samples T test and the Pearson Chi-Square test. The correlation coefficients between the EA dimension and background variables were analysed with the Pearson and Spearman correlation. The differences on EA variables between the municipality of the ECEC centres was analysed with the Univariate Analysis of Variance. The differences between the intervention and control group on EA pretest variables were tested with the Independent Samples T-test. Then, the repeated measures ANOVA was applied to analyse the intervention effect on EA dimensions between the study groups, and in relation to background characteristics used as a covariate or an extra between-subjects variable. All analyses were performed by IBM SPSS statistical software (version 25), and the significance level was 5%. Corrected effect sizes (Cohen's *d*) for intervention effect analyses between the study groups were calculated for mean differences of groups with unequal sample sizes within pre- and delayed post-test measurements (Klauer, 2001; Turner & Bernard, 2006). An effect size of .30 was considered a small effect, of .50 a medium effect, and of .80 a large effect.

Results

To test differences between the groups at the start of the study, early childhood professionals in both groups were compared on background characteristics listed in Table 1, as well as pretest scores on the dimensions of the Emotional Availability (EA) Scales. No statistically significant differences were found in any of the background variables or EA dimensions between the intervention and the control group, indicating that the groups were comparable.

The evaluation of the background characteristics

The first phase of the analyses was to evaluate associations between background characteristics and the EA in group interactions. The correlations between the EA dimension and the background variables were analysed by using Pearson and Spearman correlation coefficients. The purpose of these correlation analyses was to investigate the usage of potential covariates in the intervention effect analyses. Based on the bivariate correlations (see table 4), the ECPs' education level was included in the further analyses with all EA dimensions. The size of a child group and children with special needs in the child group were included in the further analyses with EA dimension adult structuring and children with special needs with child responsiveness. In addition, the ECPs' age was included with EA dimensions for sensitivity, structuring and non-intrusiveness. No significant correlations were found between EA and the ECP's working experience and team size or children's age group, and as a result, these variables were excluded from the main analyses. Univariate Analysis of Variance revealed a significant difference between the municipality of the ECEC centre and child EA involvement variable at the pretest [$F(3, 57) = 3.11$, $p = .03$], and this background variable was also included in the main analyses.

TABLE 4 Correlation coefficients between EA dimension and background characteristics

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1 Pretest sensitivity											
2 Pretest structuring	.870**[a]										
3 Pretest non-intrusiveness	.691**[a]	.552**[a]									
4 Pretest responsiveness	.836**[a]	.770**[a]	.474**[a]								
5 Pretest involvement	.771**[a]	.750**[a]	.447**[a]	.816**[a]							
6 ECPs' age	-.120[a]	-.028[a]	-.117[a]	-.073[a]	-.136[a]						
7 ECPs' working experience	-.100[a]	-.063[a]	-.115[a]	-.123[a]	-.176[a]	.672**[a]					
8 Child group size	-.219[a]	-.300*[a]	-.134[a]	-.051[a]	-.025[a]	.020[a]	-.175[a]				
9 ECP team size	-.127[a]	-.206[a]	-.118[a]	-.132[a]	-.018[a]	-.042[a]	-.202[a]	.758**[a]			
10 ECP level of education	-.512**[b]	-.375**[b]	-.254*[b]	-.398**[b]	-.341**[b]	.163[b]	.117[b]	-.115[b]	-.008[b]		
11 Special needs children	.154[b]	.257*[b]	.010[b]	.093[b]	.152[b]	-.188[b]	-.056[b]	-.465**[b]	-.170[b]	-102[b]	
12 Children's age group	-.058[b]	-.151[b]	-.091[b]	.031[b]	.049[b]	.189[b]	-.014[b]	.707**	.444**[b]	-.196[b]	-.500**[b]

(Table continues on the following page)

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1 Post-test sensitivity											
2 Post-test structuring	917**[a]										
3 Post-test non-intrusiveness	.813**[a]	.740**[a]									
4 Post-test responsiveness	.861**[a]	.891**[a]	.711**[a]								
5 Post-test involvement	.819**[a]	.854**[a]	.663**[a]	.938**[a]							
6 ECPs' age	-.399**[a]	-.383**[a]	-.453**[a]	-.324*[a]	-.295*[a]						
7 ECPs' working experience	-.111[a]	-.105[a]	-.216[a]	-.104[a]	-.057[a]	.672**[a]					
8 Child group size	-.202[a]	-.234[a]	-.088[a]	-.066[a]	-.023[a]	.020[a]	-.175[a]				
9 ECP team size	-.103[a]	-.115[a]	.053[a]	.038[a]	.057[a]	-.042[a]	-.202[a]	.758**[a]			
10 ECP level of education	-.365**[b]	-.286*[b]	-.283*[b]	-.308*[b]	-.380**[b]	.163[b]	.117[b]	-.115[b]	-.008[b]		
11 Special needs children	.246[b]	.314*[b]	.123[b]	.315*[b]	.222[b]	-.188[b]	-.056[b]	-.465**[b]	-.170[b]	.102[b]	
12 Children's age group	-.162[b]	-.197[b]	-.094[b]	-.015[b]	.040[b]	.189[b]	-.014[b]	.707**[b]	.444**[b]	-.196[b]	-.500**[b]

(Table continues on the following page)

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1 Delayed post-test sensitivity											
2 Delayed post-test structuring	.818**[a]										
3 Delayed post-test non-intrusiveness	.765**[a]	.610**[a]									
4 Delayed post-test responsiveness	.841**[a]	.860**[a]	.710**[a]								
5 Delayed post-test involvement	.809**[a]	.833**[a]	.672**[a]	.941**[a]							
6 ECPs' age	-.369**[a]	-.308*[a]	-.367**[a]	-.179[a]	-.142[a]						
7 ECPs' working experience	-.011[a]	-.060[a]	-.165[a]	.051[a]	.098[a]	.672**[a]					
8 Child group size	-.246[a]	-.291*[a]	-.051[a]	-.187[a]	-.193[a]	.020[a]	-.175[a]				
9 ECP team size	-.159[a]	-.193[a]	-.109[a]	-.158[a]	-.172[a]	-.042[a]	-.202[a]	.758**[a]			
10 ECP level of education	-.250[b]	-.245[b]	-.203[b]	-.227[b]	-.219[b]	.163[b]	.117[b]	-.115[b]	-.008[b]		
11 Special needs children	.112[b]	.085[b]	-.019[b]	.074[b]	.024[b]	-.188[b]	-.056[b]	-.465**[b]	-.170[b]	.102[b]	
12 Children's age group	-.210[b]	-.180[b]	-.078[b]	-.064[b]	-.048[b]	.189[b]	-.014[b]	.707**[b]	.444**[b]	-.196[b]	-.500**[b]

Note. [a] Pearson correlation coefficient, [b] Spearman correlation coefficient. *p<.05, **p<.01, ***p<.001.

The effects of the intervention

Before the main analyses the differences between the intervention and control group on EA pretest variables were tested using the Independent Samples T-test. The results did not reveal any significant differences between the intervention and control group on any of the EA pretest variables ($p > .05$). As previously mentioned, 20 ECPs in the intervention group received the basic intervention and 21 ECPs received the extra supervision session after the post-test measurement, while 20 ECPs in the control group did not receive any supervision included in the intervention. Statistical analyses with repeated measurements (pairwise comparisons with Bonferroni adjustments) did not reveal any statistically significant differences between the basic and extra intervention groups ($p > .05$) for any EA dimensions, and these two groups were combined as one intervention group with 41 ECPs.

The primary analyses consisted of differences between the study groups in three repeated measures (pretest, post-test, and delayed post-test measurements) of variance with mean Emotional Availability values serving as a within-subject variable. The early childhood professionals' education level (with all EA variables), children with special needs in the child group (with adult EA structuring and child responsiveness), and municipality of the ECEC centre (with child involvement) variables were included in the model as an extra between-subject variable with the study group. To simplify the model, analyses with these extra between-subject variables were conducted separately. The variables of a ECPs' age (with adult EA) and size of a child group (with adult structuring) were tested and removed from the final results, as having no significant interaction with the EA. The assumptions of equality of variances (Mauchly's test of sphericity $p > .05$; Box's test of Equality of Covariance Matrices $p > .001$) were fulfilled with all EA variables used in the analyses.

According to the results, a significant change across time was found on adult EA dimensions' sensitivity ($F(2, 118) = 4.466$, p = .013, $\eta^2 = .070$), structuring ($F(2, 110) = 6.065$, $p = .003$, $\eta^2 = .099$), non-intrusiveness ($F(2, 118) = 4.530$, $p = .013$, $\eta^2 = .071$), child responsiveness ($F(2, 110) = 7.830$, $p = .001$, $\eta^2 = .125$), and involvement ($F(2, 110) = 11.981$, $p = .000$ $\eta^2 = .179$). Moreover, the difference between the study groups was found to be significant across the time points on the adult EA dimensions of sensitivity ($F(2, 118) = 8.597$, $p = .000$, $\eta^2 = .127$) and non-intrusiveness ($F(2, 118) = 4.804$, $p = .010$, $\eta^2 = .075$), and almost significant on EA structuring ($F(2, 110) = 3.048$, $p = .051$, $\eta^2 = .053$). The EA dimensions of structuring ($F(4, 110) = 2.785$, $p = .030$, $\eta^2 = .092$), child responsiveness ($F(4, 110) = 3.675$, $p = .008$, $\eta^2 = .118$), and involvement ($F(4, 110) = 2.950$, $p = .023$, $\eta^2 = .097$) had a significant Time x Group x Education interaction. The variables for children with special needs in the child group and municipality of the ECEC centre had no significant interaction with the EA dimensions, and they were excluded from the results. Table 5 summarizes the results of the intervention-effect analyses.

TABLE 5 Repeated measures Analyses of Variance

EA Variable	*MS*	*df*	*F*	*p-value*	*Partial eta squared* η^2
Sensitivity					
Time	.74	2	4.466	.013*	.070
Group x Time	1.42	2	8.597	.000***	.127
Group x Time x Education	.29	4	1.786	.137	.061
Structuring					
Time	1.31	2	6.065	.003**	.099
Group x Time	.66	2	3.048	.051	.053
Group x Time x Education	.60	4	2.785	.030*	.092
Non-intrusiveness					
Time	1.16	2	4.530	.013*	.071
Group x Time	1.23	2	4.804	.010*	.075
Group x Time x Education	.24	4	.911	.460	.032
Child responsiveness					
Time	1.34	2	7.830	.001**	.125
Group x Time	.478	2	2.797	.065	.048
Group x Time x Education	.629	4	3.675	.008**	.118
Child involvement					
Time	2.62	2	11.98	.000***	.179
Group x Time	.303	2	1.385	.255	.025
Group x Time x Education	.645	4	2.950	.023*	.097

Note. Repeated measures ANOVA with Sphericity Assumed. * $p < .05$, ** $p < .01$, *** $p < .001$.

For EA sensitivity, the Test of Within-Subjects Contrasts revealed that the Time x Group interaction was significant between the pretest and post-test measurement $F(1, 59) = 17.343$, $p = .000$, $\eta^2 = .227$, and also between the pretest and delayed post-test measurement $F(1, 59) = 6.383$, $p = .014$, $\eta^2 = .098$. In addition, the similar interaction for EA non-intrusiveness was significant between the pretest and post-test measurement $F(1, 59) = 9.606$, $p = .003$, $\eta^2 = .140$, and almost significant between the pretest and delayed post-test measurement $F(1, 59) = 3.818$, $p = .055$, $\eta^2 = .061$. No differences were found between the post-test and the delayed post-test measurement for EA sensitivity or non-intrusiveness. Effect size (Cohen's *d*) for mean differences of groups with unequal sample size within the pre- and delayed post-test measurements was .829 for EA sensitivity and .611 for non-intrusiveness. Figures 1 & 2 visualize the differences between the study groups for EA sensitivity and non-intrusiveness.

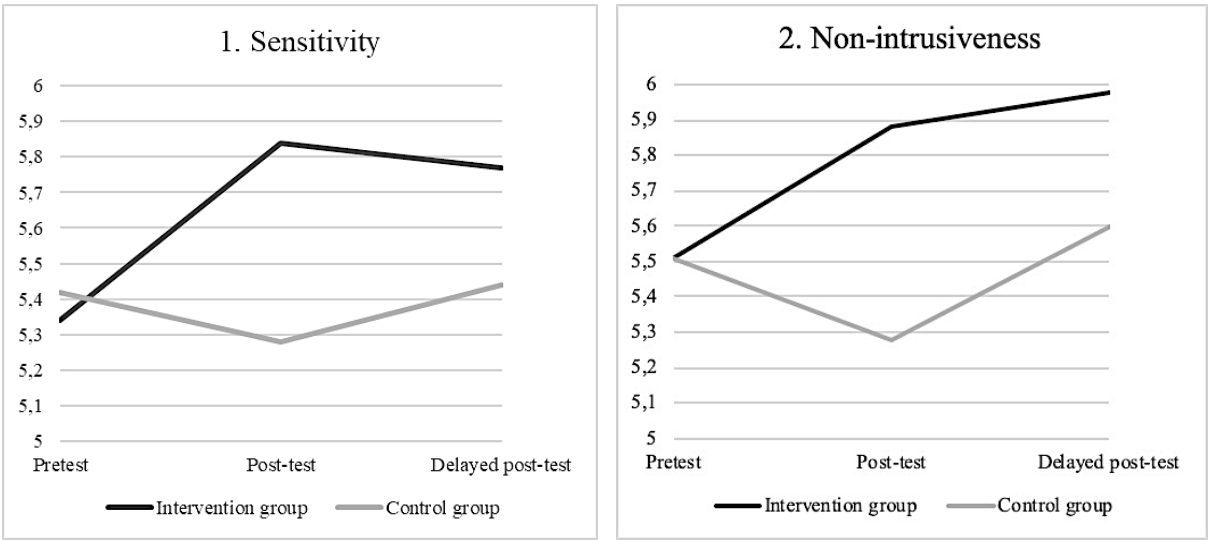

FIGURE 1 & 2 Intervention effect on sensitivity and non-intrusiveness

Discussion

The study focused on the quality of interaction in Finnish ECEC, considering the structural characteristics that may influence its appearance in everyday encounters of early childhood professionals and children. More specifically, the purpose of this study was to discover whether PedaSens intervention had an effect on the development of the early childhood professionals' emotional availability in group interactions with the children. Emotional availability was used to investigate the emotional features of professional-

child relationships, such as ECP sensitivity, structuring, non-intrusiveness, non-hostility and child responsiveness and involvement (Biringen, 2008).

The main finding of this research was the significant interaction between study groups and time in the EA dimensions of sensitivity and non-intrusiveness. The effect size for EA sensitivity was considered to be large, and for EA non-intrusiveness, considered to be medium. First, this means that the intervention increased the EA sensitivity and role of emotions in ECPs' interaction with the children. This refers to professionals' ability to co-regulate children's behaviour and emotions as well as create a generally positive, genuine, and authentic affective climate in the child group. The ECPs learned to express their emotions to the children appropriately and to receive emotional signals from the children. The ECPs' physical and emotional responsiveness to children's physical and emotional signals and communications were present in the interactions (Biringen, 2000; Biringen et al., 2014). Second, considering the main finding for EA non-intrusiveness, the intervention helped ECPs to be available to the children without interfering in the ongoing activity or being overprotective (Biringen, 2000), for example, when the children were physically active. In addition, ECPs avoided overstimulating behaviour, and they allowed children's autonomy in relation to the child's level of development (Biringen et al., 2014).

These findings are partly consistent with the previous EA intervention and the development of emotional availability in the context of ECEC. According to the study of Biringen et al. (2012), intervention had a positive effect on adult structuring and child responsiveness with the training that included informational supervision sessions between the professional and the supervisor. The improvement of teacher sensitivity has been previously established in video-feedback intervention that had a positive and persistent effect on sensitive and responsive interaction of ECEC teachers (Fukkink & Tavecchio, 2010). The increase in the professional's sensitivity is also associated with the specialized training programme targeted towards the play-group practice (Rhodes & Hennessy, 2000).

In the current study, the development of ECP sensitivity and non-intrusiveness may be a result of video-based supervision targeted at the professional teams working with the same group of children through the whole research period. It is possible that team supervision has enabled the ECPs to reflect on their personal interaction and practices in relation to the group and individual characteristics of the children.

According to Cherrington and Thornton (2013) teachers' reflective and shared discussion on the video-recorded episodes allows them to gain new knowledge about children, and also to collectively negotiate among the meanings that shape their understanding and practices during the process. This can, for example, help teachers to redefine their

teaching role and to consider alternative strategies when encountering challenging events with children (see also Wenger, 1998).

The results of this study should also be viewed from a critical perspective. The development of the ECPs' EA sensitivity and non-intrusiveness was strongest at the post-test measurement, and especially for EA sensitivity, it decreased at the delayed post-test measurement. In addition, intervention with one extra supervision session for half of the intervention group did not seem to enhance the development of the ECPs' EA significantly. According to Fukkink and Lont (2007), the change in the caregiver's attitudes may anticipate changes in his/her behaviour, and it is possible that these attitudinal changes require long-lasting training programmes. Although the findings of this study do not provide a basis for long-lasting training for ECPs, its importance should not be underestimated. Further research should focus on how the duration of the intervention affects the development of the emotional availability of ECPs.

Study limitations

This study has several limitations. First, the number of research participants and sample size remained relatively small. The problem with the sample size of the intervention group was corrected by combining the two groups as one study group that received intervention. Notwithstanding, the size of the control group remained low. Meta-analyses of randomized controlled trials revealed a problem concerning the sample size, and an inadequate number of subjects can lead to underpowered studies (Werner et al., 2016). Moreover, four child groups were willing to participate only as an intervention child group, which may have reduced the randomness of the sample. To improve the reliability of the study, analyses were re-performed by removing these four groups from the study population. As a result, the presence of these groups did not significantly affect the original result. In addition, considering the fact that some intervention and control child groups were in the same centre, this study has a potential threat of spillover. This may weaken the internal validity of the study (Rosenbaum, 2007). Limitations related to sample size and randomization must be considered when interpreting the results of this study.

The second limitation is associated with the video observations of the study. The limitation related to video observations was the duration of the video-recorded interactions, and a small percent (7%) of these videos was shorter than 20 minutes, but more than 10 minutes long. According to Biringen (2005), it is possible to achieve reliability for 10-minute observations, but this might result in limited confidence and validity of the results.

The third limitation of this study concerns the intervention fidelity. According to Gray and McCormick (2005), successful implementation of an intervention programme in early

childhood education is associated with fidelity, and the degree and quality of implementation should be monitored. The fidelity of the ECPs in the intervention group was measured with the use of a reflective diary at both the individual and team levels. Data analyses revealed that approximately one fourth of the ECPs and half of the teams made regular diary entries until the end of the study. This offers a limited amount of information about the personal and team reflection of the ECPs in group interventions.

Conclusion

In this study we introduced a new perspective on the research and improvement of the interaction quality in ECEC. The study was built on an EA framework in group interactions, highlighting the emotional and pedagogical interaction between the early childhood professional and children.

The strength of this study is the focus of group interaction supported by the supervision at the individual and team levels. In addition to the theory and video-based contents, the supervision enables ECPs and teams to discuss and share their knowledge about good pedagogical practices in relation to children and group characteristics. This study indicates that PedaSens intervention may lead to the development of an ECP's pedagogical group sensitivity in ECEC child groups. The perspective of group interaction includes reciprocal interaction and emotional availability between the ECP and several children present in the child group, which enables a deeper understanding of the quality of the interaction.

This study also opens up a new approach to quality improvement with the collaboration of ECEC services and universities that work for the same purpose and can learn from each other. The study process and the improvement of the interaction quality were achieved with the help of researchers and supervisors, ECEC management, professionals with different educational backgrounds as well as children and their parents. This study is the result of diverse collaborations and countless meaningful interactions during the research. This kind of collaboration is particularly important after the COVID-19 pandemic while recovering from and repairing its consequences.

As previously emphasized, the development of the ECP's interaction has several positive outcomes for children's development and learning. In-service training can offer several benefits for ECPs and children, and evidence-based research implemented in collaboration with ECEC services and professionals should be used as a foundation for policy-making in ECEC.

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