

Orijinal Araştırma / Original Article

A Cooperative Physical Activity Intervention to Improve Physical Activity Level and Social Skills of Preschool Children with Autism Spectrum Disorder

Uğur Aydemir¹, Ufuk Töman², Erkan Yarımka³

¹Department of Coaching Training, Bayburt University Faculty of Sports Sciences, Bayburt, Türkiye

²Department of Basic Education, Trabzon University Faculty of Education Sciences, Trabzon, Türkiye

³Department of Recreation, Bayburt University, Faculty of Sports Sciences, Bayburt, Türkiye

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What is already known on this topic?

- It is known that preschool children with autism spectrum disorder have limitations in social skills and physical activity participation compared to their typically developing peers.
- Regular physical activities support the physical activity level of preschool children with autism spectrum disorder and contribute to their social skills.
- In order to support the social skills of preschool children with autism spectrum disorder, it is important to include typically developing peer participation in activities, including physical activities, and to carry out activities in a cooperative learning environment.

What does this study add on this topic?

- Studies examining the effects of collaborative physical activities on the social skills and physical activity levels of preschool children with autism spectrum disorder are limited. In this respect, the current study contributes to the related literature.
- This study showed that typically developing peers can be easily included in the physical activity environment organised for preschool children with autism spectrum disorder.
- The results of the study revealed that social skills and physical activity levels of preschool children participating in cooperative physical activities increased positively.

Abstract

The aim of this study was to evaluate the effects of cooperative physical activities on the physical activity level and social skills of preschool children with autism spectrum disorder. This study used the explanatory mixed-method design consisting of quantitative and qualitative stages. A total of 24 preschool children (12 children with autism spectrum disorder and 12 typically developing children) participated in the study. Children were randomly assigned to an experimental group (child with autism spectrum disorder $n=6$; typically developing child $n=6$) and a control group (child with autism spectrum disorder $n=6$; typically developing child $n=6$). Children in the experimental group participated in cooperative physical activities for 6 weeks. The cooperative physical activities consisted of stages such as a general warm-up, a child with autism spectrum disorder and a typically developing child forming a group, group task completion, and a general cool-down. Data were collected using the Personal Information Form, Leisure Time Exercise Questionnaire, Social Skills Assessment Scale and Semi-Structured Interview Form. After cooperative physical activities, a significant increase was observed in the physical activity level ($F=15.163, p<.05, \eta^2=.603$) and social skills ($F=10.213, p<.05, \eta^2=.505$) of the children with autism spectrum disorder in the experimental group. Parents reported that cooperative physical activities were a useful intervention to improve the physical activity level and social skills of children with autism spectrum disorder.

Keywords: Autism spectrum disorder, cooperative learning, peer support, physical activity

Otizm Spektrum Bozukluğu Olan Okul Öncesi Çocukların Fiziksel Aktivite Düzeyi ve Sosyal Becerilerini Geliştirmek İçin İşbirlikçi Bir Fiziksel Aktivite Müdahalesi

Öz

Bu çalışmanın amacı, işbirlikçi fiziksel aktivitelerin otizm spektrum bozukluğu (OSB) olan okul öncesi çocukların fiziksel aktivite (FA) düzeyi ve sosyal becerileri üzerindeki etkilerinin değerlendirilmesidir. Çalışmada, nicel ve nitel aşamalardan oluşan açıklayıcı karma yöntem tasarımı kullanılmıştır. Çalışmaya toplam 24 okul öncesi çocuk (12 OSB olan çocuk ve 12 tipik gelişim gösteren (TGG) çocuk) katılmıştır. Çocuklar rastgele bir deney grubu (OSB olan çocuklar $n=6$; TGG çocuklar $n=6$) ve bir kontrol grubuna (OSB olan çocuklar $n=6$; TGG çocuklar $n=6$) atanmıştır. Deney grubundaki çocuklar 6 hafta boyunca işbirlikçi FA'lara katılmıştır. İşbirlikçi FA'lar; ısınma, OSB olan bir çocuk ve TGG olan bir çocuğun grup oluşturma, grup görevi tamamlama ve soğuma gibi aşamalardan oluşmuştur. Veriler; Kişisel Bilgi Formu, Serbest Zaman Egzersiz Anketi, Sosyal Beceri Değerlendirme Ölçeği ve Yarı Yapılandırılmış Görüşme Formu kullanılarak toplanmıştır. İşbirlikçi FA'lar sonrası, deney grubundaki OSB olan çocukların FA düzeyinde ($F=15.163, p<.05, \eta^2=.603$) ve sosyal becerilerinde ($F=10.213, p<.05, \eta^2=.505$) anlamlı bir artış olduğu gözlemlenmiştir. Ebeveynler, OSB olan çocuklarının FA düzeyi ve sosyal becerilerini geliştirmek için işbirlikçi FA'ların yararlı bir müdahale olduğunu bildirmişlerdir.

Anahtar Kelimeler: Akran desteği, fiziksel aktivite, işbirlikçi öğrenme, otizm spektrum bozukluğu

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impairments in social interaction and communication, repetitive patterns of behavior, or restricted interests (American Psychiatric Association, 2013). Autism spectrum disorder has negative effects on the physical activity (PA) levels as well as on different developmental areas of children diagnosed with this disease (Bandini et al., 2013). There is evidence that preschooler children with ASD do not meet daily recommendations for PA (Ketcheson et al., 2018) and may have lower levels of PA than their typically developing (TD) peers (Thomas et al., 2019). Preschool children with ASD experience difficulties in acquiring PA skills due to factors such as social interaction and communication impairments and motor skill problems (Pan et al., 2011). Due to the mentioned factors, but not limited to these, the low PA level and sedentary life observed in children with ASD are an important source of risk that may expose children with ASD to chronic diseases (McCoy et al., 2016). Previous studies have shown that children with ASD tend to lead more sedentary lives than their TD peers (Zuckerman et al., 2014) and are more likely to be obese (Criado et al., 2018).

2 Considering that preschool PA level affects later childhood (Jones et al., 2013), early PA participation may be important for children with ASD (Schmidt et al., 2023). Physical activity participation has been associated with various benefits in the areas of physical, social, and emotional development in preschool children with ASD (Yarım kaya et al., 2022). Participation in regular PA is considered as an intervention strategy to improve difficulties such as social interaction deficits, off-task behaviors and aggression (Healy et al., 2018). Physical activity participation in children with ASD has positive effects on motor development (Ruggeri et al., 2020), communication skills (Chan et al., 2021), stereotypic behaviors (Teh et al., 2021), and social interaction skills (Howells et al., 2019). Although the benefits of regular PA on children with ASD are extensive (Bassette et al., 2018), researchers have largely focused on interventions delivered individually or in groups consisting solely of children with ASD, as opposed to learning environments that include TD peers (Schmidt et al., 2023). Typically developing peer participation has significant benefits in teaching academic and social skills to children with ASD (Bauminger, 2007; Calhoun and Fuchs, 2003; Harper et al., 2008). Peer-mediated interventions that include TD peer participation have positive effects on developmental characteristics of children with ASD, such as play development, repetitive motor skills, communication initiation and response to communication, peer interaction and motivation (Gardner et al., 2014; Loftin et al., 2008). Peer-mediated interventions have begun to be used in PA studies for children with ASD in recent years. Researchers found that the participation of children with ASD in PA with their peers facilitated the implementation of activities (Ward & Ayvazo, 2006) and improved their communication, motor and social skills (Pan, 2011; Sansi et al., 2021; Yarım kaya et al., 2017).

Although there are advantages to using peer-mediated interventions in learning environments, including PA settings, for children with ASD, attention should be paid to the potential disadvantages of these interventions (Lee et al., 2022). Simply using PA interventions for TD preschooler children to preschooler children with ASD is not recommended due to the unique barriers to participation in PA for this population, such as delayed motor skills, behavioral problems, social communication difficulties, and language delays (Must et al., 2015). Additionally, peer-mediated PA interventions generally require teacher training as well as student training for social skills before

implementation (Lee et al., 2022; Pan, 2011; Sansi et al., 2021; Ward & Ayvazo, 2006; Yarım kaya et al., 2017). Furthermore, peer-mediated interventions require additional teaching time, creating additional workload for PA teachers (Lee et al., 2022). Therefore, instead of complex procedures and teacher/student training, it is recommended to use manageable procedures and developmentally appropriate cooperative PAs for preschooler children with and without ASD (Lee et al., 2022).

Cooperative learning is an effective learning strategy that encourages interaction between students (Kristén et al., 2020). Cooperative learning involves dividing students into small groups, where group members work together and share the reward (Gillies, 2016). Cooperative learning has been recommended for use in the PA environment to support the developmental areas of children with ASD (Grenier & Yeaton, 2011). During cooperative PAs, small groups are formed that include children with and without ASD, and each individual contributes towards the group goal (Lee et al., 2022). There is only one study in the literature that included TD peer participation and evaluated the effects of cooperative PAs for children with ASD. Lee et al., (2022) suggested that cooperative PAs may be a promising intervention to increase participation and social interaction for children with ASD. In the current study, the literature gap on cooperative PAs was taken into consideration and instead of PAs containing complex procedures, it was planned to design and implement cooperative PAs based on group work, which were hoped to be simple and fun for preschool children with and without ASD. The lack of evidence-based interventions for cooperative PA for preschool children with ASD in Türkiye supported the design of this study. The aim of this study was to create cooperative PAs in accordance with the developmental characteristics of preschool children with ASD and to examine the effects of the intervention on the PA level and social skills of children with ASD.

Material and Methods

Study Design

The current study was designed the explanatory mixed-method model. This design involves collecting quantitative and qualitative data, respectively, about a topic that is planned to be examined (Creswell & Plano-Clark, 2011). In the present study, a quasi-experimental design was used to first evaluate the effects of 6 weeks of cooperative PAs on PA level and social skills of children with ASD. Physical activity level and social skills of children with ASD were assessed at two time points (pretest and posttest) using the Leisure Time Exercise Questionnaire (LTEQ) and the Social Skills Assessment Scale (SSAS). Then, semi-structured interview questions were used to address parents' views on changes in PA levels and social skills of children with ASD.

Participants

A total of 24 preschool children (12 children with ASD and 12 children with TD) participated in the study. Children with ASD and TD peers were recruited from full-time inclusive kindergartens and special education kindergartens based on criterion sampling method (Creswell, 2014). Inclusion criteria for preschool children with ASD and TD peers were as follows: (a) parent signing the consent form, (b) children with ASD and TD peers being between 4 and 6 years of age, (c) children with ASD having received a formal diagnosis, and (d) children with ASD having no health problems that would prevent them from participating in PA. Support was received from school administrators where children with ASD and TD peers were educated in identifying children in line with these criteria. In the first stage, preschool children with

ASD and TD peers were identified in full-time inclusive kindergartens and special education kindergartens in the region. The children's ASD diagnosis (doctor and hospital confirmed) was learned during initial eligibility visits to schools. No observations of children with ASD were made during the selection of participants. The primary researcher identified 12 children with ASD and 12 children with TD peers who met the inclusion criteria and requested signed consent forms from their parents. Children with ASD and TD peers were randomly assigned to two groups: an experimental group (ASD $n=6$, TD $n=6$) and a control group (ASD $n=6$, TD $n=6$). All children with ASD and TD who participated in the study completed the intervention. Demographic information of children with ASD and TD peers is presented in Table 1.

As seen in Tables 1 and two of the children with ASD in the experimental group were female and four were male, while one of the children with ASD in the control group was male and five were female. In terms of age, the mean age of the children with ASD in the experimental group was 4.66, while the mean age of the children with ASD in the control group was 4.83. In terms of additional comorbidities, five of the children in the experimental group had additional intellectual disabilities, while six of the children in the control group had additional intellectual disabilities. Of the TD children in the experimental group, three were female and three were male, while of the TD children in the control group, three were female and three were male. In terms of age, the mean age of the TD children in the experimental group was 4.33, while the mean age of the TD children in the control group was 5.16.

Cooperative Physical Activities

Cooperative PAs were created to support the PA levels and social skills of children with ASD. Cooperative PAs were applied for 6 weeks, 3 days a week, 35–40 minutes a day. In preparing the cooperative PAs, previous studies were first benefitted from (Lee et al., 2022; Sansi et al., 2021; Yarımkaya et al., 2017) that included cooperative or TD peer-supported PAs for children with ASD. The draft activities were sent to two academics who are experts in the fields of ASD and inclusive PA.

Experts had scientific studies on ASD, inclusive PAs, school-based PA, adapted PA, and PA promotion in preschool children. Secondly, two physical education teachers and two preschool teachers provided feedback on the cooperative PAs designed by taking expert opinions. Based on the feedback, the researchers finalized the cooperative PAs.

Each daily PA session consisted of four periods approximately 10–20 minutes: a) a warm-up, b) a main PA, c) a stretching-cooling and d) reward period. In the warm-up period, all children with ASD in experimental group participated in individual stretching exercises, limb joint rotation, and walking activities. During the main PA period, all children did the dance activities, sports tracks, fun games, and functional exercises as a group, respectively. Instructors explained the rules of daily PA and introduced the activity to the children by modeling it. Small groups were then formed, including one child with ASD and one TD child, and the small groups did the activity together. During group work, instructors monitored all children and provided feedback to children who did not understand the task. Instructors guided and praised each child for interacting with his/her group during the activities. Stretching and breathing activities were performed during the cool-down period. During the reward period, the instructors emphasized the importance of interacting with the group and completing the activity and gave various awards to the students.

The study used the cooperative learning approach steps proposed by Lee et al. (2022) to increase social interaction and communication between children with ASD and TD peers. A cooperative PA involved an ASD child and a TD peer forming a group and doing the activity together with the group. The instructor told the children to pair up with a peer (For example, kids, I want you to group up with a peer you want to play with today. Come on, now everyone should find a playmate). Instructors observed children with ASD during the group formation stage and helped them join a group. The instructor asked the children to say “Can I play with you?” to the friend they wanted to play with and instructed the students who received the offer to say “OK.” The instructor was quick to praise the children who spontaneously offered to partner with the participant. If a child could not find a partner, the instructor asked him/her, “Who do you want to play with?” and took the child to the peer s/he pointed to and asked him/her to say, “Can I play with you?” When the child with ASD did not find a partner, the instructor assisted him/her and had him/her form a group with a TD peer. The instructor praised the child with ASD and the TD child and said, “You have made a great group.” Group formation during the sessions took approximately 5 minutes. During the activities, groups of two lined up and did the activity together. The instructors did not give the TD peers any cues or instructions to help their partner. However, when the TD peer spontaneously engaged with his/her partner during the activity, the instructor praised the TD peer. Initially, two children with ASD did not understand the activities and did not want to move with the group. The instructor took an interest in these children and verbally directed them back to the activity. As a result, the groups successfully carried out the activities. At the end of each session, the instructor gave all children stickers as well as praise for acting with the group, following the rules, offering to play games with each other, and completing the activities.

Instruments

Data were collected with four instruments: Personal Information Form, the Leisure Time Exercise Questionnaire and the SSAS. At baseline, parents completed a Personal Information Form that inquired about their child's gender, age and diagnosis so that the intervention could be adapted to fit participants' developmental characteristics.

Table 1.
Participant Characteristics

		Groups	
		Experimental ($n=6$)	Control ($n=6$)
Children with ASD ($n=12$)	Sex n(%)		
	Female	2 (33.34%)	1 (16.67%)
	Male	4 (66.66%)	5 (83.33%)
	Age (M+Sd)	4.66+0.81	4.83+0.98
	Diagnosis n(%)		
	ASD	6 (100%)	6 (100%)
	Additional comorbidities n(%)		
TD children ($n=12$)	ID	5 (83.33%)	6 (100%)
	N	1 (16.67%)	-
	Sex n(%)		
	Female	3 (50.00%)	3 (50.00%)
	Male	3 (50.00%)	3 (50.00%)
	Age (M+Sd)	5.33+0.81	5.16+0.75

Note: ASD=autism spectrum disorder; ID=intellectual disability, M=mean; N=none; Sd=standard deviation; TD=typically developing.

Table 2.
ANOVA Results of Physical Activity Level Pretest and Posttest Scores of the Groups

Source	Type III Sum of Squares	Df	Mean Square	F	p	η^2
Group	1107.042	1	1107.042	15.163	.003*	0.603
Error (Group)	730.083	10	73.008			
Time	715.042	1	715.042	350.224	.000*	0.972
Time*Group	672.042	1	672.042	329.163	.000*	0.971
Error (Time*Group)	20.417	10	2.042			

*Represents $p < .05$; $\eta^2 = \text{eta}^2$.

Leisure Time Exercise Questionnaire

Leisure Time Exercise Questionnaire (LTEQ) is a questionnaire used to explore participants' self-assessment of PA (Godin & Shephard, 1985; Sari & Erdoğan, 2016). Leisure Time Exercise Questionnaire allows you to determine the number of a) strenuous b) moderate and c) mild PAs you have done for at least 15 minutes in the last week. The scoring of the LTEQ is done as follows: strenuous PAs $\times 9$, moderate PAs $\times 5$, and mild PAs $\times 3$. Then, all the multiplications are added together to find the total score (Godin, 2011). The validity and reliability of the Turkish version of the LTEQ was conducted by Yerlisu-Lapa et al. (2016). Exploratory Factor Analysis results revealed a single-factor structure. The Cronbach Alpha reliability coefficient for the entire survey regarding the LTEQ scores in the current study was calculated as .84, and for the survey items as .80, .76 and .72, respectively.

Social Skills Assessment Scale

The social skills of children with ASD were evaluated using the SSAS developed by Akçamete and Avcioğlu (2005). Social Skills Assessment Scale, which consists of 69 items in a 5-point Likert style, is used to examine the social skills of children with special needs, including children with ASD (5: Always, 4: Very often, 3: Usually does, 2: Less often, 1: Never). Social Skills Assessment Scale includes basic social skills, relationship initiation skills, relationship maintenance skills, and group work skills. Excellent Cronbach's alpha reliability has been reported for the SSAS (0.98). Within the scope of the current study, the Cronbach Alpha reliability coefficient regarding the reliability of the SSAS was calculated. The Cronbach Alpha reliability coefficient for the scores obtained by children with ASD from the SSAS was found to be 0.85. SSAS is completed by parents to reflect the current social skills of children with ASD.

Semi-Structured Interview Form

Interview questions were used to evaluate changes in PA level and social skills of children with ASD after collaborative PAs from the perspective of parents. Interview questions were created by taking the opinions of two academicians who have experience in the fields of ASD and PA. Then, a pilot study was conducted with two parents of children with ASD to examine the comprehensibility of the interview questions. Parents who participated in the pilot study were not included in the study sample. The interview questions were finalized in line with the feedback received from parents in the pilot study. Interviews started after receiving permission forms from the parents. The video-recorded interviews were completed in approximately 20 minutes. The interview form included the following questions: (a) What was your overall experience with the cooperative PAs in which your child participated? (b) How beneficial have cooperative PAs been on your child's PA level? (c) How beneficial have cooperative PAs been on your child's social skills level?

Ethics Committee Approval

This study was conducted in accordance with scientific ethical rules. Bayburt University Ethics Committee approval was obtained before starting the data collection process (Date: December 27, 2024 / No: 29).

Data Analysis

Quantitative data analyses in the current study were conducted using SPSS version 25.0. Differences in PA level and social skills between the groups were examined through repeated measures ANOVA. For repeated measures ANOVA, the assumptions of normal distribution (Shapiro-Wilk), sphericity (Mauchly Sphericity Test) and homogeneity of variances (Levene Test) were checked. Post hoc Bonferroni adjustment was used for significant differences in ANOVA. Deductive coding was used in the analysis of the qualitative data of the study (Mayring, 2014). First, the audio recordings were transcribed into written text. Then, in line with the aims of the study and the quantitative phase, the authors independently created themes and placed the data into these themes. Support was received from two academics who are experts in qualitative analysis for the reliability of the analysis process. Three main themes were reached with the support of the experts. The following methods were used for the validity and reliability of the analysis process: 1). Written texts were submitted for parental approval via Whatsapp, 2). The agreement of the analyses conducted by the authors and experts was examined. The Miles and Huberman (1994) formula ($\text{Consensus} / (\text{Consensus} + \text{Disagreement}) \times 100$) was used to examine the agreement. It was determined that there was 93% agreement between the authors and experts, and 3). Direct quotes were frequently included in the parental opinions.

Results

Changes in Physical Activity Level of Children with Autism Spectrum Disorder

A repeated measures ANOVA test was utilized to explore the effect of cooperative PAs on the PA level. ANOVA revealed a significant group effect ($F = 15.163, p < .05, \eta^2 = .603$), a significant time effect ($F = 715.042, p < .05, \eta^2 = .972$), and a significant group $\times$ time interaction ($F = 329.163, p < .05, \eta^2 = .971$) on the PA level of children with ASD (see Table 2).

Bonferroni adjustment was performed to analyze whether there was a change over time in the experimental and control groups (see Figure 1). Pairwise comparisons showed that there was a significant increase in the posttest PA scores of children with ASD in the experimental group compared to their pretest PA scores (adjusted Bonferroni= $p < .05$, Difference= +21.500). In contrast, there was no significant difference between the pretest and posttest PA scores of the control group (adjusted Bonferroni= $p > .05$, Difference= +.333).

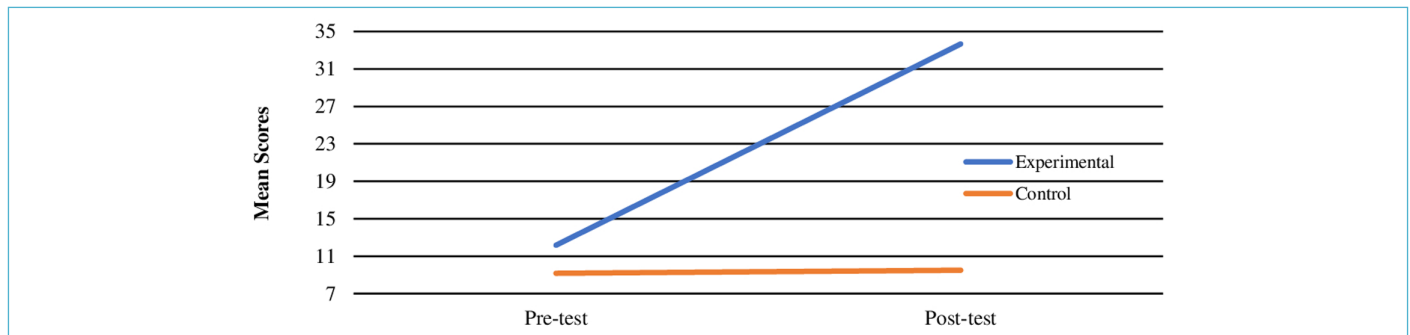


Figure 1.
Physical Activity Scores of the Groups in Pretest and Posttest.

Parents' Perceptions of Changes in Physical Activity Level of Children with Autism Spectrum Disorder

The following findings were obtained as a result of the analysis of the data collected to investigate the opinions of the parents in the experimental group about the effects of cooperative PAs on their children's PA level. Parents were extremely satisfied with their children's participation in cooperative PAs and thought that their children's PA levels increased after cooperative PAs. Parents' opinions on this subject are as follows: *"The activities made very positive contributions in this regard. My daughter was very sedentary, she had a routine life between school and home. It made me very happy that she participated in such activities. She participated in activities 3 days a week, moved and her PA level increased."*- P12's mother

"It was very helpful. My son became more active thanks to PAs. It was a very useful experience. His PA level improved, and he had fun."- P4's mother

"PAs contributed a lot to my son. He was always at home or at school, and since our city was small, there was not much activity space. However, when he participated in your study, he became physically active 3 days a week. When he gets home, we talk, he tells me about some of the things he did, he says he had a lot of fun in the activities, thank you very much."- P7's father

Changes in Social Skills of Children with Autism Spectrum Disorder

A repeated measures ANOVA test was conducted to determine the effect of cooperative PAs on social skills. ANOVA revealed a significant group effect ($F = 10.213$, $p < .05$, $\eta^2 = .505$), a significant time effect ($F = 137.672$, $p < .05$, $\eta^2 = .932$), and a significant group $\times$ time interaction ($F = 143.378$, $p < .05$, $\eta^2 = .935$) on the social skills of children with ASD (see Table 3).

Bonferroni adjustment was used to analyze whether there was a change over time in the experimental and control groups (see

Figure 2). Pairwise comparisons showed that there was a significant increase in the posttest social skill scores of children with ASD in the experimental group compared to their pretest social skill scores (adjusted Bonferroni= $p < .05$, Difference= +32.833). In contrast, there was no significant difference between the pretest and posttest social skill scores of the control group (adjusted Bonferroni= $p > .05$, Difference= -.33).

Parental Perceptions of Changes in Social Skills of Children with Autism Spectrum Disorder

The following findings were obtained as a result of the analysis of the data collected to investigate the opinions of the parents in the experimental group regarding the effects of cooperative PAs on their children's social skills. According to parents, cooperative PAs positively affected the social skills of children with ASD. P8's mother said the following about this subject: *"Sir, it definitely helped a lot. I have already watched many of your practices as a spectator. My daughter's development touched me very much. I mean, my daughter used to want to get away from the environment when she saw other children. Now she created a group with her friend. She followed the group rules and played games together. These are very important developments for us. My daughter greets her other friends and looks at them as she leaves games and activities."* Similarly, parents of P5 and P9 said that there were positive changes after cooperative PAs in their children's social skills such as interacting with a friend, obeying group rules, making new friendships, and acting in a group. *"Sir, it contributed a lot, thank you very much to you and your team. I think the biggest contribution was sociality. He had many friends. He was very eager to participate in activity days. I saw that he was watching his friends. I was very happy that he was included in a group and was not disturbed by other children."*- P5's mother

"Yes sir, my daughter has improved a lot in social skills. Your idea of creating a group is very good. I was very happy that she talked to her friends, formed groups together and completed the game with the group. She talked to her

Table 3.
ANOVA Results of Social Skill Pretest and Posttest Test Scores

Source	Type III Sum of Squares	df	Mean Square	F	p	η^2
Group	1162.042	1	1162.042	10.213	.010*	0.505
Error (Group)	1137.417	10	113.742			
Time	1584.375	1	1584.375	137.672	.000*	0.932
Time*Group	1650.042	1	1650.042	143.378	.000*	0.935
Error (Time*Group)	115.083	10	11.508			

*Represents $p < .05$; $\eta^2 = \text{eta}^2$.

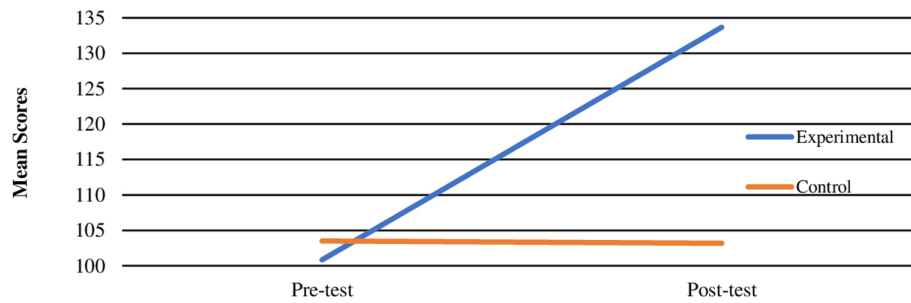


Figure 2.
Social Skill Scores of the Groups in Pretest and Posttest.

friends during the activities, exchanged greetings, and the activities contributed a lot to her communication and socialization.”- P9’s father

Discussion

The aim of this study was to examine the effects of cooperative PAs on the PA level and social skills of preschool children with ASD. To the authors’ knowledge, this study is among the pioneering studies evaluating the effectiveness of cooperative PAs to improve PA level and social skills in preschool children with ASD. The results revealed that the PA level and social skills of preschool children with ASD in the experimental group showed positive changes after cooperative PAs. Parents reported that cooperative PAs were a useful intervention to improve the PA level and social skills of children with ASD.

This study included peer selection and group task completion, which are shown to be among the components of cooperative learning, to increase social interaction and communication between children with ASD and TD peers (Gillies, 2016). All children completed cooperative PAs after an individual warm-up in which the instructor demonstrated the movements. Instructors created a cooperative learning environment in which one child with ASD and one TD child were grouped and which included group task completion and feedback. Instructors supported the cooperative learning environment with praise and various rewards. Children with ASD successfully completed all activities in a fun and social interaction environment, and their social skills as well as PA level improved. These results are consistent with previous research using cooperative PAs to increase the social interaction skills of preschool children with ASD. As a result of their research using concurrent multiple baseline designs across participants, Lee et al. (2022) found that cooperative PAs improved the social interaction skills of three children with ASD. The current study, unlike the previous study, included a larger number of preschool children with ASD and TD peers and addressed the children’s PA level as well as social interactions.

To date, many previous studies used peer mediation to improve the motor skills (Sansi et al., 2021), PA participation (Ward & Ayvazo, 2006), social interaction behaviors (Chu and Pan 2012), and communication skills (Yarımkaaya et al., 2017) of children with ASD in PA environments. However, these studies required preparations that included some time-consuming and relatively complex procedures, and the teaching process was time-consuming (e.g., preparation of instructors or TD peers and the need for additional time; Lee et al., 2022; Zimbelman et al., 2007). Therefore, in the current study, PAs recommended by others Lee et al. (2022) were designed to be easy to manage and that children would enjoy. During the implementation process, instructors showed the PAs to the children, guided the

children to form groups and complete group tasks, and praised and rewarded the children’s social behavior. Instructors were able to improve the PA level and social interactions of preschool children with ASD without the need for intensive preparation or additional time.

Although the instructors did not make intensive preparations for the cooperative PAs in this study, they had some duties during the cooperative PAs, especially in the group formation and group task completion sections. It primarily involved group formation by an ASD child and a TD peer, under the guidance of a cooperative PA instructor. Instructors rarely encountered behavior such as declining invitations during cooperative PAs. For these situations, the instructor helped the children in the process of searching for peers, offering peers to form a group, responding to the invitation, praised those who were in a group, and created opportunities for those who could not form a group. These processes were consistent with previous studies that emphasized the importance of instructor prompts in the PA environment (Kohler et al., 1995; Lee et al., 2022). In conclusion, the current study showed that cooperative PAs effectively increased the PA level and social skills of children with ASD. Findings provided evidence that cooperative PAs involving TD peer participation can be easily implemented for children with ASD without extensive preparation by educators and without requiring additional time. Additional studies could be planned to investigate the usefulness of collaborative PAs for children with ASD and their effectiveness on the developmental characteristics of children with ASD.

Limitations of the study

Although the study is a pioneering study examining the effects of cooperative PAs on the PA level and social skills of children with ASD, it has some limitations. The instructors only encountered some problems with children’s grouping during cooperative PAs and resolved these problems with instruction, rewards, and praise. However, instructors did not encounter any aggressive behavior or inappropriate social interaction during cooperative PAs. Therefore, the study does not contain information about how an instructor finds a solution when faced with aggressive behavior or inappropriate social interaction. Since the application group consisted of 12 children with ASD, the generalizability of the results obtained from the questionnaire and interviews regarding the PA level and social skills of children with ASD may be limited.

The current study includes author self-assessments and literature information regarding the comparison of cooperative PAs and peer-mediated PAs for children with ASD. Future studies can compare the effects of cooperative PAs and peer-mediated PAs by applying them to two different groups of children with ASD. Additionally, cooperative PAs can be applied by a physical education teacher in

an inclusive physical education classroom environment to examine the effects of cooperative PAs on children with ASD and the usefulness of cooperative PAs. In future studies, interviews can be held with physical education teachers about the usefulness of cooperative PAs.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

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