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Supporting social-emotional development in early childhood education and care – a randomized parallel group trial evaluating the impact of two different interventions

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ABSTRACT

A randomized controlled parallel-group trial was conducted to investigate the effectiveness of two 10-week early childhood education and care (ECEC) interventions "SAGA" and "Pikkuli" for supporting socialemotional and verbal development. All children above the age of 4 were invited from 15 Finnish volunteer ECEC groups (n SAGA = 52, n Pikkuli = 56, n control group = 42). The children and caregivers, but not the personnel (who carried out the intervention), were blinded to the group assignment. Children in the SAGA intervention advanced in prosocial behavior and social orientation and had fewer internalizing and externalizing problems after the intervention. Children in the Pikkuli intervention advanced in prosocial behavior and had fewer internalizing problems after the intervention. There were no significant changes in any of the aforementioned outcomes in the control group. The results suggest that both interventions have good potential in supporting children's social-emotional development in the ECEC environment.

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KEYWORDS

Early childhood education and care; intervention; social-emotional development; mentalizing; positive pedagogy

Abbreviations

- CI Confidence interval
- ECEC Early childhood education and care
- EEF Educator's evaluation form
- MD Mean difference
- SDQ Strengths and difficulties questionnaire

Introduction

The social-emotional development of young children captures several interdependent components, such as social and emotional competence, psychological wellbeing, and self-regulation (Campbell et al., 2016). Social-emotional skills are known to be positively linked with school readiness

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(Denham et al., 2014), later academic achievement (Trentacosta & Izard, 2007), and better wellbeing in both short (Flouri & Sarmadi, 2016) and long-term (Jones et al., 2015) follow ups.

A wealth of research has focused on the characteristics that predict positive social-emotional development and how it could be further supported. Traditionally, these studies have concentrated on the child-caregiver interaction in the first years of life, and it is well acknowledged that features such as parental sensitivity (Meins, 1997) affect attunement (Legerstee & Varghese, 2001), and the use of mental state language with the child (Bekar et al., 2018; Meins et al., 2013; Symons et al., 2006) are of crucial importance. Gottman and colleagues suggest that optimal parenting is based on an "emotion-coaching philosophy", including parental awareness, validation of low-intensity emotions, and assisting the child in verbally labeling their emotions (Gottman et al., 1996).

There is strong evidence that social-emotional development can also be supported by interventions in early childhood education and care (ECEC). A meta-analysis by Blewitt and colleagues (2018) involved 51 intervention programs focused on social-emotional development (see supplementary online content eTable 2; Blewitt et al., 2018). Majority of the studies were conducted in North America or Europe. All interventions shared the foundation of actively practicing social-emotional skills among under school-aged children in ECEC settings using a wide range of activities (Blewitt et al., 2018).

Blewitt and colleagues focused on how the following variables: instruction time per session, intervention duration and intensity, participant age, and person delivering the program (educator or specialist) affected the efficiency of the interventions. The reported mean age of participating children varied from 2.2 to 6.2 years, session duration varied from 10 min to 3 h of instruction time and the intensity varied from sessions held once a week to each day, the overall duration of the interventions varied from less than six weeks to a whole academic year.

When compared to control groups, these interventions were altogether effective in supporting social-emotional development and early learning skills. The strongest effects were found in supporting emotional competence (e.g., empathy and prosocial relationships). Smaller effects were observed for social competence, self-regulation, and a decrease in behavioral problems. Intervention sessions held by researchers or trained specialists were more efficient than teacher-held sessions, and interventions were somewhat more efficient among older children. The instruction time or length of the interventions did not affect the results (Blewitt et al., 2018).

Although several programs for supporting social-emotional development in the ECEC environment already exist, studies implemented in the Finnish and Nordic ECEC environments are still scarce. For example, none of the studies included in Blewitt and colleagues' (2018) meta-analysis were conducted in the Nordic countries and a clear need to develop social-emotional intervention tools in the Finnish ECEC has been recognized by the Finnish National Agency for Education (Määttä et al., 2017). To develop interventions further in a specific country, they should be studied using the language(s) of the country in question and within its pedagogical context. Additionally, it is important to test and apply new methods that can be easily adapted to the day-to-day curricula at the ECEC centers. Social-emotional learning programs carried out by the ECEC personnel can be brought closer to a child's everyday environment; if proven effective, such interventions may benefit all children participating in ECEC.

Furthermore, since the previously published studies using different theoretical frameworks and methods also vary in other aspects (such as intensity, duration, and person delivering the program) (Blewitt et al., 2018), it is difficult to study the role of the different theoretical frameworks and tools used in the interventions on their efficiency. Different methodological solutions should be compared using a similar implementation procedure among groups of children with similar backgrounds to better understand which methods deliver the best results. If a clear difference between the efficiency of the interventions is found, this can guide us in further developing the intervention to meet the developmental needs of the children.

Aims of the study

We designed a randomized controlled parallel-group trial to investigate two promising Finnish intervention protocols "SAGA" and "Pikkuli". Our main research question is: How do these interventions affect children's social-emotional development, including prosocial behavior, social orientation, behavior problems, and self-regulation, as well as language development, when compared to a control group?

Both interventions were implemented by the ECEC personnel after a brief training and lasted for 10 weeks. The rationale for comparing these two interventions is that both are potentially easy to integrate with daily activities in the ECEC centers, and for both interventions only a short training is needed.

The main difference between these interventions is the theoretical base and that SAGA focuses on one activity: shared storybook reading with inner state dialogues (Kalland & Linnavalli, 2022), whereas Pikkuli includes a larger array of tools and activities all aiming and supporting socialemotional development. The interventions' theoretical background as well as suggested mechanisms of change can be found in the following sections. A more detailed description of the intervention protocols can be found in Appendix 1.

Intervention programs

The SAGA intervention

The SAGA intervention is based on mentalization theory (Ensink & Mayes, 2010; Fonagy et al., 1991; Meins & Fernyhough, 1999) the core of which lies on individual's capacity to understand another person's mental states that underlie overt behavior. The aim of the intervention is to support children's social-emotional development via shared storybook reading among children aged 3–6 years in ECEC (Kalland & Linnavalli, 2022). This is done by encouraging and training the teachers to steer the children's interest towards the emotions, thoughts, and motives of the characters of the storybooks through conversations during the reading sessions. In addition to supporting children's social-emotional understanding, SAGA intervention aims to enhance the teachers' ability to recognize emotions and intentions in children and thus improve interaction between children and adults in ECEC centers. All personnel working with children were trained for the intervention provided in three training sessions (altogether 7 h) via video conference calls.

The Pikkuli intervention

The Pikkuli intervention was piloted for the first time in this study. The theoretical background of the intervention is based on positive pedagogy (Seligman et al., 2009) which is connected to positive psychology (Gable & Haidt, 2005). The premise of positive pedagogy is that positive emotions, resilience, and engagement can be taught to children via positive feedback and recognizing the strengths of each child (Seligman et al., 2009). The positive pedagogy concepts were taught to the educators as a part of the intervention training.

The intervention uses a multimedia approach focusing on the Pikkuli bird (the main character of the intervention). The material is based on animated videos accompanied by story books, plush toys, music, and emotion cards, and instruction to the educators on using these to support discussions and activities about emotions, social problem solving, and relaxation. All the participating educators at the ECEC centers underwent a 6-hour training period via video conference calls consisting of three individual 2-hour training sessions.

The control group

The personnel in the control group were instructed to conduct the usual circle times and small group activities (called "control sessions" hereafter) in their ECEC groups during the 10-week intervention

period. These sessions usually consisted of reading together, listening to audiobooks or music, using emotion cards, and having group discussions. After the intervention had ended in fall 2021, the control group personnel were offered the intervention training of their choosing (SAGA or Pikkuli).

Hypotheses and potential mechanisms of change

We hypothesize that both interventions will have positive influences on children's psychological wellbeing, peer relationships, and self-regulation skills, and that especially the SAGA intervention will support the children's verbal abilities as discussed later in this section.

Several mechanisms may explain the positive influences of these interventions. Following the Bronfenbrenner's bioecological model (Bronfenbrenner & Morris, 2007) these mechanisms are likely to function during long-lasting reciprocal interactions within the child's immediate environment with peers and teachers, as well as with intriguing objects and symbols provided by the learning environment, and in this case the interventions.

The improvement of mentalizing skills offers one promising mechanism explaining the development of the children's social-emotional skills during the interventions. Mentalizing abilities are known to support peer relationships and social competence (Banerjee et al., 2011; Caputi et al., 2012; Imuta et al., 2016; Razza & Blair, 2009) and especially the SAGA intervention is explicitly built on mentalization theory.

Both interventions link to earlier studies showing consistently that adult-led discussions about thoughts and emotions in small groups of children are efficient in supporting mentalizing (Hofmann et al., 2016). For example, discussing mental states instead of physical states of a story's characters led to improved mentalizing skills among 4- to 5-year-olds in a three-session intervention (Lecce et al., 2014), and telling stories of similar situations happening to themselves after listening to a story (instead of drawing a picture of it) supported mentalizing in a two-month intervention held twice a week among 7-year-olds (Ornaghi et al., 2014). In addition to supporting mentalizing through group discussions both interventions aim at supporting the teachers themselves to recognize and name children's emotions, acting on the teachers in this way is previously known to support also the mentalizing abilities of the children (Valle et al., 2016).

As discussed earlier, the Pikkuli intervention is a multimedia program that includes several other methods in addition to those related to the mentalizing framework, that may support socialemotional skills. First, Pikkuli includes musical interaction which has been previously shown to support prosocial behavior among under school-aged children through shared emotional states and moving in synchrony (Cirelli et al., 2014; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012). Second, Pikkuli uses dramatic play activities where children are guided to role play different emotional states and interact together in pretend play, these types of activities are shown to support self-regulation (Goldstein & Lerner, 2018). Third, the relaxation exercises might also support self-regulation abilities via reducing stress and supporting nervous system regulation as shown in other intervention studies as well (Neal, 2021). All these evidence-based methods together provide a strong rationale to expect positive changes in children's social-emotional development during the Pikkuli intervention.

It is well known that shared reading is an influential method in supporting children's verbal abilities (Dowdall et al., 2020). Both interventions included in this study involve reading together. Pikkuli intervention materials include story books about each animated episode used in the intervention, and the SAGA intervention explicitly builds on shared reading sessions in small groups. Furthermore, language and social-emotional development are known to be interrelated (Kalland & Linnavalli, 2022; Longobardi et al., 2016; Thurm et al., 2018) and both receptive and expressive vocabulary are linked to social-emotional skills and positive peer relationships in young children (Gertner et al., 1994; Rajalin et al., 2021). Thus, it is meaningful to test whether, in addition to supporting social-emotional development, these interventions also support children's verbal abilities. We hypothesize that children's verbal abilities may develop during the interventions and this development may be stronger for the children participating in the SAGA intervention.

Material and methods

Participants

The participating children came from 15 different groups within nine public ECEC centers from two municipalities in Southern Finland. Our aim was to assign approximately 50 participants each into both intervention groups and the control group, since earlier studies have found significant results with samples this size (Blewitt et al., 2018). Due to limited resources for the study, we were not able to invite more groups to participate. Volunteer ECEC managers from these two municipalities inquired the willingness of their ECEC group educators to take part in the study, groups with children aged 4- to 7-years were invited. All the groups that were initially willing to participate took part in the study, except one group that canceled before the study started due to limited personnel resources, in this case another group from the same municipality was invited to participate. The same number of groups from the same municipality were randomly allocated manually to either of the two intervention conditions or to the control condition in 1-1-1 ratio (see Appendix 2). The children and caregivers, but not the personnel (who carried out the intervention), were blinded to the group assignment. In case of multiple groups from the same ECEC center, all groups participated in the same condition to prevent spillover effects.

Willingness to participate in the study was inquired from the parents/caregivers of all at least 4year-old children in the ECEC groups. The invitation and information letters were distributed to the families by the teachers, all materials provided to the families were translated to the families' most spoken languages at the specific ECEC center. The parents were not informed beforehand whether their child was participating in the intervention or control condition.

Of the 238 invited children, 164 (69%) families agreed to participate (n SAGA = 53 [67% of the invited children in this condition], n Pikkuli = 60 [70%], n Control = 51 [70%]). Of these, children attending less than 10 intervention or control sessions over the 10-week intervention period were excluded from further analyses, resulting in 150 (n = 77 girls) children providing valid data from the SAGA (n = 52), Pikkuli (n = 56), and control (n = 42) groups. Of these children, 103 (67%) came from families that had at least one parent with a university level degree or equivalent. Finnish was the strongest language of 139 (93%) children, and 28 (17%) had more than one language spoken at home. Baseline data was collected before the intervention from February to March 2021; follow-up data was collected after the end of the intervention from May to June 2021.

Due to the COVID-19 situation during the data collection in spring 2021, the researchers did not enter the ECEC center premises. Thus, the data collected were mainly based on questionnaires completed by the personnel. A volunteer responsible teacher was recruited from each ECEC group to assist with administering the study and collecting the data. The responsible teachers received training detailing all the required tasks and were in close contact with the research coordinator during the data collection and received monetary compensation for the additional work required by the study. The personnel of each group also received a small gift after the intervention had ended.

The University of Helsinki Ethical Review Board in the Humanities and Social and Behavioural Sciences approved the study protocol (statement number 1/2021). The parents and the ECEC personnel provided written informed consent. The responsible teachers also signed a data management agreement detailing confidential handling of data.

Measures

Participation in the group sessions

The responsible ECEC teachers maintained a log on the frequency, content, and duration of the intervention or control sessions held at their group and how often the children were able to attend the sessions. At the end of the intervention, the teachers calculated the sum of sessions that each child participating in the study was able to attend during the whole intervention period. For the

SAGA intervention, two ECEC groups also agreed to videotape altogether 11 sessions for the researchers to verify that the intervention was conducted as designed. Separate consent from parents was obtained for the children to appear on the videos.

Social-emotional development

Children's social-emotional development was assessed via the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) and the Educator's Evaluation Form (EEF) (Veijalainen et al., 2021), which were completed by the ECEC personnel before and after the intervention. Questionnaires of the same child were completed by the same person before and after the intervention.

The SDQ is a 25-item (answered on a scale from 0 to 2) behavioral screening questionnaire consisting of five five-item subscales (emotional problems, conduct problems, hyperactivity, peer problems, and prosocial behavior) and the composite scales of internalizing problems (sum of emotional and peer problems) and externalizing problems (sum of conduct problems and hyperactivity) (Goodman & Goodman, 2009). In this study, the scales of internalizing and externalizing problems and prosocial behavior were used as recommended for community-based research (Goodman et al., 2010). The SDQ is shown to have good discriminant (Ferreira et al., 2021) and predictive validity (Goodman & Goodman, 2011), but modest convergent validity between raters (Ferreira et al., 2021). Although internalizing and externalizing problems are not direct measures of social-emotional development, a lower value in these composite scales can be considered an indicator of psychological wellbeing, which is one of its key components (Campbell et al., 2016).

The EEF assesses the child's social-emotional wellbeing via two scales. The self-regulation scale consists of seven items, and the social orientation scale consists of five items answered on a Likert scale from 1 to 5. The EEF has been used extensively in the Finnish ECEC context (Reunamo & Alijoki, 2014; Reunamo, Hakala, et al., 2014; Reunamo, Lee, et al., 2014; Veijalainen et al., 2017, 2021). The self-regulation scale of the EEF questionnaire has been validated against children's meta-cognitive skills and special needs (Veijalainen et al., 2017), however, no validation studies have been provided on the social orientation scale.

Verbal fluency

The verbal fluency test was chosen as an indicator for verbal abilities since it is positively correlated with overall verbal reasoning skills (Ardila et al., 2000) as well as easy and time efficient to administer for the ECEC personnel. Semantic verbal fluency was measured by a task where the children were asked to come up with first as many animal words and second as many food and beverage words as they could within 1 min (Kaleva & Vanhala, 2002; Korkman et al., 2007). The test used in this study is a shortened version of the word generation subtest from the well-validated NEPSY neuropsychological assessment battery (Korkman et al., 2007). This shorter version of the task has been previously proven to associate with children's social-emotional wellbeing (Kalland & Linnavalli, 2022). The task was administered by the responsible teacher in a calm environment at the ECEC center before and after the intervention.

Background variables

The parents completed a brief questionnaire about the child's gender, date of birth, verbal development, languages spoken at home and child's strongest language, their own educational level, and reading at home together with the child.

Statistical analyses

All analyses were performed using IBM SPSS Statistics, version 27. One-way analyses of variance for continuous variables and chi-squared tests for categorical variables were used to compare means between groups at baseline. In case of significant differences, post-hoc tests using the Games-Howell procedure were performed to examine group differences for continuous variables. For

categorical variables, the adjusted residuals were used to test for significant differences from expected cell counts (Appendix 3).

The change over time in children's psychosocial wellbeing and verbal fluency before and after the intervention was analyzed with linear mixed-model analyses with restricted maximum likelihood. Mixed-model analyses can account for the hierarchical structure of the data arising in this case from repeated measures collected from children who are clustered in ECEC groups and centers.

Bayesian information criteria were used to assess model fit. To test for varying intercepts across groups, we first ran basic models with time as a fixed factor including participant, ECEC group, and center as random factors with random intercept while predicting the outcome variables. The effect of time showed significant variance in intercepts across participants in all models (p < 0.001). The effect of time showed significant variance in intercepts across ECEC groups when predicting verbal fluency (p = 0.027) and prosocial behavior (p = 0.048), and model fit increased significantly when the random intercept for the ECEC group was included in these models. This was not the case when predicting the other outcome variables (p-values > 0.17). Time did not show significant variance in intercepts as models (p-values > 0.68). Based on these findings, each child and ECEC group were treated as random factors with random intercept when predicting verbal fluency and prosocial behavior. The ECEC group was not included in the model for the other outcome variables.

To test whether the change over time in children's psychosocial wellbeing and verbal fluency varied according to the intervention and the control conditions, we included an interaction term "intervention × time" into the model following the main effects. In the case of significant interactions, subanalyses were used to test whether the main effect of time was significant in each of the three conditions separately. Cohen's f^2 -values were calculated to indicate effect sizes for the effect of time within the subanalyses (Cohen, 1988; Selya et al., 2012). All models were inspected for normality of residuals, homoscedasticity, and multicollinearity; no violations to the assumptions were found.

Potential covariates

Apart from the basic models, all analyses were adjusted for the child's age at the start of the intervention (Blewitt et al., 2018), parental education (highest of either parent) (Cutting & Dunn, 1999), and the child's gender (Garaigordobil, 2009). To investigate whether the number of sessions participated in by the child affected the results, we reran the analyses including the number of sessions as an additional covariate in the model.

Results

Reliability

EEF's internal consistency measured by Cronbach's α was 0.91 for the self-regulation scale and 0.87 for the social-orientation scale. Cronbach's α for the internalizing, externalizing, and prosocial scales of the SDQ were 0.80, 0.86, and 0.83, respectively.

Descriptives

There were no differences between conditions in the children's gender, parent-reported verbal development, spoken languages, or reading at home (*p*-values > 0.30) (Appendix 3). The children in the Pikkuli group were younger than the children in the SAGA group (p = 0.012). The parents' educational background was not evenly distributed between groups (p = 0.015). More children in the control group (z = 2.57, p = 0.009) and fewer children in the SAGA group (z = -2.81, p = 0.009).

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0.005) had parents with Master's degree or higher, whereas the control group children had fewer parents with a Bachelor's degree or equivalent (z = -2.54, p = 0.01).

Before the intervention, the children did not differ in internalizing or externalizing problems or in self-regulation (*p*-values > 0.093). Children in the SAGA group had lower prosocial skills than children in the Pikkuli (p = 0.002) and control groups (p = 0.023). Although there was a significant overall difference between groups in social orientation (p = 0.038), the post-hoc tests did not reveal significant pairwise differences (*p*-values > 0.066). Children in the control group performed better in the verbal fluency task than those in the Pikkuli group (p = 0.012) (Appendix 3).

Number of sessions during the intervention

In the SAGA intervention, the average number of shared storybook reading sessions in the ECEC groups over the 10-week period was 68.4 (SD = 15.0). During these sessions, the dialogue cards were utilized 42% of the time on average (M = 29.0, SD = 10.6 sessions). As the sessions were held in small groups the same child did not participate in all sessions. The average number of sessions per child during the intervention was 27.1 (SD = 4.4).

For the Pikkuli intervention, the average number of sessions held at the ECEC groups over the 10-week period was 42.6 (SD = 9.7). During these sessions, the Pikkuli animations were used 38% of the time (M = 16.4, SD = 3.9 sessions), the storybooks were used 9% of the time (M = 9.4 sessions, SD = 0.2 sessions), emotion cards were used 34% of the time (M = 14.6, SD = 0.3), and other supplemental methods (such as music, arts and crafts) were used 38% of the time (M = 16.4, SD = 7.4).

For the control group, the average number of sessions was 41.8 (SD = 12.4), reading occurred in 67% of the sessions (M = 27.8, SD = 8.3 sessions), audiobooks were used 23% of the time (M = 9.8 sessions, SD = 7.3 sessions), emotion cards were used 10% of the time (M = 4.4, SD = 4.2), and other methods (such as music, arts and crafts, and group discussions) were used 18% of the time (M = 7.4, SD = 6.9 sessions). The average number of sessions per child during the 10-week follow-up was 19.6 (SD = 5.3).

When compared to the Pikkuli and control groups, the total number of sessions attended per child was significantly higher in the SAGA group (*p*-values < 0.001) (Appendix 3).

Effectiveness of the interventions

The type of intervention significantly interacted with time when predicting internalizing (F(2, 145.31) = 3.55, p = 0.031), externalizing (F(2, 145.28) = 7.47, p < 0.001), prosocial behavior (F(2, 145.40) = 5.40, p = 0.005), and social orientation (F(2, 145.27) = 3.30, p = 0.040), but not when predicting self-regulation (F(2, 145.25) = 2.60, p = 0.078) or verbal fluency (F(2, 143.05) = 0.24, p = 0.785).

For the significant interactions, subanalyses were used to test whether the main effect of time was significant in each of the three conditions separately. The subanalyses excluded the main effect and the interaction term related to the type of intervention. The results of these analyses are shown in Table 1. For the children in the SAGA intervention, externalizing (p < 0.001, $f^2 = 0.226$) and internalizing (p < 0.001, $f^2 = 0.182$) symptoms significantly decreased over time, whereas prosocial behavior (p < 0.001, $f^2 = 0.448$) and social orientation (p = 0.002, $f^2 = 0.164$) significantly increased over time. For the children in the Pikkuli intervention, internalizing significantly decreased over time (p = 0.001, $f^2 = 0.179$), whereas prosocial behavior increased (p = 0.040, $f^2 = 0.060$), and no change over time was observed in externalizing or social orientation (p-values > 0.18). No change over time was observed in the control condition regarding any of the outcome variables (p-values > 0.47).

None of the results changed significantly when the analyses included the number of intervention or control sessions as an additional covariate to the model.

Variable	MD ^a	959	6 CI	p-value	f^{2b}			
SAGA								
Internalizing	1.15	0.49,	1.81	< 0.001	0.182			
Externalizing	1.29	0.61,	1.96	< 0.001	0.226			
Prosocial behavior	-1.25	-1.73,	-0.77	< 0.001	0.448			
Social orientation	-1.37	-2.19,	-0.54	0.002	0.164			
Pikkuli								
Internalizing	0.74	0.31,	1.17	0.001	0.179			
Externalizing	-0.17	-0.80,	0.48	0.608	0.011			
Prosocial behavior	-0.45	-0.89,	-0.02	0.040	0.060			
Social orientation	-0.46	-1.13,	0.22	0.181	0.016			
Control group								
Internalizing	0.10	-0.42,	0.61	0.713	0.019			
Externalizing	-0.17	-0.63,	0.30	0.475	0.011			
Prosocial behavior	-0.10	-0.73,	0.54	0.763	0.018			
Social orientation	0.00	-0.77,	0.77	>0.999	0.022			

Table 1. Change over time in children's social-emotional wellbeing during the SAGA and Pikkuli interventions and the control condition.

Note. MD = mean difference; CI = confidence interval.

^aEstimated MDs before and after the intervention. Positive MDs indicate higher values at the start of the intervention. Analyses are adjusted for child's age, gender, and parental education (highest of either parent).

^bCohen's $t^2 \ge 0.02$, $t^2 \ge 0.15$, and $t^2 \ge 0.35$ indicate small, medium, and large effect sizes, respectively (Cohen, 1988, p. 413–414).

Discussion

We investigated the effectiveness of two Finnish ECEC interventions, SAGA and Pikkuli, aimed at supporting children's social-emotional and verbal development. We found that children in the SAGA intervention advanced significantly in their prosocial behavior (large effect size) and social orientation (medium effect size). These children also had fewer internalizing and externalizing problems after the intervention (medium effect size). Children in the Pikkuli group also advanced in prosocial behavior (small effect size) and had fewer internalizing problems (medium effect size) after the intervention. There were no significant changes over time in any of the aforementioned outcomes in the control group.

Our results indicate that both interventions have potential in supporting children's socialemotional development. They also show that there was a larger amount of significant positive effects in the SAGA intervention (on four outcome variables) when compared to the Pikkuli intervention (on two outcome variables) and that the positive effect on prosocial behavior was stronger in the SAGA intervention based on the effects sizes. Several potential factors might explain this difference.

First, the Pikkuli intervention is a multimethod intervention that includes various activities and materials, whereas SAGA relies on a single method (shared storybook reading) (Kalland & Linnavalli, 2022). It is possible that shared reading and discussions about mental states are the most influential ingredients in both interventions and focusing solely on this method is thus more fruitful in supporting social-emotional development. Furthermore, the training period for personnel using SAGA was altogether 7 h and was 6 h for those using Pikkuli. It is possible that a multimethod intervention such as Pikkuli also requires a longer training period for the personnel to fully grasp the use of all the materials. Second, in contrast with Pikkuli, the SAGA training also included two additional training sessions held during the intervention, which may have further motivated the teachers to use the intervention.

The fact that the number of sessions based on the teachers' logs did not impact the outcomes is in line with the Blewitt and colleague's meta-analysis indicating that the intensity or duration of the interventions did not have an impact on their efficiency (Blewitt et al., 2018). It also indicates that the outcomes were not merely a result of the number of sessions held and that the number of sessions was adequate in both interventions for the designed activities to support development. Furthermore, according to altogether 11 video recordings made in two of the participating ECEC

groups, the SAGA sessions were in essence conducted as designed, which further supports the effectiveness of the intervention activities.

One potential mechanism explaining the effects of both interventions may be the improvement in children's mentalizing abilities that have been positively linked to social skills (Banerjee et al., 2011; Caputi et al., 2012; Imuta et al., 2016; Razza & Blair, 2009). This may also explain the stronger positive effect of the SAGA intervention, SAGA focused on mentalizing, whereas the Pikkuli intervention had several different focuses. Extensive evidence shows that mentalizing can be supported by using mental state language and assisting the child in naming emotions (Bekar et al., 2018; Bianco et al., 2016; Gottman et al., 1996; Lecce et al., 2014; Meins, 1997; Ornaghi et al., 2014; Symons et al., 2006) and that ECEC interventions using discussions about mental states are successful in supporting mentalizing (Hofmann et al., 2016). Regarding the Pikkuli intervention, additional mechanism explaining the findings may be provided by musical interaction which is known to promote prosocial behavior (Cirelli et al., 2014; Kirschner & Tomasello, 2010; Rabinowitch et al., 2012).

No differences between groups were observed for the change over time in self-regulation or verbal fluency, although the results regarding self-regulation were close to being statistically significant. Also, earlier intervention studies have demonstrated more modest results regarding self-regulation, as compared to prosocial behaviors and empathy (Blewitt et al., 2018). It is possible that the activities carried out in the interventions were not sufficient to promote a significant change in self-regulation, although especially pretend play (Goldstein & Lerner, 2018) and relaxation exercises (Neal, 2021) used in the Pikkuli intervention have previously been related to improved self-regulation.

The lack of results relating to verbal fluency might arise from the fact that reading together was common also in the control group as a part of the ECEC daily activities, thus all children developed in this area. Additionally, the verbal fluency task may not be specific enough to measure the change in verbal abilities that may relate specifically to social-emotional themes. Future studies should elaborate this finding with more precise measures of verbal development, such as the vocabulary subtest of the Wechsler Preschool and Primary Scale of Intelligence (Wechsler, 2012), emotional vocabulary could also be assessed via the Teddy Bear Test introduced by Kalland and Linnavalli (2022).

This study shows that interventions for social-emotional development can be successfully implemented by the ECEC personnel, and that the training can be provided via online meetings. This is of importance as interventions that are carried out in the everyday settings of ECEC are more likely to bridge the gap between research and practice when promoting sustainable positive practices that are accessible for the whole community. The aim of both SAGA and Pikkuli interventions is to provide methods that can be used as part of normal daily ECEC functions and that can become a part of the teachers' personal toolkit to be freely used in supporting children's social-emotional development, also when the 10-week intervention period is over. The teachers can and were encouraged to continue using the intervention methods even after the intervention period was over.

Strengths, limitations, and future work

These results allow for further development and improvement of the interventions. Based on the findings of this study, the Pikkuli intervention has already been modified to include a longer training of 4 separate 2.5-hour sessions that are spread over a 6- to 9-week period during which the educators are able to start using the method immediately and receive feedback at the subsequent training sessions.

This study has several strengths, such as the relatively large sample size representative of typical Finnish ECEC centers and testing two different interventions at the same time in comparison with the control group. The participation rate was high (67% to 70%), and we were able to collect data from all participants before and after the intervention. We measured several aspects of social-emotional development including prosocial behavior, social orientation, self-regulation, and behavior problems as well as children's verbal development. The reliability of both the SDQ and the EFF

was found to be good (Cronbach's a varied from 0.80 to 0.91). The SDQ is used extensively in research worldwide and is known to have a good validity among low-risk participants especially when using the broader composite scales as done in our study (Goodman et al., 2010). The EFF has been repeatedly used in the Finnish ECEC environment and has a history of continuous development and revisions (Veijalainen et al., 2017, 2021).

This study also has some weaknesses. Although the logs held by the educators indicated that the intervention sessions were being held throughout the intervention period, we did not directly supervise the intervention sessions in each ECEC group, thus we do not have solid proof of each group's fidelity to the intervention protocol.

Although the results are generalizable to typical Finnish ECEC centers they may not be generalizable to other countries with different pedagogical practices and educational level for the personnel. Furthermore, the study was not preregistered as a protocol prior to being conducted which would have strengthened the transparency of the study protocol.

It should also be noted that although the EEF questionnaire has been widely used in the Finnish ECEC context, the social orientation scale has not been validated in previous studies, thus the results on social orientation should be interpreted with some caution.

Some of the baseline characteristics differed between the conditions despite the random allocation of the interventions. Children in the Pikkuli group were younger than others and children in the control group had more highly educated parents. However, the age distributions still overlapped in all groups, and the parental educational level was rather high in all groups, and they generally had similar proportions of parents with or without a university-level degree (Bachelor's or Master's). Furthermore, the results remained significant although age and parental education were included as covariates in the analyses.

The children participating the SAGA intervention had initially lower levels of prosocial behavior when compared to others. This may reflect coincidental differences among children or result from a different answering style between the teachers who completed the questionnaires. Indeed, the mixed-model analyses revealed that there was a significant variance in intercepts between groups regarding prosocial behavior. This means that there were significant groupwise differences in how prosocial behavior was evaluated. However, we were able to consider this by including the random intercept of ECEC group in the model when predicting the change over time in prosocial behavior. Additionally, the same observer completed the questionnaires from the same children before and after the intervention, thus minimizing any problems that may be caused by different answering styles. Although children in the Pikkuli intervention had higher prosocial skills at baseline, they also benefited from the intervention, whereas the control group did not. This indicates that the results in the SAGA group were not due only to a lower baseline level, which left more room for improvement in the prosocial skills area.

Another limitation is that the teachers were not blind to the intervention condition. In educational research, blinding is often difficult to achieve (Blewitt et al., 2018). Since the same personnel was responsible for both implementing the intervention and completing the questionnaires, it was impossible for them to be blind to the condition. However, it is important that the personnel who are most familiar with the children also complete the questionnaires instead of, for example, teachers from other groups. Parental reports could be a potential addition in future studies. However, reports from educators are important since parents, although able to reliably rate other children's behavior, may be biased in their reports on their own child (Seifer et al., 1994). Furthermore, the home environments of each child vary, and certain behaviors that take place in a group of children at the ECEC environment, may be difficult to assess at home.

It should be noted that we did observe differences in the effectiveness of the SAGA and Pikkuli interventions, indicating that the results were not due only to bias in the teachers' evaluations after the intervention, as in this case both interventions should most likely yield very similar results.

The duration of the interventions was short (10 weeks), and this may also explain the lack of findings in some of the outcome variables (e.g., self-regulation), it is possible that a longer

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follow-up period may have revealed potential positive influences of the intervention taking a longer time to develop. A longer follow-up would also be useful to investigate how the positive effects are maintained over time. Additionally, direct measures of mentalizing skills could be used such as the Theory of Mind and emotion recognition subtests from the NEPSY-II developmental neuropsychological test battery (Korkman et al., 2007). Interviewing the children would be valuable to emphasize their perspective on the methods.

Conclusion

These results indicate that both Finnish ECEC interventions SAGA and Pikkuli have good potential in supporting social-emotional development. Interventions using several methods, such as Pikkuli, might benefit from a more extensive training period. Future studies should investigate these interventions using for example neuropsychological methods, interviews, and a longer follow-up period.

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Disclosure statement

Professor Mirjam Kalland has developed the SAGA intervention. Materials related to the intervention are freely available in Finnish and Swedish at the project website www.helsinki.fi/saga. University of Helsinki will be providing intervention training for ECEC personnel in Finnish and Swedish, the course (5 ECTS) is free for participants enrolled in the University of Helsinki, whereas participants outside the university will be offered the course through open university education and pay a course fee. Metsämarja Aittokoski is the CEO of Pikkuli Group Ltd. that has developed the Pikkuli intervention. Some of the Pikkuli animations and materials as well as pedagogical training videos are freely available through Pikkuli's website and YouTube channel: www.pikkuli.fi/en. For pedagogical training a course fee is charged.

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Appendix 1

Description of the intervention protocols

The SAGA intervention. Fourteen stories were chosen for the intervention; a dialogue card was developed for each story. In the chosen stories, the characters typically experienced different positive, negative, and neutral emotions with varying intensity. The dialogue cards included questions that encouraged the children reflect on the story characters' emotions, thoughts, and behaviors, and the reasons behind them (e.g., "How do you think Onni [a boy] felt when he went to the daycare for the first time?", "Do you think mother noticed that Onni was anxious?", "What does it mean to be brave?", "How does it feel, if one does not find anyone to play with?").

All personnel working with children were trained for the intervention provided in three training sessions (altogether 7 h) via video conference calls. The training included presentation of the theory behind the intervention, instructions about the implementation of the intervention, and creating dialogue cards for two stories together with all participants.

In the SAGA intervention, each child participates in three weekly 15- to 20-minute shared storybook reading sessions in groups of 6–7 children. An adult reads a story and with the help of dialogue cards initiates a discussion with the children, focusing on the emotions of the story characters. The ECEC personnel were also encouraged to use stories other than originally chosen and develop appropriate questions themselves. The intervention lasted for 10 weeks, during which two workshops were offered for the ECEC personnel. In workshops, the personnel reflected on their experiences on the intervention and created new dialogue cards for self-chosen stories.

The Pikkuli intervention. The Pikkuli intervention's primary purpose is to promote social-emotional development in ECEC settings and to reinforce the so-called 21st-century competencies (collaboration, communication, creativity, and critical thinking skills) (Voogt & Roblin, 2012). In addition, the intervention activities consider the transversal competencies outlined in the Finnish National Core Curriculum for ECEC, including the interactive, metacognitive, and everyday life skills that are at the core of all learning activities (Finnish National Agency for Education, 2019).

The Pikkuli intervention and its associated pedagogical activities were created in collaboration with early childhood educators. The intervention is built upon a 26-episode animated series concerning the life and adventures of a little bird called "Pikkuli". The animated videos feature nonverbal communication emphasizing facial expressions, body language, sounds, and image bubbles, which provide children a universal bridge to process emotions in their own native language. All episodes address several social-emotional themes. In these stories, Pikkuli, the main character, goes through different emotional states and tries to cope with his own emotions.

The materials of the Pikkuli intervention piloted in this study are based on two 5-minute animated Pikkuli episodes chosen from the animated series. Both episodes are accompanied with a story book and a five-lesson plan that includes interactive pedagogical activities. All lessons have the same action structure. An introductory activity first invites the children to join the Pikkuli session, then the subject of the session is introduced, followed by two activities with movement and actions. Finally, there is a concluding activity to support relaxation. Arts and creativity are reinforced through these activities as children learn in diverse ways through drama, singing, dancing, and puppet theatre.

Throughout the Pikkuli sessions, educators support the dialogue to assist the children in exploring the several emotional states they might experience. For example, this includes "How would you feel if Pikkuli would have given you this invitation card?", "How did the guests feel when they received their invitations?".

The material package also contains supplemental supportive pedagogical materials, such as emotion cards, a Pikkuli plush toy, and Pikkuli music, which plays a significant role in the animated series. In addition to the two core episodes of the series, the educators can select which additional episodes they would like to focus on and are encouraged to select the episodes that are accompanied by a storybook.

All the participating educators at the ECEC centers underwent a 6-hour training period via video conference calls consisting of three individual 2-hour training sessions. During the training period, the educators were introduced to the Pikkuli positive pedagogy concept and the pedagogical materials and were given instructions for implementing the intervention in their ECEC groups. Before Each Session, the educators familiarized themselves with the Pikkuli story and the activity plan for the session built around the story.

The Pikkuli intervention lasted for 10 weeks. The educators were instructed to conduct the intervention sessions in groups of up to 7 children. During each week, the children were expected to participate in at least one session where the Pikkuli animations or books were used, and at least two sessions where other Pikkuli material (emotion cards, play activities, music) was featured.

Appendix 2

Allocation of participants to the intervention and control conditions



Descriptive statistics for included participants

	Contro	ol group	Pikkuli g	group	SAGA group		
Variable	М	SD	М	SD	М	SD	<i>p</i> -value
N	42		56		52		
Girls (<i>n</i> , %)	22	52.4	30	53.6	25	48.1	0.839
Age (years)	5.7	0.9	5.4 ^b	0.9	5.9 ^b	0.8	0.012
Daycare start age (months)	28.1	13.9	27.3	13.7	29.1	18.9	0.807 ^d
Spoke sentences at age (months)	22.7	5.2	24.1	7.3	24.4	6.9	0.301
Strongest language other than Finnish (n, %)	3	7.1	5	8.9	3	5.8	0.819
More than one language spoken at home $(n, \%)$	8	19.0	8	14.3	12	23.1	0.502
Parental education (highest of either parent) $(n, \%)$							
Up to high school diploma or equivalent	13	31.0	14	25.5	20	38.5	0.015
Bachelor's degree or equivalent	7	16.7 ^c	20	36.4	21	40.4	
At least Master's degree or equivalent	22	52.4 ^c	21	38.2	11	21.2 ^c	
Reading with child at home $(n, \%)$							
Less than once a week	5	11.9	9	16.7	8	15.4	0.566
Once a week	3	7.1	10	18.5	11	21.2	
Almost daily	13	31.0	12	22.2	12	23.1	
Daily	21	50.0	23	42.6	21	40.4	
Intervention and control sessions							
Number of participated sessions per child	19.6	5.3	18.2 ^b	7.4	27.1 ^{a,b}	4.4	<0.001 ^d
Mean duration of sessions per group (min)	17.5	7.0	21.8 ^{a, b}	12.5	18.7 ^b	5.6	<0.001 ^d
SDQ before the intervention							
Internalizing (scale 0-20)	2.9	3.1	3.2	2.9	4.2	3.4	0.093
Externalizing (scale 0-20)	4.9	4.9	4.1	3.6	5.6	4.5	0.196
Prosocial behavior (scale 0-10)	6.6	2.5	6.8 ^b	2.3	5.2 ^{a, b}	2.5	0.002
EEF before the intervention							
Social orientation (scale 5-25)	19.3	4.6	19.0	4.1	17.2	4.2	0.038
Self-regulation (scale 7-35)	25.5	7.0	24.8	5.9	24.0	6.6	0.569
Word fluency before the intervention							
Sum of food and animal words	19.2	7.8	15.0 ^a	5.7	15.9	6.3	0.006

Note. SDQ = Strengths and Difficulties Questionnaire; EEF = Educator's Evaluation Form. In case of significant group differences, results from the subanalyses are marked as follows:

^aSignificantly different value from control group (p < 0.05).

^bSignificantly different values between intervention groups (p < 0.05).

^cSignificantly different value from the expected count (p < 0.05).

^dWelch-test was used when homogeneity of variance assumption was not fulfilled.

Children's unadjusted social-emotional wellbeing and verbal fluency before and after the intervention

	Control group				Pikkuli group				SAGA group			
Variable	М	SD	95% CI		М	SD	95% Cl		М	SD	95% CI	
Pre-intervention values												
SDQ at time 1												
Internalizing	2.9	3.1	1.9,	3.9	3.2	2.9	2.4,	4.0	4.2	3.4	3.3,	5.2
Externalizing	4.9	4.9	3.3,	6.4	4.1	3.6	3.2,	5.1	5.6	4.5	4.4,	6.9
Prosocial behavior	6.6	2.5	5.8,	7.4	6.8 2.3 6.2, 7.4		7.4	5.2	2.5	4.5,	5.9	
EEF at time 1												
Social orientation	19.3	4.6	17.9,	20.7	19.0	4.1	17.8,	20.1	17.2	4.2	16.0,	18.4
Self regulation	25.5	7.0	23.3,	27.6	24.8	5.9	23.2,	26.4	24.0	6.6	22.2,	25.9
Word fluency at time 1												
Sum of food and animal words	19.2	7.8	16.7,	21.7	15.0	5.7	13.4,	16.5	15.9	6.3	14.1,	17.7
Post-intervention values												
SDQ at time 2												
Internalizing	2.8	3.5	1.7,	3.9	2.4	2.8	1.7,	3.2	3.1	2.9	2.3,	3.9
Externalizing	5.0	5.0	3.5,	6.6	4.2	3.5	3.2,	5.1	4.3	4.1	3.2,	5.5
Prosocial behavior	6.7	2.5	5.9,	7.5	7.3	7.3 2.2 6.7, 7.8		6.5	2.4	5.8,	7.1	
EEF at time 2												
Social orientation	19.3	4.4	17.9,	20.7	19.4	4.1	18.3,	20.4	18.6	4.2	17.4,	19.8
Self regulation	26.0	7.3	23.8,	28.3	26.1	5.2	24.7,	27.5	26.1	6.6	24.3,	27.9
Word fluency at time 2												
Sum of food and animal words	22.1	7.5	19.7,	24.5	17.0	5.5	15.5,	18.5	18.3	6.5	16.4,	20.1

Note. SDQ = Strenghts and Difficulties Questionnaire, EEF = Educator's Evaluation Form, CI = confidence interval.

CONSORT

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	ltem No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title	see title
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	see abstract
Introduction			
Background and	2a	Scientific background and explanation of rationale	pp 1 - 4
objectives	2b	Specific objectives or hypotheses	p 4
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	p 5
	Зb	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	not applicable
Participants	4a	Eligibility criteria for participants	p 5
	4b	Settings and locations where the data were collected	p 5
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually	р 3, 5,
		administered	Appendix 1
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	pp 5 - 6
	6b	Any changes to trial outcomes after the trial commenced, with reasons	not applicable
Sample size	7a	How sample size was determined	p 5
	7b	When applicable, explanation of any interim analyses and stopping guidelines	not applicable
Randomisation:			
Sequence	8a	Method used to generate the random allocation sequence	not applicable
generation	80	Type of randomisation; details of any restriction (such as blocking and block size)	p5
Allocation	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing	not applicable
conceaiment		any steps taken to conceal the sequence until interventions were assigned	
Implementation	10	Who appareted the random ellocation accurates who escaled participants, and who escienced participants to interventions	
Plinding	110	If done, who was blinded after assignment to interventions (for example, participants, and who assigned participants to interventions)	
Dimoning	iia	in done, who was billided alter assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	μJ
	11h	If relevant, description of the similarity of interventions	nn 3 - 4
			Appendix 1
Statistical mathada	120	Statistical methods used to compare groups for primary and secondary outcomes	pp 6 7
Statistical methods	124	Statistical methods used to compare groups for primary and secondary outcomes	pp0-7
	120	methous for additional analyses, such as subgroup analyses and adjusted analyses	
Results	40-	Enclosed and the construction of a statistical contraction of the base of the distribution of the statistical contraction of	
Participant flow (a	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were	p 5
diagram is strongly	4.01-	analysed for the primary outcome	
Recommended)	130	For each group, losses and exclusions after randomisation, together with reasons	
Reclutiment	148	When the trial ended enurse steepend	p 5
Pacalina data	140	A table showing baseling demographic and clinical characteristics for each group	Appondix 2
Numbers analysed	16	A table showing baseline demographic and clinical characteristics for each group	Appendix 5
Numbers analysed	10	Por each group, number of paracipants (denominator) included in each analysis and whether the analysis was by original assigned groups	the same in
		assigned groups	each analyses
			(no missing
			data)
Outcomes and	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as	Table 1
estimation		95% confidence interval)	
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	not applicable
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified	p8
		from exploratory	
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	not applicable
Discussion			·
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	pp 11 - 12
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	p 11
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	pp 9 - 12
Other information			
Registration	23	Registration number and name of trial registry	the trial was not
-		- · · · ·	preregistered
Protocol	24	Where the full trial protocol can be accessed, if available	not available
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	p 12

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.