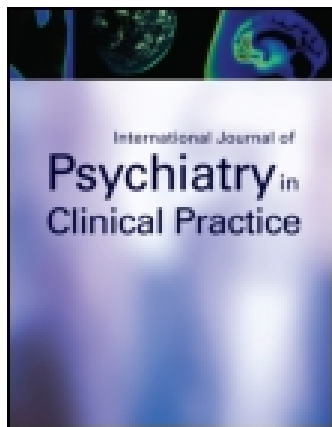


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ORIGINAL ARTICLE

Social skills training in children with PDD-NOS: An exploratory study

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Abstract

Objective. A deficit in social interaction is characteristic for children with Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS). The aim of this exploratory study is to assess the effect of Social Skills Training (SST) in children with DSM-IV based PDD-NOS. **Methods.** Ten consecutively referred children ($n = 3$ girls and $n = 7$ boys, mean age = 8.5, mean Full Scale Intelligence Quotient [FSIQ] = 104) participated in the standardized SST in a university outpatient department of child psychiatry. The valid and reliable Children's Social Behaviour Questionnaire (CSBQ) and Self-Perception Profile for Children (SPPC) were filled out pre- and post treatment by parents and children respectively. **Results.** Parent's CSBQ total and subscale "Social understanding" scores were significantly lower after the SST. Children's scores on the subscale "Scholastic Competence" of the SPPC were significantly higher after SST, whereas their scores on the SPPC subscale "Physical Appearance" were significantly lower after SST as compared to before. **Conclusions.** This study provides a first indication of positive effects of SST in children with PDD-NOS.

Key Words: Social skills training, PDD-NOS

Introduction

SST is a common intervention method for children with Autism Spectrum Disorders (ASDs) and is often based on behavioral and/or cognitive principles. However, randomized controlled trials (RCTs) testing the effectiveness of SST are lacking [1–4] and studies seem to yield inconsistent findings. This might partly be the result of heterogeneous study populations, methodological shortcomings, and a variety of outcome measures [5]. Effect sizes vary per study, but an overview study of Beelman and colleagues [6] showed an average effect size of 0.45 (d from 0.01 to 1.20) depending on the targets of intervention, the different populations and the different outcome measures. Rao et al. [2] reviewed 10 SST intervention studies in patients with high functioning autism and Asperger's syndrome. They found that 70% of the studies reported positive treatment effects and 30% reported no treatment efficacy. They also emphasized that one of the limitations across studies was the lack of a common definition of social skills, which makes different studies hard to compare. Further, only

two studies included a comparison group and only three studies included more than 10 subjects.

PDD-NOS occurs at least twice as often [7] as autism, but the paradox is that, although PDD-NOS may be much more common, the disorder is much less frequently studied than autism [8]. Matson and colleagues [9] state in their overview study that nearly all SST studies have focused on children or adults with autism and that therefore studies on related ASDs are required. Therefore, in this manuscript, an exploratory study about the effect of SST in children with PDD-NOS will be presented. A classification of PDD-NOS applies when an individual fails to meet specific criteria for autism or another explicitly defined ASD, but has similar difficulties in social interaction, reciprocal communication, and/or stereotypical behavior [10]. These difficulties may be milder or of different quality than those seen in autism [11], and these pervasive impairments in the socialization process may have negative consequences on the development of other daily life skills.

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Solomon and colleagues [12] compared boys in a SST group to boys in a control group. Boys in the SST group were aged 8–12 ($FSIQ \geq 75$), and had a DSM-IV diagnosis of Asperger's syndrome ($n = 5$), high functioning autism ($n = 3$), or PDD-NOS ($n = 1$). Diagnoses were confirmed by the Autism Diagnostic Observation Schedule-Generic (ADOS-G; [13]) and the Autism Diagnostic Interview-Revised (ADI-R; [14]). They found significant improvements in emotion recognition and real life type problem solving in the SST group as compared to the control group [12]. This study had very explicit and standardized inclusion criteria, as well as many standardized outcome measures, and a clearly stated and reproducible SST manual. However, the study sample was still small which limited the ability to generalize the results, only boys were included, only one outcome measure of social skills was included, and most importantly, children with different ASDs were merged into one group which makes this study group very heterogeneous and no conclusions can be drawn about any of the ASD groups in isolation.

Lopata et al. [15] evaluated a manualized summer social program on the social performance of 54 children (mean age = 9.5) with autism ($n = 36$), high functioning autism ($n = 6$) and PDD-NOS ($n = 12$). Classifications were made by using the DSM-IV [10]. All children had a short-form IQ > 70 . Strengths in this study were that parents as well as staff of the training course filled out outcome measures, and that behavioural as well as neuropsychological variables were assessed. Overall, parents as well as staff members reported significant improvements in social skills and problem behaviours. Some limitations of this study were the lack of a control group, and although they applied an intensive diagnostic screening procedure, the "gold standard" measures ADOS-G [13] and ADI-R [14] were not included. Further, although the authors acknowledge difficulties with differential diagnoses of autism, high functioning autism, and PDD-NOS, no conclusions can be drawn from this study about children with PDD-NOS as a separate group. Only 22% of the sample consisted of children with PDD-NOS, whereas in clinical practice a classification of PDD-NOS occurs much more often than autism.

Barry and colleagues [1] also examined whether an outpatient-based SST for children with DSM-IV based high functioning autism ($n = 4$) leads to improvements of social skills. Their age range was from 6–9 years, and Verbal IQ (VIQ) scores ranged from 96 to 119 with a minimum of 70 as the inclusion criterion. Parent's reports, child self reports, as well as observation outcome measures were included. The curriculum of the SST seemed explicitly defined although it is unclear whether this involved an officially published

and widely available SST protocol. The authors found that particularly greeting and play skills improved, and the children reported an increased feeling of social support at school. Generalization of social skills to other settings showed limited improvements. Strength of this study was that very specific social behaviours were trained in the SST and were evaluated pre- and post treatment. However, the sample size was very small and no children with PDD-NOS were included.

Summarized, PDD-NOS is the most commonly occurring type of ASD, and children with PDD-NOS are characterized particularly by impairments in social interaction. Therefore, SST seems a rational intervention and results from studies in children with broader ASDs seem promising. Thus, studies that evaluate the efficacy of SST in a homogeneous group of children with PDD-NOS are required. This exploratory study presents some preliminary findings of the effect of a SST in school-aged children with PDD-NOS in an academic outpatient setting.

Methods

Participants

In order to decrease a selection bias as much as possible, ten consecutively referred children, three girls and seven boys, who were 8–9 years old ($M = 8.5$; $SD = 0.5$), participated in the SST. All patients had been diagnosed with PDD-NOS according to DSM-IV-criteria [10], by a child- and adolescent psychiatrist, who based his diagnosis on several standardized assessments carried out by a multidisciplinary team. Standardized diagnostic assessments consisted of an intake with the parent(s), the administration of the Semi structured Clinical Interview for Children and Adolescents (SCICA; [16]) to the child, intelligence tests and other psychological tests if considered necessary for classification (i.e. ADOS-G; [13]), filling out questionnaires by the parents (i.e. CBCL; [17]), and contact with the teacher (standardized DSM-IV criteria). Children were subsequently referred for SST because of their social impairments. Two children (20%) fulfilled criteria for Attention Deficit/Hyperactivity-Disorder (ADHD) as well, one child (10%) met criteria for Oppositional Defiant Disorder (ODD), and one child (10%) met criteria for Obsessive Compulsive Disorder (OCD) as well as PDD-NOS criteria. For all 10 children the primary classification was PDD-NOS. For seven (70%) children an ADOS-G [13] was administered before participation in the SST. All children showed impairments in reciprocal social interaction, but only three (43%) of them met full criteria for an ADOS-G classification of ASD. The Wechsler Intelligence Scale for

Children-revised version (WISC-R; [18]) was administered to all children (mean FSIQ = 103.5; SD = 11.5). Table I presents a summary of descriptives of IQ and ADOS-G scores.

The authors of the SST protocol [19] specified some exclusion criteria: (1) insufficient cooperation or motivation of the child or the parent(s); (2) presence of other primary problems that need treatment first; (3) the child is too anxious to participate in a group process with other children; (4) the child participates in special education; (5) the child suffers from “partial defects” such as extreme difficulty in reading. Eleven consecutive children matched all inclusion criteria. One boy was excluded due to insufficient motivation. The 10 remaining children were subsequently divided in two identical SST groups. Prior to participating in diagnostics and treatment in our academic setting, parents are always informed that some of the information they provide may be anonymously used for scientific studies. If parents did not agree with this their information was removed from further study, but this was not the case in the present study.

Procedure and assessment

The two trainers (registered psychologists) selected consecutive children from the SST waiting list. Parents filled out the CSBQ [20–21] before the start of the SST and a week after the first parents meeting, the children started with the SST. In their first meeting they filled out the Dutch version of the SPPC [22–23]. Following the last SST session, parents filled out the CSBQ again. Eight of the parents did this within a maximum of 1–2 months, and two parents needed several reminders and filled out the questionnaire only 6 months after the SST. All children of one group ($n = 5$) filled out the SPPC again in their last session of the SST.

Table I. IQ ($n = 10$) and ADOS-G ($n = 7$) scores for patients participating in the SST.

	M	SD
FSIQ	103.5	11.5
VIQ	104.3	9.7
PIQ	102.0	13.8
ADOS-G: Communication	1.6	0.8
ADOS- ADOS-G: Reciprocal social interaction	3.9	3.9
ADOS-G: Imagination/Creativity	0.4	0.8
ADOS-G: Stereotyped behaviours/restricted interests	0.7	1.3
ADOS-G: Communication + Reciprocal social interaction	5.4	4.5

ADOS-G, Autism Diagnostic Observation Schedule-Generic; FSIQ, Full Scale Intelligence Quotient; M, Mean; PIQ, Performance Intelligence Quotient; SD, standard deviation; SST, social skills training; VIQ, Verbal Intelligence Quotient.

SST “Spelend Leren, Leren Spelen” (Learning to Play, Playing to Learn)

We used a standardized Dutch protocol of a SST in this study: “Spelend leren, Leren spelen” [19]. This is a SST developed specifically for children aged 8–12 years, with difficulties in social contact with other children and/or for children who don’t understand their own social situation sufficiently. Diagnostically, these children mostly meet criteria for PDD-NOS. This SST is suitable for outpatient and semi-residential health care settings, child psychiatric institutions and schools for special education [19].

The method of the SST is based on behavioral as well as on cognitive keystones and focus lies on social cognitions and social skills.

Several techniques in the SST “Spelend Leren, Leren Spelen” originate from cognitive behavior theory (CBT), such as the Antecedent-Behavior-Consequence (ABC) principle. In the sessions, children practice with different situations, different feelings, thoughts and behaviors and different consequences related to these behaviors. By practicing several social skills in the training, the main goal is to broaden their repertoire of social skills, since a lot of these children tend to react in one rigid way only. Other techniques include positive reinforcement, reward systems, role modelling and cognitive restructuring. To generalize learned behavior in the SST, children are given homework tasks as well. These need to be practiced on a daily basis at home with the parent(s) and sometimes at school with the teacher(s) or other children.

The SST protocol consisted of 16 child sessions, of which 14 were regular weekly sessions, and two were follow-up-sessions. In total the SST covered a period of around 6 months. Every regular session took around 1.5 h and was built up in a very standardized, systematic order. Every session focused on a specific and explicitly defined theme as stated in the manual: (1) getting to know each other; (2) show that you listen; (3) giving and receiving compliments; (4) show your feelings; (5) ABC model; (6) asking others; (7) making conversation; (8/9) asking to participate in a group; (10) saying “No”; (11) being criticized; (12) tell someone else he is bothering you; (13/14) rehearsal and practice.

Further, parents and teachers were involved in the SST as well. For parents four compulsory parent meetings were included in which the parents were explained what happened in the SST in general but also specific progress about each individual child was discussed.

CSBQ

The CSBQ [22–23] is a 49-item parent questionnaire that covers a wide range of ASD features of a child in the past 2 months. The CSBQ is specifically

chosen as an outcome measure in this study since its development was based on the idea that existing ASD instruments were not suitable for children with PDD-NOS, because items were mainly derived from the DSM-criteria for autistic disorder. In doing so, the more subtle social problems of children with PDD-NOS are not covered sufficiently [24]. The CSBQ is based on a dimensional perspective of ASDs and is more sensitive to the milder symptoms, such as seen in children with PDD-NOS, and therefore seems to match the population of this study. Although the CSBQ was not designed as a social skills measure per se, its emphasis on different ASD aspects of social-cognitive functioning makes it a viable social skill assessment tool for this population [25].

The CSBQ has been administered to a large number of children ($n = 3407$) to obtain reliability and validity data. Originally, the instrument consisted of 96 items, which were refined and shortened to the current 49 items. A 6-factor structure was demonstrated: (1) behavior/Emotions not optimally tuned to the social situation (Not tuned, 11 items), (2) reduced contact and social interests (Reduced contact, 12 items), (3) orientation problems in time, place or activity (Orientation, eight items), (4) difficulties in understanding social information (Social understanding, seven items), (5) stereotyped behavior (Stereotyped, eight items), and (6) fear and resistance to change (Fear of change, three items) [24,26]. The score format is “does not apply” (score 0), “sometimes or somewhat applies” (score 1), or “clearly or often applies” (score 2). Overall the internal consistency of the CSBQ is very high (Cronbach’s $\alpha = 0.94$), with CSBQ subscales ranging from reasonable (Cronbach’s $\alpha = 0.76$ for Stereotyped) to excellent (Cronbach’s $\alpha = 0.90$ for Not tuned). Further evidence of validity is provided by comparing CSBQ scores in children with PDD-NOS, ADHD and mental retardation, with children in the PDD-NOS group scoring higher than the other groups [24]. Moreover, an inter-rater reliability (Intra Class Coefficient [ICC]) of 0.75–0.89 was found and a test–retest reliability (r) of 0.80–0.90. We hypothesised that overall scores on the CSBQ would be lower after the SST as compared to before.

Table II. CSBQ pre- and post-SST scores and effect sizes ($n = 10$).

CSBQ subscale	Pre-test M (SD)	Post-test M (SD)	<i>P</i> value	ES (<i>d</i>)
1. Not tuned	15.30 (3.74)	13.89 (5.13)	0.13	0.32
2. Reduced contact	8.10 (4.77)	6.67 (3.64)	0.13	0.33
3. Orientation	7.10 (3.41)	6.00 (3.40)	0.23	0.32
4. Social understanding	9.30 (3.68)	7.20 (3.01)	0.01	0.62
5. Stereotyped	1.90 (1.10)	1.40 (2.12)	0.27	0.30
6. Fear of change	3.10 (2.02)	2.90 (1.85)	0.59	0.10
CSBQ total score	44.80 (13.55)	37.78 (14.44)	0.02	0.50

CSBQ, Children’s Social Behaviour Questionnaire; ES, effect size; M, mean; SD, standard deviation.

SPPC

The SPPC [22,23] has been widely used in research to measure feelings of competence in specific domains and overall self-worth. The instrument is a self-administered questionnaire. The children’s version is comprised of five subscales to assess perceived domain-specific competence: (1) Scholastic Competence, (2) Social Acceptance, (3) Athletic Competence, (4) Physical Appearance and (5) Behavioral Conduct and one scale to assess overall self-worth (Global SelfWorth). Items are scored from 1 to 4 with 4 representing higher competency. Further, percentile scores are calculated. Internal consistency of the subscale Physical Appearance of the Dutch version was good, of the other subscales was reasonable, apart from the subscale Behavioral Conduct. On this last subscale internal consistency in the Dutch version was considered fair to poor [23]. According to the SPPC manual, scores for boys and girls should be analyzed separately. However, in this study we analyzed the two sexes together since no significant sex differences were found on any of the subscales before or after treatment. Further, SPPC scores for only five children ($n = 1$ girl, and $n = 4$ boys) were available, which was considered too few to analyze separately.

Statistical analyses

Paired-samples *t*-tests were used to compare pre- and post-test scores on CSBQ subscales, CSBQ total score, SPPC subscale scores and SPPC percentile scores. In addition to these tests for statistical significance, effect sizes (Cohen’s *d*) were calculated in order to evaluate the magnitude of the differences between pre- and post-test scores. An effect size of 0.20 was considered as small, of 0.50 as medium and an effect size of 0.80 and above was considered as large [27].

Results

Means and standard deviations for pre- and post-test scores of CSBQ scores and SPPC scores are presented in Tables II and III, respectively. Parent’s total

Table III. SPPC pre- and post-SST scores and effect sizes ($n = 5$).

SPPC subscale	Pre-test M (SD)	Post-test M (SD)	<i>P</i> value	ES (<i>d</i>)
1. Scholastic Competence RS	18.20 (4.09)	20.00 (3.74)	0.07	0.46
1a. Scholastic Competence PS	58.00 (32.44)	71.00 (27.64)	0.04	0.43
2. Social Acceptance RS	17.20 (5.26)	18.60 (6.50)	0.41	0.24
2a. Social Acceptance PS	47.80 (39.04)	59.40 (44.67)	0.21	0.28
3. Athletic Competence RS	17.60 (4.9)	17.40 (5.27)	0.90	0.04
3a. Athletic Competence PS	45.20 (36.42)	43.80 (40.08)	0.90	0.04
4. Physical Appearance RS	22.60 (1.67)	18.80 (4.60)	0.05	1.10
4a. Physical Appearance PS	73.20 (20.96)	43.40 (33.36)	0.03	1.07
5. Behavioral Conduct RS	17.40 (4.62)	18.40 (5.90)	0.30	0.19
5a. Behavioral Conduct PS	58.00 (39.57)	57.40 (42.22)	0.88	0.01
6. Global Self Worth RS	22.60 (1.67)	22.40 (2.30)	0.78	0.10
6a. Global Self Worth PS	79.20 (20.97)	76.40 (29.38)	0.75	0.11

ES, effect size; M, mean; RS, raw score; SD, standard deviation; SPPC, Self-Perception Profile for Children.

CSBQ scores were significantly lower after the SST intervention ($t[8] = 3.053$, $P < 0.05$, $d = 0.50$). The size of this treatment effect is considered to be medium and these results were in the expected direction. Further, parents reported significantly lower scores after the SST on the CSBQ subscale "Social understanding" ($t[9] = 3.280$, $P = 0.01$, $d = 0.62$). This is classed as a medium effect and also these results were in the hypothesised direction. It is important to note here that if Bonferroni correction is applied for multiple testing, the significance level would be $0.05/7 = 0.007$. Effect sizes of the treatment effects would not change but results should then not be classed as significant. However, the primary outcome measure of this study was CSBQ total score, information and *t*-tests for the individual subscales is provided as additional information.

Children's scores on the SPPC after SST also showed some significant differences compared with scores on the SPPC before SST. Children's scores on the subscale "Scholastic Competence" were significantly higher after SST ($(t[4] = -3.135$, $P < 0.05$, $d = 0.43$ for the percentile scores, and $(t[4] = -2.449$, $P = 0.07$, $d = 0.46$ for the raw scores)). Results are in the expected direction with a small to medium effect size. Further, children scored significantly lower on the SPPC subscale "Physical Appearance" after SST as compared to their scores before the SST ($(t[4] = 3.487$, $P < 0.05$, $d = 1.07$ for the percentile scores, and $(t[4] = 2.728$, $P = 0.05$, $d = 1.10$ for the raw scores)). According to Cohen [27] this is a large effect size. This difference is in the opposite direction of what would be expected.

Discussion

To our knowledge this was the first study that evaluated the effect of a standardized SST protocol in a homogeneous group of school-aged children with PDD-NOS. The sample size can be considered

average compared to previous studies. The SST protocol that was used was explicit, and focused particularly on children with PDD-NOS, whereas this was not the case in most previous studies. White and colleagues showed that only two studies used published manuals that were developed specifically for children with ASD [4]. Further, the currently used SST program Spelend Leren, Leren Spelen, met all essential criteria for successful group SST as listed by Krasny and colleagues [28] (i.e. predictable routines, complex social behaviors broken down in concrete steps, opportunities for daily practice outside the weekly group sessions, in more naturalistic settings such as home and school) and was specifically designed for children with milder social contact problems, such as children with PDD-NOS. Other strengths of this exploratory study were the use of an outcome measure that specifically targeted the milder forms of ASD behavior (the CSBQ) and the use of multiple informants. In review studies a lack of consensus on outcome measures for SST is often referred to (i.e. [4]). Measures that are specifically aimed at measuring ASD symptoms and that may be sensitive to change after treatment should be used. We agree with Gerhardt and Mayville [25] that the CSBQ, with good psychometric properties, as used in this study, could potentially be one of those measures. White et al. [4] also showed that only three out of their 14 reviewed SST studies supplied adequate documentation about the diagnoses, and intellectual functioning of the participating subjects. In the present study, for all children a standardized DSM-IV classification was available, full scale intelligence tests were administered, clear inclusion and exclusion criteria were stated and ADOS-G was administered as part of the diagnostic protocol. A last strength of the current study was that effect sizes were calculated which makes comparison across studies possible. Previous studies often failed to provide effect sizes [4].

Our preliminary results showed positive effects of an outpatient clinic-based group SST in children with PDD-NOS. According to the parent's evaluation after treatment, significant improvements in social behavior were seen in their children. Parents reported better scores, particularly on items such as "Does not fully understand what is being said to him/her, i.e., tends to miss the point", "Takes in information with difficulty". Overall, effect sizes were considered medium [27]. Further, children perceived themselves as performing better on schoolwork after the SST as compared to before. They reported higher scores on items like "Do schoolwork quickly", "Just as smart as other kids", or "Do well at class work". Although scholastic performance is not directly targeted in the SST, the subjective experience of school related competence had improved. This could be considered an indirect positive effect on the global feeling of self-worth, which has increased after the SST. Subsequently, the children also rated themselves as being less physically attractive after the SST, as compared to before the SST. They scored lower on items such as "Happy with the way I look", "Happy with height and weight", "Like body the way it is". This effect is surprising. Although physical looks were not directly targeted in the SST, we expected this to have improved or unchanged instead of declined. A possible explanation could be that children with PDD-NOS tend to interpret concepts as more concrete and could therefore reason that their physical looks were unchanged during the SST, which literally is correct. However, this does not explain why they would rate themselves as less attractive. Another possible explanation could be related to the process of increasing somatic complaints after clinical treatment [29]. However, these observations stem from a long time ago and were not based on standardized and structured studies of children with PDD-NOS, so therefore we can't generalize these findings directly to the current study.

Besides its strengths and interesting preliminary findings, this study also suffered from several shortcomings. First, children were included based on DSM-IV criteria for PDD-NOS and 50% of the children also suffered from a co morbid disorder. With respect to the latter it could be added that high co morbidity rates were demonstrated before in children with PDD-NOS (i.e. [30]) and therefore this sample is not uncommon. However, strictly speaking it was not the effect of a SST in children with PDD-NOS that was studied, but the effect of a SST in children with PDD-NOS and co morbid disorders. Further, PDD-NOS is a very heterogeneous rest category, and ideally, children should have been included based on the "gold standard" measurements ADOS-G [13] and ADI-R [14]. ADOS-G assessment was carried

out, but children were not included on this basis and only half the children met criteria for an ADOS-G classification. Important to note here is that all children did show impairments on the dimension of Reciprocal Social Interaction (RSI). Their mean score on this ADOS-G dimension was 3.9, whereas the cut-off for ASD on the ADOS-G lies at 4.0 [13]. The ADOS-G is only an observation of the child and an ADOS-G classification does not need to be identical to DSM-IV classification because it does not supply information about the early childhood, speech and communication developments etc. This information would have ideally been gathered with the ADI-R [14] but at the time of study this instrument was not officially translated in the Dutch language yet. Further, due to logistic limitations in this study the ADOS-G was not administered post-treatment and therefore changes in ASD symptoms could not be based on this observational scale rated by the clinician, but only on measurements of the parent and the child (CSBQ and SPPC).

Second, the CSBQ was the main outcome measure used in this exploratory study, which obviously makes careful interpretation of the findings necessary. A parent rated measure might suffer from expectancy effects (i.e. the parent expecting and therefore reporting an effect of the intervention). One could even reason that the results may be entirely driven by this parent bias. However, child self-report rating did partly point in the same direction, albeit only in a small number of cases. Ideally, observational and teacher report measures should be included as well. Although teachers were informed about the goals of the SST and were involved in some of the homework tasks, insufficient attention was paid to gathering completed ratings of the teachers. We did send the teachers a Teacher's Report Form (TRF; [31]) and a CSBQ but due to time and personnel limitations at the time of study only five CSBQ forms were returned before the SST and none post-treatment. No TRFs were returned before the SST, and only three were returned after. Therefore, no standardized conclusions can be drawn about the teacher's perspective on the effect of this SST. The teacher would have been a very valuable informant, besides the parent(s) and the child, particularly for evaluation of generalization of the newly acquired social skills in more naturalistic settings. Further, 80% of the parents filled out the CSBQ in the first 2 months after completion of the SST, we are aware that 20% of the parents did not. These two parents completed the CSBQ only 6 months after the SST whereas the items reflect behavior of the past 2 months. One could argue that this can be seen as a measurement of the long-term effect of the SST, whereas the other 80% represents the more immediate or short-term

effects, and we should not have included these measurements in one and the same group.

Third, as in many previous studies, our study did not include a comparison group, let alone a randomized control group. It is therefore impossible to compare the effects we found to for instance a no-treatment group or to a group of children with a different psychiatric disorder, or a different form of treatment. We can therefore never be sure that the effects are not due to other factors (e.g. regression to the mean, third variable effect) and emphasize that this study was merely an exploratory study.

Fourth, our study sample was small and may therefore lack in statistical power. Our results obviously need to be assessed in bigger samples of children with PDD-NOS. According to Koenig and colleagues [5] sample sizes for group SST intervention studies vary from three to 45 children, with an average of nine subjects per study. Thus, although we would consider the current study sample as being small, compared to other studies it seems to be reasonable in size.

Fifth, treatment fidelity was not assessed in this study. Although a standardized manual was used by both trainers, trainers were not required to demonstrate a minimum of for instance 90% fidelity during training.

A final thought of consideration about this exploratory study, but not specific for this study, is related to the concept of social skills. Social reciprocity is often the focus of treatment in SST for children with ASDs. However, there seems to be a lack of a common definition of social skills across different SST intervention studies which make studies very hard to compare [2]. We do agree with Koenig et al. [5] that social reciprocity is a multi-dimensional, complex construct. It should not be seen as a stable and static goal for interventions but as a dynamic and developing concept. In our opinion one of the difficulties with efficacy studies of SST in children with ASD is that the core deficit in ASD is considered a deficit in social reciprocity and therefore researchers and clinicians feel this construct is what needs to be reflected in the outcome measures. Possibly, it would be more objective to quantify and measure specific aspects of this multidimensional construct. For instance, factors such as the ability to understand facial expressions, the ability to comprehend non-verbal communication, or the quality of making eye contact could be measured pre- and post treatment.

Summarized, the findings of this preliminary study seem encouraging with respect to the effect of SST in children with PDD-NOS, a group of children that is understudied. However, in future studies,

subjects need to be better defined in bigger samples, more informants and objective outcome measures should be used to determine children's improvements over more data points in time and comparison groups should be included.

Key points

- For children with autism, studies of the effects of SST show mixed but overall positive results. The paradox is that PDD-NOS has a much higher prevalence than autism, but studies assessing the effects of SST in PDD-NOS are lacking
- Children with PDD-NOS are understudied. The condition however is of chronic nature, societal costs are high and evidence-based treatments are lacking
- This study shows preliminary but encouraging findings of the effects of a standardized SST in school-aged children with PDD-NOS.

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Statement of Interest

The authors report no declaration of interest.

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