






Health and Disability

Social competence group intervention (SOCO) for children with autism spectrum disorder: A pilot study

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This study aimed to describe concept of social competence as a theoretical background for social skills group intervention for children with autism spectrum disorder (ASD). A model of social competence comprised of three components: social skills, social performance, and social adjustment. We also examined the feasibility and preliminary efficacy of the manualized Social Competence group intervention for children with autism spectrum disorder (SOCO) using a variety of outcome measures. The nine-month intervention included children groups, parental support groups and co-operation with teachers. A pilot study involved 23 children aged 7 to 12 years ($n = 16$ intervention, $n = 7$ control) and intervention outcomes were measured with questionnaires for parents and teachers, neuropsychological tests, and observations. The parents of the intervention group reported improvements in social skills and social adjustment, whereas the teachers reported increases in social performance. Findings also indicated that affect recognition skills, social overtures, and reactions to peers were improved in the intervention group. Although the evidence of the pilot study should be considered as preliminary, it gives some indication of the feasibility of the SOCO group intervention and supports the usability of the theoretical background and approach for multiple outcome measures.

Key words: Affect recognition, autism spectrum disorder, group intervention, social competence.

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INTRODUCTION

Difficulties in social interaction are central features of autism spectrum disorder (ASD), challenging the ability to establish satisfying peer relationships (APA, 2013). The social difficulties of children with ASD persist into adulthood, where they continue to impact social and occupational functioning (Rao, Beidel & Murray, 2008). The development of evidence-based social interventions for children and adolescents with ASD is an essential research target to improve the quality of life for these individuals.

Group interventions have been widely used to improve the social skills of cognitively able individuals with ASD (Gates, Kang & Lerner, 2017). The efficacy studies have shown some encouraging evidence that participants in social skills groups improved in overall social competence and friendship quality, as evaluated by their parents (Derosier, Swick, Davis, McMillen & Matthews, 2011; Gates *et al.*, 2017; Reichow, Steiner & Volkmar, 2013). The participating children and their parents have also reported increased life satisfaction (McMahon, Lerner & Britton, 2013). There have been medium effects reported on task-based measures (mainly in theory of mind tasks) (Gates *et al.*, 2017), but ratings from teachers and observer-based studies have rarely shown any significant improvements (Gates *et al.*, 2017; McMahon *et al.*, 2013). The social skills which previous group

interventions have targeted have varied greatly, and the theoretical background of the intervention usually has not been described explicitly (see for a review, Gates *et al.*, 2017). In this article, we describe the Social Competence group intervention (SOCO) for children with ASD (Kylliäinen, Helminen & Rantanen, 2016), which was developed to improve social competence through a multilevel approach to rehabilitation rather than simply using social skills training in school-aged children and adolescents with ASD. In addition, we pilot the feasibility and efficacy of the method as part of tailoring the intervention to a Finnish healthcare context utilizing a variety of outcome measures.

Definition of social competence

There are many ways to define social competence. In general, social competence refers to a child's ability to use social skills effectively to achieve interpersonal goals, establish positive relationships, and adopt appropriate roles in multiple social groups (Rose-Krasnor, 1997). Some definitions emphasize social competence as a property of a person or an innate ability of prosocial behaviors and lack of antisocial behavior (Junttila, Voeten, Kaukiainen & Vauras, 2006) whereas according to other definitions it is described as effectiveness of situational interaction which is consistent with age-appropriate abilities (Dirks, Treat & Weersing, 2007). For the SOCO group intervention, we utilized a

model of social competence that comprises three components: (1) social skills; (2) social performance; and (3) social adjustment (Cavell, 1990). Social competence is strongly affected by biological and environmental factors (Fig. 1). In our model, the essential individual underlying factors for social competence are thought to be neurocognitive functioning (including social cognition and executive functioning), emotional regulation, motivational aspects, and self-concept (Kylliäinen *et al.*, 2016).

In the three-component model of social competence, social skills are specific abilities that are essential for appropriate behavior in social situations (Dodge, Pettit, McClaskey & Brown, 1986; Rose-Krasnor, 1997). Multiple domains of social cognition (e.g., social information processing, affect recognition, theory of mind) underlie the development of social skills which typically evolve in early childhood and include, for example, the use of eye contact, synchronized speech patterns, and basic social overtures. The skills that are more complex, such as conversation skills, affect regulation, and social problem-solving, progress gradually during development (e.g., Davies, 2010). The concept of social performance refers to the ability to use and adapt social skills appropriately and flexibly in varying social situations (Cavell, 1990). For example, children with ASD may master an individual social skill (or a task of social cognition) and, at the same time, lack the ability to use this skill in a socially adequate way in real-life situations. The reason for this difficulty can vary between individuals; it could, for example, relate to rapidly changing social situations, anxiety, or lack of motivation. The distinction between the concepts of social skills and performance is vital in designing intervention procedures in order to focus on accurate goals. Social adjustment is the highest level in the hierarchy of the three components of the social competence model. It refers to age-appropriate achievements in social and emotional well-being evidenced by prosocial behavior and an absence of internalizing or externalizing behavior problems. Social adjustment is not, however, merely explained by adequate social skills and performance but also by other factors such as gender, physical appearance, and academic skills (Cavell, 1990). Stereotypical and

restricted behaviors as a part of the diagnostic criteria of ASD could also be considered to affect social adjustment. It should be noted that the three components of social competence should not be considered entirely separate but rather overlapping.

The SOCO group intervention

The SOCO group intervention method was built not only on the theoretical background of the three-component social competence model, but also on the background of neuropsychological rehabilitation (Dean, Barisa & Noggle, 2013; Hunter & Donders, 2007) and on cognitive behavioral therapy (Ho, Stephenson & Carter, 2014). The SOCO method is based on the development of the Rehabilitation of EXecutive Function and ATtention (EXAT) group intervention for children with attention deficits (Rantanen, Vierikko & Nieminen, 2018). The SOCO adopts a similar multilevel approach to EXAT in which the collaboration and psychoeducation are targeted also to parents and teachers as part of the intervention goals. The main goal of the SOCO group intervention is to improve social competence; other goals include the reinforcement of executive functions, support for a realistic self-image, and an increase in self-esteem for the participants. The principal approaches to neuropsychological rehabilitation, that is, cognitive training, strengthening compensatory strategies and aids, psychoeducation, and psychosocial support (Dean *et al.*, 2013; Hunter & Donders, 2007), are utilized in order to improve all the components of social competence. Children's social skills are trained, for example, using age-appropriate psychoeducation combined with the simulation of social situations through role-play and social stories (cf., Gray & White, 2005). Social performance is reinforced in the diverse social situations of the group sessions by supporting the participants in their ability to modify their own behavior to adapt to different social situations. Social adjustment can be nurtured, for example, by strengthening the participants' self-esteem and self-awareness. This can be done by creating social situations in which the participants can succeed and by guiding the children to recognize their emotions and the

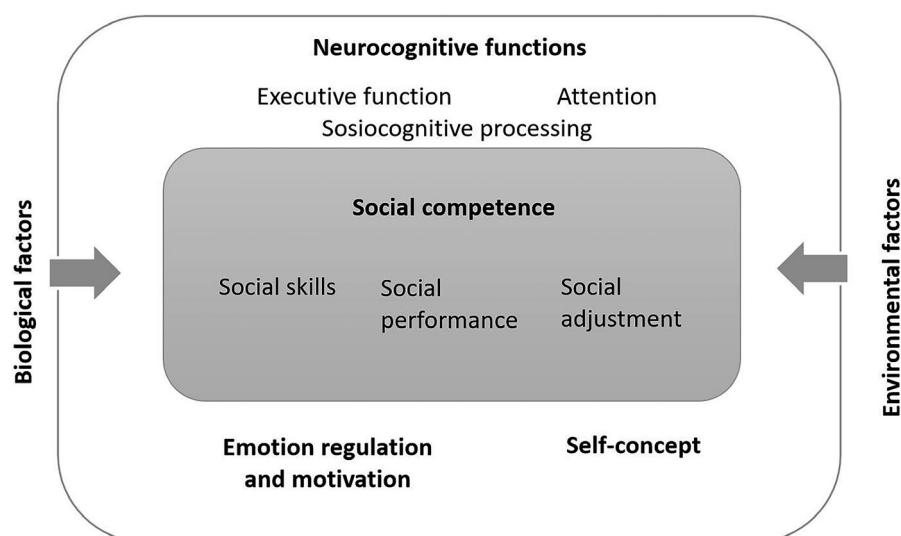


Fig. 1. The model of social competence (modified from Kylliäinen *et al.*, 2016)

anxiety elicited by social interaction. In addition, working in collaboration with the parents and teachers is a vital component in making an impact on a child's social adjustment. The participants' individual goals are based on a neuropsychological assessment and developmental psychology. Specific individual goals are defined with the parents and the child in order to generalize the achievements to everyday life (cf., Jonsson, Choque Olsson & Bölte, 2016). The SOCO group intervention was also designed to meet the recommendations of the ASD literature (Krasny, Williams, Provencal & Ozonoff, 2003; McMahon *et al.*, 2013; White, Keonig & Scahill, 2007) including, for example, being a structured, manual-based program and involving the parents and school in the intervention.

The purpose of the present study was to pilot the nine-month, outpatient, manualized SOCO group intervention method for 7- to 12-year-old cognitively able children with ASD (Kylliäinen *et al.*, 2016) and to examine the feasibility of the three-component model of social competence as a theoretical background together with various outcome measures. Following the research reviews (Gates *et al.*, 2017; McMahon *et al.*, 2013), a variety of measures including questionnaires, neuropsychological tests, and observations were selected to achieve a pilot insight of how these different measures could capture the possible changes in social competence and its three components: social skills, social performance, and social adjustment. The questionnaire, the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) for parents and teachers, was selected as it has been commonly used in previous studies (Gates *et al.*, 2017) and was thought to be suitable in covering the different components of social competence. Neuropsychological tests were utilized to give some indication of possible changes in social cognition that underlie a variety of social skills. Facial affect recognition was selected as a relevant subdomain of social cognition in ASD (e.g., Lozier, Vanmeter & Marsh, 2014) and it was one of the training targets in our SOCO group intervention. We used two qualitatively different tests of facial affect recognition: a traditional pen and paper test (NEPSY-II Affect Recognition Task; Korkman, Kirk & Kemp, 2008) and a computer-based test (Frankfurt Test and Training of Facial Affect Recognition; FEFA-2; Bölte, Ciaramidaro, Schlitt, Hainz, Kliemann & Beyer, 2015). The FEFA-2 offers the possibility to assess affect recognition of both the full face and the eyes only, which is important given that individuals with ASD have deficits in recognizing emotions in the eyes (e.g., Baron-Cohen, Campbell, Karmiloff-Smith, Grant & Walker, 1995). In addition, direct evidence of the children's social performance in the groups was gathered through observations.

It was hypothesized based on previous studies (Reichow *et al.*, 2013) that the intervention effects on social performance and adjustment would be evident in the parents' reports at the short- and long-term outcome reference points, whereas there would not be a great improvement in the teacher's reports. It was also assumed that the assessments of affect recognition with the NEPSY-II and the FEFA-2 would show improvements in the intervention group but not in the control group. Although we expected improvements during the group intervention, no precise hypothesis was made concerning the observations due to the lack of earlier comparable studies and the pilot nature of the current study.

METHODS

Participants

The participants were drawn from a clinical sample of two different sites and from five different SOCO groups that consisted of 20 children altogether. Of those, a total of 16 children and their parents agreed to participate in the study. All participants were boys, with a mean age of 10.5 years (SD = 1.3; range 7.9–12.7 years). The children were referred to the SOCO group intervention by community psychologists, child psychiatrists, and child neuropsychiatry clinics across Pirkanmaa and South Karelia, Finland. The inclusion criteria were clear symptoms and suspicion of ASD, cognitive functioning in the normal or higher range, and parental commitment to the intervention. A formal diagnosis of ASD could not be an inclusion criterion as most of the participants were in the middle of diagnostic assessment. The diagnosis procedure followed the clinical guidelines of ASD diagnostics and was confirmed by a professional, experienced multidisciplinary team. By the long-term follow-up, there was only one participant who did not yet have a formal ASD diagnosis. The SRS (Constantino & Gruber, 2005), which was collected at the baseline of the study, also confirmed the autism spectrum symptoms (mean of total t-score = 82; SD = 11.6; range 55–99). The children's cognitive functioning was assessed prior to inclusion with the Wechsler Intelligence Scale for Children—Third or Fourth Edition (WISC-III; Wechsler, 1999; WISC-IV; Wechsler, 2010) and was within the normal range (M \pm SDs) (mean = 99; SD = 15.2; range = 76–121). Only one child used medication, and two of the children had other weekly interventions at the same time. Two of the children attended special education classes, and five children received special pedagogical support within their own mainstream class. The children and their parents were interviewed before the intervention to obtain information about autism symptom severity and to define individual goals by combining the theoretical background in neuropsychological rehabilitation and the expectations of the parents. To support the success of the intervention, it was also important to ensure the families' commitment to a long intervention.

In addition, a separate control group of seven children took part in the study. Originally, ten children were assessed at the baseline, but three dropped out from the control group at the beginning as they did not return the questionnaire data. The children in the control group had the same inclusion criteria as the intervention group, that is, having a formal ASD diagnosis or being in the middle of the diagnosis procedure. The age (mean = 9.4; SD = 1.6; range 7.8–12.5 years) and cognitive functioning (mean = 104; SD = 17.4; range 80–129) of the control group were not significantly different from the intervention group ($U = 28, 5; p = n.s.$; $U = 42, 5; p = n.s.$). Three of the children were waiting-list controls and took part in the study whilst waiting for a place in the group intervention. This study underwent an ethical review (number 581/13.00/2012) by the South Karelia Social and Health Care District (Eksote) and by the University of Tampere (50/2017). All participating families were provided with written and oral information prior to their consent to take part in the study. The teachers were also provided the written information prior to participation.

Intervention

The intervention groups lasted nine months; two groups were held at a community clinic and three groups at a university clinic. All groups included four children and two interventionists. The groups consisted of 26 to 32 weekly, 90-minute group sessions. The parents participated in their own separate 90-minute group sessions, which were held nine times, once per month, during the intervention. In addition, the parents had two individual meetings, one at the beginning of the intervention and one at the end. The teachers were met once or, most typically, twice, once during the first half of the intervention and once during the second half. A summary of the SOCO group intervention process is shown in Appendix 1. The main goals of the SOCO groups were to improve the children's social competence, reinforce their executive functions, and support their realistic self-image and self-esteem. The aims for the parent

groups were: (1) to help the parents create a more functional daily life; (2) to generalize the rehearsed skills to everyday life; (3) to reinforce good practices in child rearing; and (4) to support the parents' well-being. The main aims of the collaboration with the teachers were: (1) to share information; (2) to generalize the intervention outcome to the school environment; and (3) to counsel and support the teachers. The interventionists were two psychologists in three of the groups, and a psychologist and a neuropsychiatric coach in two of the groups. A psychologist, a neuropsychologist, or a family therapist led the group sessions for the parents. To ensure the quality and fidelity of the intervention process, all group leaders attended supervisory meetings once a month (16 hours in total) led by a neuropsychologist from the SOCO development team. There were ten intervention providers, and only one of them was part of the research team. She (S.H.) was an interventionist in only one group for the first ten sessions. The group intervention was carried out following the SOCO manual (Kylläinen *et al.*, 2016, unpublished at the time of the intervention), including the structure, practical guidelines, and examples of intervention. The specific content of the intervention program for each group was defined by the group leaders in consideration of the children's individual goals.

In line with the principles of neuropsychological rehabilitation and methods of cognitive therapy, the intervention included elements of cognitive training, strengthening compensatory strategies and aids, psychoeducation, and psychosocial support. At the beginning of the year, the individual goals focused on basic social skills and social performance (e.g., making eye contact when initiating a question to another child). During the year, the goals became more advanced, aiming to increase social adjustment. Facial affect recognition was included in the goals as one of the main subdomains in social cognition that underlies many social skills (see the intervention timeline in Appendix 2).

Each group session was structured with a program that was written on a white board and further visually supported by drawn picture cards of the activities. Meetings followed a sequence of activities, some of which were more structured (e.g., a social performance exercise and a relaxation session) and some more informal (e.g., recounting personal news and playing board games). Every activity was planned to promote progress in specific goals towards social competence. Different aspects of social competence were trained through social themes that were composed from the children's individual goals. Each theme involved three to four group meetings and included training in basic skills, applying skills to a more realistic situation, and finding compensational ways to act both in group sessions and through homework. For example, the theme of "interacting with another child" started with skill-directed training involving role-play and comics and moved on to training social performance in a game or in more unstructured situations. Another example of a theme from the intervention was "when getting frustrated." The theme typically supported all components of social competence. For example, instead of reacting to someone's comment instantly, the children were taught a new social skill, that is, to ask the speaker what he/she meant. The social performance was trained by practising the skill in different situations, whereas social adjustment was supported by helping the children to familiarize themselves with their feelings and come up with new ways to react to frustration. The children and their parents were also given a homework task of coming up with different ways to react to frustration. The homework was also discussed in the parent groups afterwards. An example of a group program is given in Appendix 2.

Study design

The study design for the intervention group included the baseline (T1), short-term outcome (T2) 10 months after the baseline that is, right after the intervention ended, and long-term outcome (T3), one and a half year (two groups) or around two or three years (three groups) after the baseline. The wide variation of the time interval in the long-term outcome was due to the two different sites included in the study. The questionnaires (SRS) for parents and teachers were administered to all of the participants in the intervention group at T1, T2, and T3. Some data were lost because not all of the parents and teachers returned the outcome questionnaires. According to a visual analysis of the descriptive data, there were no

differences in age, IQ, level of ASD, or site in the missing questionnaire data. Table 1 illustrates the number of cases in each outcome measure and at each timepoint. The number of participants in each analysis is also presented in the result text and in Tables 2 and 3.

The neuropsychological tests (NEPSY-II, Affect Recognition; FEFA-2, face and eyes tasks) and observations were administered for the subsample of the children from two groups at one site only ($n = 8$) at T1, T2, and T3. The neuropsychological tests were done in a separate individual session with a researcher. The baseline observation (O1) was conducted four to six weeks after the start of the intervention groups in order to ensure that the participants had settled into the group procedure before the observation. The two following observations were done at the mid-point of the intervention (O2) and during the final month (O3).

In the control group, there were only baseline and short-term outcomes available from the questionnaires and neuropsychological tests. Only four control children appeared for the neuropsychological assessment in the short-term follow-up (see Table 1).

Outcome measures

To have a diverse perspective on social performance and adjustment at home and in school, both the parents and the teachers were asked to complete the SRS (Constantino & Gruber, 2005), a 65-item rating scale measuring children's social competence and autistic behavior. The SRS provides Likert-scale information on the severity of ASD symptoms as they occur in natural settings. There are five subscales in addition to the total score: social awareness (8 items), social cognition (12 items), social communication (22 items), social motivation (11 items), and autistic mannerisms (12 items). The SOCO development team conducted a careful single-item analysis of the SRS, based on clinical and theoretical judgement. According to this analysis, we confirmed that the subscales of social awareness and cognition were appropriate to measure social skills whereas the subscale of social communication described social performance. The subscale of social motivation mainly defined social adjustment in the three-component social competence model (Cavell, 1990). The items presented in the subscale of autistic mannerisms could be considered to play a role in social adjustment difficulties as well. In the SRS, the higher t -scores ($M = 50$; $SD = 10$) represent greater difficulties within the subscale. The questionnaire's reliability was measured by using internal consistency, which varied from 0.77 (social awareness) to 0.92 (social communication). Social awareness was the only subscale that fell below 0.80.

The affect recognition task of the social perception domain in the NEPSY-II (Korkman *et al.*, 2008) was used. The NEPSY-II is a standardized neuropsychological test battery designed to assess children's neurocognitive functions. In the affect recognition task, a child was asked to match emotional expressions with photographs of children's faces. In the first part of the task, the child was shown a picture of a target face

Table 1. The number of cases in each outcome measure and at each timepoint

	Baseline		Short-term outcome	Long-term outcome
	T1	Intervention	T2	T3
Questionnaire (SRS)				
Parents				
Intervention	16		12	15
Control	7		7	–
Teachers				
Intervention	16		12	8
Control	7		7	–
Affect recognition tasks				
Intervention	8		8	8
Control	7		4	–
Observation				
Intervention		O1 O2 O3		
		8 8 8		

Table 2. Baseline, short-term, and long-term measurements of the affect recognition tasks in the intervention group ($n = 8$) and the control group ($n = 4$)

	Baseline Mean (SD; Range)	Short-term outcome Mean (SD; Range)	Long-term outcome Mean (SD; Range)
NEPSY-II (SS)			
Intervention	9.8 (3.2; 3–13)	9.5 (2.6; 6–15)	10.8 (2.2; 8–13) [†]
Control	8.3 (1.5; 6–9)	8.3 (5.0; 1–12)	
FEFA: Face task (%)			
Intervention	73.2 (5.6; 64–80)	75.3 (7.5; 62–86) [†]	80.0 (6.4; 70–88)*
Control	67.5 (10.0; 60–82)	78.5 (6.2; 70–84)	
FEFA: Eyes task (%)			
Intervention	70.0 (11.5; 52.5–82.5)	73.8 (9.5; 57.5–85)	78.1 (9.2; 57.5–90)*
Control	61.3 (9.2; 60–82)	68.1 (4.3; 62.5–72.5)	

Notes: SS = standardised score (Mean = 10; SD = 3). % = percent of right answers on the FEFA. Asterisks and daggers indicate the statistical significance for the difference in relation to baseline,

[†] $p < 0.1$; * $p < 0.05$.

Table 3. First, second, and third trimester measures (Mean; SEM) for the children's observed behaviors in the intervention group ($n = 8$) during the ten-minute play session

Observed behavior	1 st trimester Mean (SEM)	2 nd trimester Mean (SEM)	3 rd trimester Mean (SEM)
Appropriate general overtures	6.9 (2.5)	10.0 (2.1)	8.3 (2.6)
Inappropriate general overtures	0.9 (0.9)	1.3 (0.6)	1.6 (0.8)
Appropriate overtures targeted at another child	1.3 (0.6)	2.6 (1.3)	2.1 (0.8)
Inappropriate overtures targeted at another child	0.0 (0.0)	1.3 (0.9)	0.6 (0.6)
Appropriate reaction to the overtures of another child	1.6 (0.6)	4.9 (1.5)	5.4 (1.6)
Inappropriate reaction to the overture of another child	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)
Withdrawal	0.0 (0.0)	0.3 (0.2)	0.4 (0.3)

with emotional expression together with four faces of other individuals of which only one showed the same expression. The child was asked to select the face with same expression than the target face. In the second part of the test, the child had similar instructions but was allowed to look 5 seconds of the target face before it was turned away and the four matching faces were shown. The task has no time limit. There was a maximum of 20 target faces which were shown until the child could not get five consequent expressions right. Raw scores were standardized with a mean of 10 (SD = 3). The task's reliability was 0.94.

Both submodules of the FEFA-2 (Finnish version: Bölte, Ollikainen, Feineis-Matthews & Poustka, 2003) were used, namely, the face task and the eyes task. In the first part of the task, a child was shown a photograph of an adult face on a computer screen and was asked to choose one of the seven emotions written at the side of the photograph. In the second part of the task, the child had same instruction but only eye region of the face was visible (Fig. 2). The task has no time limit. The task included 50 pictures of faces and 40 pictures of eyes. The program produces the number of correct answers without normed data.

All observations were video recorded during the board game session of the group in which free social interaction and the need for affect regulation were anticipated to be at the highest level. The children were not given any specific instructions regarding the video recording, as the camera was present at every group session, and the children knew that they were being recorded in all the group sessions. The observation categories were: (1)

appropriate general overture; (2) inappropriate general overture; (3) appropriate overture targeted at another child; (4) inappropriate overture targeted at another child; (5) appropriate reaction to an overture of another child; (6) inappropriate reaction to an overture of another child; and (7) withdrawal from social interaction. The overtures and reactions with the adults in the group were not coded. The observation duration for analysis was ten minutes, and they were taken from the first, second, and third trimesters of the intervention period. Three master's degree-level psychology students performed the analyses. The observers were trained to code the videos using video samples; they coded the videos independently and were not aware of the intervention stage. To increase the observers' reliability, an observation was used for analysis only if two of the three observers had coded the same individual observation. Agreement between the observers was measured in the category of appropriate overture targeted at another child, where it varied between 66.8 and 83.3% ($M = 75.2$; $SD = 5.8$) of all the observations, and in the category of appropriate reaction to an overture of another child, where it varied between 78.4 and 84.8% ($M = 81.7$; $SD = 3.2$) of all the observations.

Statistical analyses

The data of the five intervention groups were pooled. The outcome data were analyzed using non-parametric measures. The threshold of significance was set at $p < 0.05$, and the threshold for a tendency of change was set at $p < 0.1$ due to the pilot nature of the study and the small sample size. IBM SPSS Statistics 23.0 was used to perform Wilcoxon signed-rank tests to examine the within-group differences at T1, T2, and between T1 and T3. T1–T2 measures immediate treatment effect, and T1–T3 measures the long-term effect after the follow-up period. T2–T3 was not included in the analyses as we assumed the change in treatment affect during that time interval would be non-significant. This indicates that the possible treatment effect remains, and non-significant findings could be easy to achieve with a small sample size. The between-group differences in the questionnaire data were analyzed with the Mann-Whitney test at T1 and T2. The effect size was calculated using Rosenthal's formula $r = \frac{z}{\sqrt{N}}$ in which N refers to the total number of observations (Rosenthal, 1994). Standardized scores ($M = 10$, $SD = 3$) were used in the NEPSY-II. In the FEFA-2, the percentage of the correct answers was used. For the SRS, the standardized t -scores ($M = 50$; $SD = 10$) provided in the scoring manual (separately for parents and teachers) were used in the analysis.

RESULTS

Questionnaire for the parents and teachers

The findings of the SRS questionnaire revealed that the parents of the intervention group ($n = 12$) reported a significant improvement

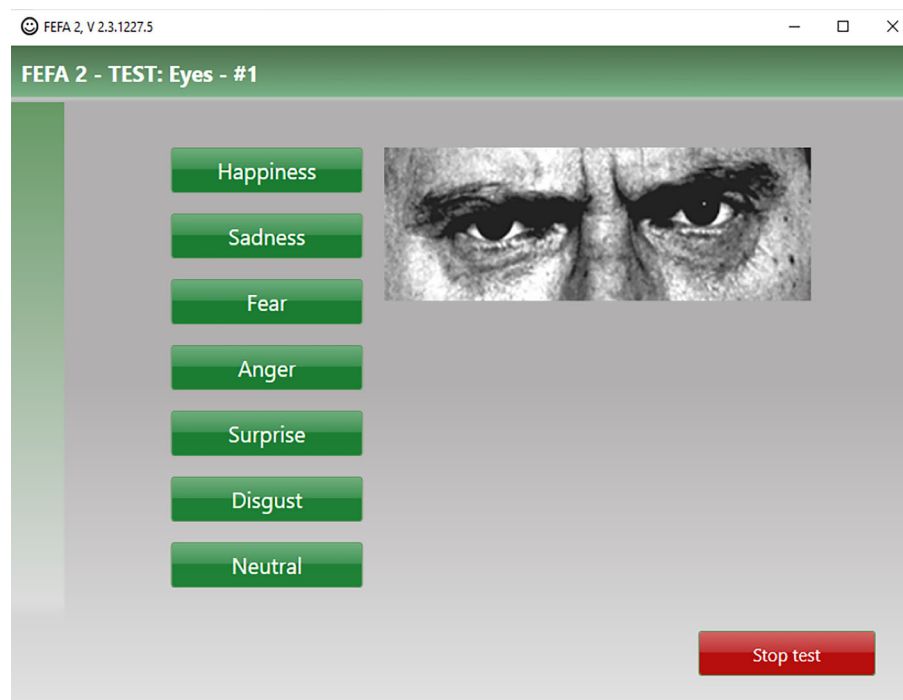


Fig. 2. Example of FEFA-2: The eyes task

in social awareness ($Z = 2.007$; $p = 0.045$; $r = 0.410$) and social motivation ($Z = 2.249$; $p = 0.025$; $r = 0.460$) between the T1 and T2 measurements (Fig. 3). There were also tendencies of improvement in social cognition ($Z = 1.847$; $p = 0.065$; $r = 0.377$) as well as a decrease in autistic mannerisms ($Z = 1.648$; $p = 0.099$; $r = 0.336$) and in the total SRS score ($Z = 1.887$; $p = 0.059$; $r = 0.385$) between the T1 and T2 measurements (Fig. 3). The results of the T3 questionnaire for the parents in the intervention group ($n = 15$) showed significant improvements in social awareness ($Z = 2.779$; $p = 0.005$; $r = 0.507$) and social cognition ($Z = 2.446$; $p = 0.014$; $r = 0.447$) as well as a decrease in total score ($Z = 2.512$; $p = 0.012$; $r = 0.459$). There was also a trend in improved social motivation between the T1 and T3 measurements ($Z = 1.886$; $p = 0.059$; $r = 0.344$). There were no significant changes or even tendencies in SRS scores between the T1 and T2 measurements according to the parents of the control group ($n = 7$). There were no significant differences between the groups. There were no long-term data of the control group available.

The teachers of the children in the intervention group ($n = 12$) reported a significant improvement from T1 to T2 in social communication ($Z = 1.978$; $p = 0.048$; $r = 0.404$), a trend in improvement for social awareness ($Z = 1.897$, $p = 0.058$, $r = 0.387$), and a significant decrease in total score ($Z = 2.443$; $p = 0.015$; $r = 0.499$). There was no significant change between the T1 and T3 measurements ($n = 8$). In the short-term outcome of the control group ($n = 7$), there was a tendency of improvement in social awareness ($Z = 1.859$; $p = 0.063$; $r = 0.497$) according to teachers' reports. The control group scored better in social awareness than the intervention group did at T1 ($U = 21.500$; $p = 0.018$; $r = 0.486$). There were no other significant differences between the groups in any other measures at T1 or at T2. There was no long-term measurement for the teachers of the control group (Fig. 4).

Affect recognition tasks

The performance of the NEPSY-II and the FEFA-2 affect recognition tasks in the intervention and control groups is presented in Table 2. The NEPSY-II did not show any statistically significant change between T1 and T2 measures in either the intervention ($n = 8$) or the control group ($n = 4$). There was a trend for improvement in the affect recognition performance ($Z = 1.667$; $p = 0.096$; $r = 0.417$) in the NEPSY-II only between the T1 and T3 measures in the intervention group. In the FEFA-2, however, there was a trend for improvement in the measurement between the T1 and T2 measures of the intervention group, which was shown in the face task ($Z = 1.706$; $p = 0.088$; $r = 0.427$) but not in the eyes task. At the T3 measurement point, there was a significant improvement compared to T1 in the FEFA-2 face task ($Z = 2.375$; $p = 0.018$; $r = 0.594$) and at this time in the eyes task ($Z = 2.375$; $p = 0.018$; $r = 0.594$). The increase in the FEFA-2 performance was not significant in the control group.

Observation

The observation results (Table 3) showed that in the first trimester of the intervention, the children ($n = 8$) made some general overtures, but few overtures were directly targeted at another child. Reactions to other children's overtures were also minimal. When summing up all appropriate interactions (i.e., appropriate general overtures, targeted overtures, and reactions), the analyses showed a significant improvement between the first and second trimesters ($Z = 2.197$; $p = 0.028$; $r = 0.594$). There were no significant changes between the trimesters when analysing the different observation categories separately. There were few inappropriate interactions and hardly any withdrawal from social interaction, and no significant differences in inappropriate interactions.

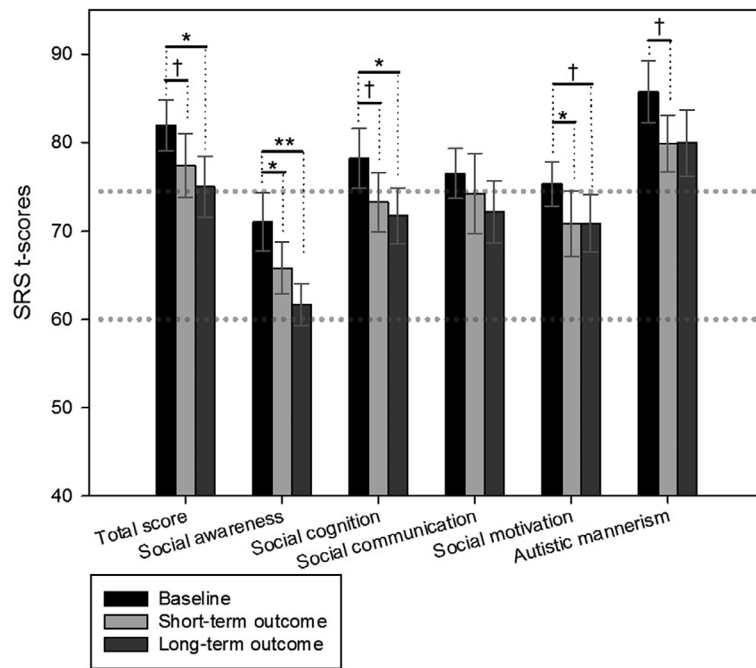


Fig. 3. The SRS t-scores (Mean & SEM) of the total scale and each subscale at baseline, short-term, and long-term outcomes. Higher scores represent more autism-related traits. Significance and tendency of change in the comparison to baseline is marked (†*p* < 0.1, **p* < 0.05, ***p* < 0.01). Dotted lines represent the SRS's two cut-off scores for ASD (≥ 60: mild to moderate; ≥ 75: severe).

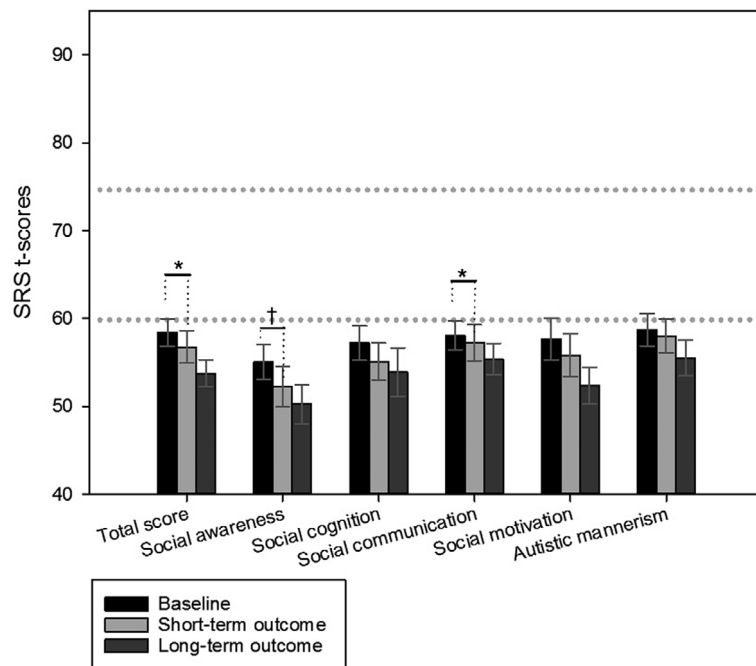


Fig. 4. The SRS t-scores (Mean & SEM) of the total scale and each subscale at baseline, short-term, and long-term outcomes. Higher scores represent more autism-related traits. Significance and tendency of change in the comparison to baseline is marked (†*p* < 0.1, **p* < 0.05, ***p* < 0.01). Dotted lines represent the SRS's two cut-off scores for ASD (≥ 60: mild to moderate; ≥ 75: severe).

DISCUSSION

In this study, we described the SOCO, a manual-based neuropsychological group intervention method developed to improve the social competence of children with ASD (Kylliäinen

et al., 2016). We examined the feasibility and preliminary efficacy of the SOCO in five groups (*n* = 16) of 7–11-year-old cognitively able children with ASD. We also had a control group of children with ASD (*n* = 7) who did not participate in the group

intervention or were on a waiting list for the intervention. In order to obtain a broad perspective of the feasibility and efficacy of the intervention, we utilized multiple outcome measures, namely, questionnaires, neuropsychological tests, and observations. To clarify the theoretical background and the targeted goals of the SOCO, we specified three different components of social competence – social skills, social performance, and social adjustment (cf., Cavell, 1990) – and evaluated the effectiveness of the intervention and the feasibility of various outcome measures through these concepts. Improvements were found in all three components of social competence. *Social skills* improved most clearly when evaluated by the parents but also somewhat when evaluated by teachers and measured by neuropsychological tests. The improvement in *social performance* was best shown in teachers' reports and somewhat through the direct observations. The improvement in *social adjustment* was clearly present in the parents' answers. There were no marked improvements in the control group.

Questionnaire for the parents and teachers

The parents of the intervention group evaluated their children by the SRS questionnaire, which we considered to reflect the different concepts of social competence (cf., Cavell, 1990). In the short-term outcome of the intervention group, the strongest findings were the increase in the subscales of social awareness and social motivation. The questions on the social awareness subscale relate mainly to basic social skills (e.g., “walks in between two people who are talking” and “focuses his or her attention on where others are looking or listening”) which we considered to resample the lowest component in the hierarchical components of social competence. The findings of the parents' reports were not, however, limited only to increased social skills. The parents also noticed direct benefits in their children's social motivation. The SRS subscale of social motivation consists of 11 items, which are not all directly related only to the concept of social motivation. The subscale includes many items concerning self-confidence, age-appropriate independence from the parents, and a lack of social isolation. These issues relate closely to the concept of social adjustment, which is defined as age-appropriate achievements in social and emotional well-being and prosocial behavior (Cavell, 1990). Social adjustment is thought to be, hierarchically, the highest level of social competence. Thus, some achievement in this domain in the short-term outcome is an encouraging finding. The previous studies have not often found improvements in this high level of social competence but have reported improvements in social communication (Gantman, Kapp, Orenski & Laugeson, 2012; Stichter, O'Connor, Herzog, Lierheimer & McGhee, 2012) and social cognition (Stichter *et al.*, 2012) which are considered relating to lower level social skills and performance in our model of social competence.

The parents of the intervention group also reported some decrease in autistic mannerisms, including items concerning stereotyped behaviors and restricted interests, soon after the intervention had ended. This finding is in line with a previous study (Gantman *et al.*, 2012) that showed a decrease in autistic mannerisms. We would like to consider the decrease of stereotyped and restricted behaviors as an improvement in social

adjustment. The majority of the items in this subscale (e.g., “has an unusually narrow range of interests” or “has repetitive, odd behaviors such as hand flapping or rocking”) relate to behavior that certainly affects a child's adjustment to his/her social surrounding in an age-appropriate way. It could also be that increased behavioral flexibility is seen as less restricted behavior in the home environment, as the SOCO group intervention also focuses on improving executive functioning. It should be noted, however, that the decrease in autistic mannerisms was not any more visible in the long-term outcome.

In the long-term outcome, most of the social improvements were even stronger than in the short-term outcome. Although it sounds promising in terms of the SOCO's efficacy that the positive outcome remains, these long-term findings should be interpreted with caution. First, there was no long-term outcome in the control group, and second, our follow-up time and sample size varied in the intervention group. Thus, further studies are needed to show whether the SOCO group intervention continues to promote improvement after the intervention has ended and how long this possible effect lasts. We did not find significant outcome differences between the intervention and control groups in the teachers' reports that were in line with the earlier studies (Gates *et al.*, 2017; McMahon *et al.*, 2013). Surprisingly, however, in the intervention group, the teachers' total SRS score showed a significant decrease, indicating fewer social difficulties in general right after the intervention had ended compared to the start of the intervention. The subscale that showed the strongest improvement was social communication, on which the parent-reported improvements were not significant. We interpreted social communication to reflect the social performance component (e.g., “difficulties in following ordinary conversations” or the reversed item “plays appropriately with peers”) in the model of social competence (Cavell, 1990). Teachers have frequent, daily opportunities to observe children communicating and playing with peers, which might make it possible for them to observe changes in social behavior. This issue may explain why the teachers noticed the positive intervention changes in social performance at the short-term outcome point although the parents did not. In addition, the teachers reported a tendency of improvement in the subscale of social awareness, but this was seen in both the intervention and control groups. This subscale describes an increase in social skills. As the previous group intervention studies for children with ASD have not consistently managed to show improvements in teachers' reports (Gates *et al.*, 2017; Laugeson, Frankel, Gantman, Dillon & Mogil, 2012; McMahon *et al.*, 2013), our findings are encouraging. In addition, the positive effects of the intervention were noticed by the teachers who were not directly involved in the intervention as they typically are in school-based programs (e.g., Rao *et al.*, 2008). Only a few similar settings outside the school had similar findings in which the teachers reported improvements in social communication (Stichter *et al.*, 2012).

Affect recognition

In the traditional neuropsychological test of the intervention group, the performance was shown to be somewhat better in affect recognition only after long-term follow-up. On the FEFA-2,

the computer-based affect recognition task, the trend for progress was already visible at the short-term outcome although it was more clearly seen in the long-term follow-up. It could be that the different natures of the tasks explain the different patterns of findings. In the NEPSY-II Affect Recognition Task, the aim is only to match the 20 facial expressions seen, whereas in FEFA-2, the participant has to match the facial expressions to the verbal labels of different emotions in 50 trials. The larger number of trials and the requirement of verbal labelling might make the FEFA-2 more sensitive in measuring outcomes, in comparison to NEPSY-II. In addition, the average performance of affect recognition in the NEPSY-II was already age-appropriate at the beginning of the intervention, which could have also lessened its sensitivity in capturing short-term intervention changes in our sample of participants. It is unclear whether the positive change in the performance of the affect recognition task in the NEPSY-II in the long-term follow-up was the outcome effect of the intervention, as we did not have a long-term follow-up for the control group. However, the positive FEFA-2 findings in the intervention group could support the interpretation that the group intervention had some positive effect on the children's affect recognition skills.

An interesting further finding concerning affect recognition skills was that performance did not improve in the eyes task of the FEFA-2 in the short-term, but it did in the long-term follow-up, which could indicate a dosage effect of the SOCO group intervention on more subtle skills. In the eyes task, the children had to identify the emotions only from the eye region, making this task more difficult than identifying emotions from the whole face. Previous studies have shown that the ability to recognize emotions from the eyes is diminished in individuals with ASD (e.g., Baron-Cohen *et al.*, 1995). Adults with ASD have shown a pattern of misrecognizing anger for fear when seeing only the eye region of the face (Wallace, Coleman & Bailey, 2008). Adolescents with ASD have also interpreted blended emotions from the eye region as negative emotions (e.g., fear and sadness) more often than typically developing adolescents do (Kuusikko, Haapsamo, Jansson-Verkasalo, Hurtig, Mattila & Ebeling, 2009). It could be possible that the improvement in the intervention group was seen in the more difficult eyes task only after the longer follow-up period as a consequence of drawing more attention to faces and therefore, improving the children's ability to read facial expressions from the eyes only. It is, however, rather speculative whether this favourable development is related to the intervention outcome, as there was no long-term follow-up for the control group in this pilot study. Nevertheless, these findings suggest that it is recommended to use sufficiently sensitive tasks when measuring change in social cognition, such as affect recognition, which is thought to underlie many social skills.

Observation

The observations were used to collect direct, detailed evidence of the changes in social performance in the intervention group. Social performance was operationalized as appropriate and inappropriate behaviors including general overtures, overtures targeted at another child, and reactions between the children. Overtures and reactions targeted at the interventionists were not

recorded because children with ASD tend to interact with adults instead of other children, and the goal of the group intervention was to reinforce appropriate overtures and reactions between peers. At the beginning of the intervention, there were few overtures or reactions, but during the intervention, there were improvements in appropriate interaction (general overtures, targeted overtures, and reactions) between the children. In earlier studies where behavior observation has been an outcome measure, the findings have not been consistent (McMahon *et al.*, 2013). For example, in a study by Herbrecht, Poustka, Birnkammer *et al.* (2009), no improvements in outcome were seen in observation, and the authors argued that this was possibly due to the small sample size and changes in the group setting (e.g., holiday breaks). Positive outcomes in observation have been reported in studies where the observer has been a part of the intervention, which could lead to a positive bias of outcome (e.g., Bauminger, 2002). In our pilot study, the observers did not take part in the intervention and were blind to the intervention stage.

Strengths and limitations

In this study, we used a variety of recommended outcome measures (Gates *et al.*, 2017; McMahon *et al.*, 2013; White *et al.*, 2007): questionnaires for parents and teachers, classical psychological assessments, and observations. We used different measurements in order to investigate the changes in different aspects of social competence. In many studies, the concept of social competence has been used in various ways to describe different aspects of social interaction. The intervention outcomes have been evaluated by measuring a wide array of cognitive functions, from theory of mind to executive functioning. In this study, we focused on the theoretical definition of social competence and tried to be explicit which aspect of social competence the outcome measures are targeting. We were able to detect some positive changes in different areas of social competence with different outcome measures. The most informative measures with strongest ecological validity seemed to be the questionnaires and direct observations. Methods of neuropsychological rehabilitation (i.e., cognitive training, compensatory strategies, psychoeducation, and psychosocial support) could be beneficial in order to achieve positive behavioral changes in children with ASD.

Although this study provides some preliminary support on the feasibility and efficacy of the SOCO and the applicability of the theoretical concept of social competence, it is limited in its generalizability due to the small sample size of the intervention and control groups. There were also missing data in the short- and long-term outcomes, different outcome measurement procedures between the two sites of the study and no long-term outcome for the control group. Furthermore, we could not evidence any significant differences between the intervention and control groups which weakens our conclusions that the positive effect in the intervention group was related to the intervention. The response bias of the parents' questionnaires due to parents participating in the intervention should also be considered when interpreting the positive findings of the parent reports.

In the future, larger clinical trials should replicate this model to strengthen the validity of the SOCO group intervention. It would be interesting to analyse the correlation between task-related

affect recognition and the social performance reported by parents and teachers. For this kind of analysis would necessitate larger intervention trials. When evaluating the intervention effects on social competence, it is also important to evaluate social adjustment, such as a lack of anxiety or behavioral problems, with precisely dedicated measurements for these issues. Social adjustment is an important aspect of emotional well-being and quality of life in individuals with ASD over a lifetime and, as such, warrants-specific attention.

CONCLUSION

To conclude, this pilot study provides some promising results on the feasibility and preliminary efficacy of the SOCO group intervention method, that was built on the three-component social competence model, background of neuropsychological rehabilitation and on cognitive behavioral therapy. The results suggest that the three-component social competence model could be beneficial in forming and evaluating the goals and in interpreting the outcome of the intervention. Especially, the SRS questionnaire and the observation measures appeared to be sensitive to the effects of the SOCO intervention and could be used in future clinical trials. In the future studies, a broad range of outcome measurements is warranted, especially in holistic neuropsychological interventions in which the main goal is to improve social competence. In addition to giving theoretical and methodological background for future studies, the theoretical background presented and tested in this study also gives direct support for interventionists in planning, conducting and evaluating the intervention. It is also clinically beneficial to collect different kind of outcome information from multiple sources.

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APPENDIX 1. SOCO SUMMARY AND EXAMPLE OF THE SESSION PROGRAM CHILDREN

- 26-32 weekly sessions, 90 min (9 months)
- 4 children, 2 interventionists
- Structured program including

- 1.. 1.. Program
- 2.. 2.. Social performance exercise
- 3.. 3.. Discussion
- 4.. 4.. Board game
- 5.. 5.. Relaxation
- 6.. 6.. Evaluation
- 7.. 7.. Home assignments

○Main goals: improving social competence, reinforcing executive functions, supporting realistic self-image and self-esteem

Parents

- 9 monthly sessions parallel to children’s group, 90 min
- parents of 4 children, 1 interventionist
- Main goals: help the parents create a more functional daily life, generalization of the rehearsed skills to everyday life, reinforcing good practices in child rearing, supporting the parents’ wellbeing.

Teachers

- Two individual meetings for each teacher together with a group leader and parents
- Main goals: sharing information, generalization of the rehearsed skills to school, counselling the teachers

APPENDIX 2. AN EXAMPLE OF THE TIMELINE OF THE SOCO GROUP INTERVENTION

