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The Effect of Balance and Coordination Exercises on Self-Regulation Skills of Preschool Children

Okul Öncesi Dönem Çocukların Öz Düzenleme Becerilerine Denge Ve Koordinasyon Egzersizlerinin Etkisi

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Abstract

In this study, the aim of the study is to examine the effect of activities focusing on balance and coordination exercises on the self-regulation skills of children in preschool education. The study included 33 children in the experimental group and 39 in the control group attending preschool education institutions. While children in the experimental group participated in activities incorporating balance and coordination exercises, children in the control group did not participate in different activities outside their regular programs. Data for the study was collected using the "Self-Regulation Skills Scale" before and after the implementation of activities focusing on balance and coordination exercises. In the analysis of the data using the SPSS programme, the relationship between the groups was examined with the Mann Whitney U test, one of the nonparametric tests, and the differences within the groups were examined with the Wilcoxon signed-rank test. Findings indicated that the initial test scores were similar between the groups, but there was a favorable difference in favor of the experimental group in the final test scores. In this regard, it is important that families are made aware of this issue and directed to activities where they can improve their children's self-regulation skills. In addition, it is essential for the development of children that preschool education institutions plan the areas where children will move correctly and provide them with opportunities to practice physical activity by experts.

Keywords: *Children, Preschool, Self-Regulation, Balance, Coordination and Exercise.*

Öz

Bu çalışmada, denge ve koordinasyon egzersizleri içerikli etkinliklerin okul öncesi eğitim sürecinde olan çocukların öz düzenleme becerilerine etkisinin incelenmesi amaçlanmaktadır. Araştırmanın deney grubunda 33 kontrol grubunda 39 okul öncesi eğitim kurumlarına devam eden çocuk yer almıştır. Deney grubu olarak belirlenen çocuklara denge ve koordinasyon egzersizleri içeren etkinlikler uygulanırken kontrol grubuna kendi programları dışında farklı etkinlikler uygulanmamıştır. Çalışmanın verileri, denge ve koordinasyon egzersizleri içerikli etkinliklerin uygulanması öncesinde ve sonrasında, "Öz Düzenleme Becerileri Ölçeği" ile toplanılmıştır. SPSS programı kullanılarak yapılan verilerin analizinde gruplar arasındaki ilişkiye parametrik olmayan testlerden Mann Whitney U testi ile grupların kendi içindeki farklılıklara ise Wilcoxon işaretli sıralar testi ile bakılmıştır. Bulgularda, grupların ön test puanlarının benzer olduğu ancak son test puanlarına bakıldığında ise deney grubu lehine bir farklılık olduğu tespit edilmiştir. Dolayısıyla aileleri bu konuda bilinçlendirmek ve çocuklarının öz-düzenleme becerisini geliştirebilecekleri aktivitelere yönlendirilmek önemli noktadır. Diğer yandan, okul öncesi eğitim kurumlarının da çocukların hareket edecekleri alanları doğru planlamaları ve uzman kişiler tarafından fiziksel aktivite uygulamalarının yaptırılacağı olanaklar sunulması çocukların gelişimi için elzem bir durumdur.

Anahtar Kelimeler: *Çocuklar, Okul Öncesi, Öz-Düzenleme, Denge, Koordinasyon ve Egzersiz.*

Araştırma Makalesi [Research Paper]

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Introduction

The early years of life are a critical stage in which children develop their cognitive, social emotional skills, personality, attitudes, behaviors and values. The knowledge, skills, behaviors and attitudes that children acquire at the earliest possible age are the cornerstones they build on throughout their lives. Therefore, it is important to maintain a healthy and high-quality preschool period in order to shape future success and happiness.

As with all skills acquired in early childhood, self-regulation skills also show a rapid development in this process starting from birth (McClelland & Cameron, 2012: 136-142). Self-regulation skills enable children to control their emotions, impulses and behaviors, play skills, peer relations, problem solving skills (Bronson, 2000; Ertürk Kara et al., 2018), adapt to school easily, and control their emotions and aggressive behaviors (Bodrova & Leong, 2013). Self-regulation, which is essential to be acquired in the early years of life, covers the individual's ability to plan his/her own thoughts, emotions and behaviors and to renew them according to the situation in achieving personal goals (Zimmerman, 2002: 64-70). The first self-regulation skills seen are reactive; the reflexes that the baby shows in the early months are affected by both external and biological factors over time, enabling the baby to provide internal control. Especially in this process, the child matures and gains different experiences and consciously manipulates his/her behaviors and forms a self-regulation system (Bronson, 2000). This structure is influenced by biological and environmental factors such as temperament, language development, self-perception, memory capacity, and family (Arslan et al., 202: 180-190).

Zimmerman (2002: 64-70) described self-regulation as a process of self-management in which the child does not represent a cognitive ability or academic performance, but rather a process of self-management in which the child can transform his/her mental ability into academic skills. Self-regulation, which refers to executive function skills such as working memory, inhibitory control and attention control, has a multidimensional feature that includes cognitive, behavioral and emotional regulations (Astarlar, 2019). While the individual's ability to keep and use short-term information in mind is working memory, inhibitory control, that is, the regulation of behaviors, is expressed as the individual's behavior of suppressing the impulse for a purpose (Saraç et al., 2021: 1-11). Although attention control, which constitutes the center of self-regulation, defines the abilities that play an intermediary role in the regulation of an individual's emotions and thoughts, it appears that these abilities represent an important place in self-regulation skills (Yazıcı Kabadayı & Öztürk, 2020:230-242).

Self-regulation refers to the multidimensional, self-directed ability to align one's feelings, thoughts, and behaviors in response to both internal factors such as motivations, emotional states, and physiological cues and external factors such as social and environmental conditions. This ability allows individuals to skillfully navigate changing circumstances across time and space, align immediate needs and desires with overarching goals, and adjust beliefs, values, and strategies in light of new insights according to individual will (Callan, 2018; Eccles & Wigfield, 2002; Kanayama et al., 2024; Nigg, 2017; Ryan & Deci, 2006).

Individual differences in emotional dispositions may serve as an implicit underlying factor influencing the various externalizing behaviors observed in children. However, the factors shaping children's ability to regulate their emotions are complex and multifaceted. Parenting styles in the familial context have a significant direct or indirect influence on children's emotional and mental well-being and have received considerable attention in the field of child growth and development both domestically and internationally (Feng et al., 2021; Li et al., 2023; Ong et al., 2018; Rongeven et al., 2022). Through self-regulation skills, the child learns to control these emotional states.

Children's ability to consciously regulate their behavior to meet their specific needs contributes to increased focus, enhanced social adaptation, and effective coping with negative emotional experiences such as pain and frustration (Chen et al., 2012:1233-1241). Self-regulation refers to an individual's capacity to regulate their behaviors, emotions, and various other responses in a timely manner to achieve specific goals and serves as an important indicator of early socialization (Moffitt et al., 2011:2693-2698). It includes the ability to manage attentional aspects such as the ability to shift or sustain attention, as well as behavioral aspects such as inhibiting impulses or unwanted behaviors (Duckworth & Kern, 2011: 259-296). It is considered as the initial hypothesis of the psychological mechanisms of self-control (Mischel & Ayduk, 2002: 113-120). It is claimed that as children develop self-control skills, their attention, cognition and emotions mature, and higher levels of self-control reduce the individual's arousal in emotionally charged situations (Li et al., 2023).

In recent years, aggression tendencies and bullying behaviors among peers are commonly seen in children. The emergence of violence as a result of uncontrollable anger has become a common situation. Among the reasons for this situation, it can be shown that playgrounds are decreasing or access to playgrounds is not easy for everyone. When this is the case, screen addiction increases in children. The images that children watch and are exposed to increase their tendency towards violence. Constant sitting and inactivity prevents children from discharging and causes them to be constantly tense and unhappy. Physical activities are important for physical, mental and spiritual relaxation. In fact, the World Health Organization recommends that children engage in physical activity on a daily basis (WHO, 2019). For

these reasons, the importance of physical activity is understood and although activities are organized in schools to ensure that children move before the lessons start, it is not enough. Activities need to be planned and carried out by experts. Especially in the preschool period, since there is no specialization, all activities are carried out by kindergarten teachers and there is a serious shortage of equipment. Preschool children in primary schools cannot use the school gardens, so games that allow them to move less in the classroom are preferred. Balance skills of physical activities are thought to have a one-to-one relationship with self-regulation, which is also a life skill.

The acute effects of physical activity (PA) on school-age cognitive performance have been widely studied and improvements have been found in children and adolescents as well as young adults, especially in what is referred to as cognitive control (Pontifex et al., 2019: 1-22; Urena et al., 2020). Studies reporting positive health effects of physical activity for preschool children (Kippe et al., 2023) are plentiful. Balance and coordination exercises, which are mostly aimed at developing cognitive abilities, are among the most important steps to complete the basic development process and to ensure proper body control (Geuze, 2003: 527-548).

Exercises through balance and coordination may develop children's ability to belong to a group, cooperation, collaboration, waiting for their turn and self-regulation. These exercises may help children focus their attention and control their movements. Balance has been described as a complex structure in which many systems related to body position, which is a combination of visual, auditory and sensory perceptions, are used effectively (Balaban et al., 2009: 133-139). Balance, which is an important factor in the acquisition of skills such as walking, jumping and running (Pennella, 1979: 366-372), includes sitting, standing, turning, bending, standing on one foot, jumping with two feet and reaching upwards (Özer & Özer, 2004: 149).

Developing self-regulation skills from an early age is important for individuals to develop desired behaviors at all stages of life, to live in harmony in society, and to be successful both personally and professionally. In this context, it is very valuable that the studies on self-regulation are especially in the content covering early childhood years. In the national literature, the studies on self-regulation were mainly related to its relationship with cognitive, academic, emotional and social skills (Keleş, 2014; Tuzcuoğlu et al., 2019: 607-623; Gülay Ogelman et al., 2023: 1-11). This study will contribute to the literature by examining the effect of balance and coordination exercises, which are the components of motor development and thought to have an effect on self-regulation skills.

Furthermore, the balance and coordination exercises will assist children in developing the capacity to regulate their emotions, thoughts, behaviours and impulses, diminish delayed gratification and behavioural issues, and enhance pro-social abilities.

In light of the aforementioned information, it is imperative to foster the development of self-regulation abilities in children. It is hypothesised that the balance and coordination exercises will positively affect children's self-regulation skills, thereby facilitating the development of these skills. The objective of this study is to enhance children's self-regulation abilities through the implementation of exercises that emphasise balance and coordination.

1. Method

This research is an experimental study with pretest-posttest control group from quantitative research methods. The pretest-posttest control group design is a commonly used correlated design in which participants are measured on the dependent variable before and after the experimental procedure (Büyüköztürk, 2016).

1.1. Research Model

This study was designed in a quasi-experimental design with a paired control group with pretest-posttest measurement within the scope of the real experimental model in which the effect of the program including balance and coordination exercises on the self-regulation skills of 48-72-month-old children attending a preschool education institution was examined. In the study, the “Self-Regulation Skills Scale” (Bayındır, 2016) was filled out by kindergarten teachers for all children. Then, the children determined to be the experimental group were included in activities involving balance and coordination exercises. After the implementation of the activities, the same scale was filled out for all children (Karasar, 2009).

1.2. Research Group

The sample of the study consisted of 33 experimental and 39 control group children totaling 72 children who received preschool education in the 2023-2024 academic year. In the study, based on previous experience, observation and information, purposive sampling, which is one of the non-probability-based sampling methods (Şahin, 2014: 111-130), which is the cluster sampling that is appropriate for the purpose of the researcher (Ural & Kılıç, 2006) and the most appropriate for the conduct of the research (Şahin, 2014), was used.

1.3. Data Collection Tools

The data of the study were collected with the "Self-Regulation Skills Scale" (Bayındır, 2016:). The scale developed by Bayındır (2016) to determine the self-regulation skills of preschool children aged 48-72 months consisted of two sub-dimensions. The reliability coefficient for the 21 items called Regulation Skills was .96, the reliability coefficient for the 12 items called Control Skills was .91, and the reliability coefficient (α) for the total was 0.96. The first factor, planning, following the process, organizing skills, included items related to action control, emotion, motivational regulation, and evaluation skills; the second factor, control skills, included items related to self-control and attention control. The scale is a 5-point Likert scale and the statements are scored from 1 to 5, ranging from "absolutely true to absolutely not true". (Bayındır, 2016; Bayındır and Ural, 2016: 119-132).

1.4. Data Collection

Prior to the conduct of the study, Hitit University Ethics Certificate dated 05.06.2024 with the decision number 2024-147 and other permissions were obtained and the principals, teachers and parents of the children to be included in the study were informed.

All children in the research group were administered the "Self-Regulation Scale" (Bayındır, 2016) as a pretest. After the scale was completed as a pretest for all children, only the children in the experimental group were given balance and coordination exercises developed by the researchers three days a week for five weeks and one day in the sixth week for repetition. After the exercises, the same scale was administered to all children as a posttest.

The literature was utilized in the preparation of activities involving balance and coordination exercises (Karaman & Süel, 2020: 529-539). The activities were prepared by determining achievements and indicators appropriate for children's age and developmental levels (MoNE, 2013). For the cognitive development area, activities were prepared to acquire skills such as starting and completing tasks spontaneously, expressing feelings, showing perseverance, expressing their wishes/needs, postponing their wishes when necessary, and adapting to transitions between environments/activities in the social emotional area. In the field of Physical Development and Health, activities were planned and carried out to gain skills such as moving arms and legs simultaneously, walking and running in different forms, walking on a balance board, maintaining balance with the support of arms and legs, and standing on one leg for a certain period of time (MoNE, 2013).

The activities were presented to the opinions of a PhD candidate in sport sciences, a PhD candidate in preschool education, and a preschool teacher. In accordance with the opinions and suggestions expressed, 16 balance and coordination exercise activities were finalised. In this context, a total of 16 activities were implemented over the course of eight weeks between 10:00 and 11:00 on Tuesdays and Thursdays, commencing on 22 April 2024 and concluding on 10 June 2024. The implementation of the activities was conducted by the researchers. The materials utilized in the activities conducted in the school garden were procured from Hitit University Faculty of Sports Sciences, and the materials were returned at the conclusion of the activity.

1.5. Data Analysis

In the study, the data were analyzed using the SPSS. After the normal tests, the Mann Whitney U test, one of the nonparametric analyses, was used to compare the experimental and control groups because the data did not show normal distribution. The Wilcoxon signed-ranks test, one of the nonparametric analyzes, was applied to the differences within the groups because the data did not fit the normal distribution. P<0.05 was considered statistically significant.

2. Results

The results of the study, which aims to support the self-regulation skills of preschool children through balance and coordination exercises, are given in tables.

Table 1. Children's Pretest Scores Mann Whitney U Test

Group		N	Rank Avg.	Rank Tot.	SS	U	P
Regulation Skills (RS)	Experimental	33	37,30	1231,00	14,6	U=617	.763
	Control	39	35,82	1397,00			
Control Skills (CS)	Experimental	33	37,00	1221,00	10,7	U=627	.851
	Control	39	36,08	1407,00			

*p<0.05

In Table 1, the pretest scores of the children were examined and no significant difference was observed (RS (U=617, p>0.05), CS (U= 627, p>0.05). Therefore, the pretest scores of the regulation and control skills of the children in the experimental and control groups are statistically similar.

Table 2. Children's Posttest Scores Mann Whitney U Test

Group		N	Rank Avg.	Rank Tot.	SS	U	P
Regulation Skills (RS)	Experimental	33	53,53	1766,50	14,68	81,500	.000*
	Control	39	22,09	861,50			
Control Skills (CS)	Experimental	33	55,24	1823,00	10,70	25,000	.000*
	Control	39	20,64	805,00			

*p<0.05

In Table 2, the posttest scores of the children were examined and a significant difference was found in favor of the experimental group. RS (U=81,500, p<0.05), CS (U= 25,000, p<0.05).

Table 3. Posttest and Pretest Scores of Children in the Experimental Group Wilcoxon Signed Ranks Test

Measure	Posttest Pretest	N	Rank Ave.	Rank Tot	Z	P
Regulation Skills (RS)	Negative Rank	0	.00	.00	-5.014	.00*
	Positive Rank	33	17.00	561.00		
	Equal	0				
	Total	33				
Control Skills (CS)	Negative Rank	0	.00	.00	-5.016	.00*
	Positive Rank	33	17.00	561.00		
	Equal	0				
	Total	33				

*p<0.05

In Table 3, there is a significant difference in the self-regulation skills scores of the children in the experimental group RS (z= -5.014, p<0.05), CS (z=-5.016, p<0.05). According to the mean scores, there was a difference in favor of the posttest. In other words, there was a positive increase in the self-regulation skills scores of the children in the experimental group.

Table 4. Posttest and Pretest Scores of Children in the Control Group Wilcoxon Signed Ranks Test

Measure	Posttest Pretest	N	Rank Ave.	Rank Tot	Z	P
Regulation Skills (RS)	Negative Rank	0	.00	.00	-5,452	.00*
	Positive Rank	39	20.00	780.00		
	Equal	0				
	Total	39				
Control Skills (CS)	Negative Rank	39	.00	.00	-5,449	.00*
	Positive Rank	0	20,00	780,00		
	Equal	0				
	Total	39				

*p<0.05

In Table 4, there is a significant difference in the self-regulation skills scores of the children in the control group. RS (z= -5.452, p<0.05), CS (z=-5.449, p<0.05). According to the mean scores, this difference is in favor of the posttest. In other words, there was a positive increase in the self-regulation scores of the children in the control group.

Conclusion and Evaluation

As a result of this study, which aimed to support children's self-regulation skills through balance and coordination exercises, the difference between the pretest scores of the Self-Regulation Skills Scale of all children in the research

group was not found to be significant. The fact that the pretest scores of both groups are close to each other indicates that the groups show similar characteristics and this similarity is a desirable situation. Preschool children go through a period of rapid physical growth and maturation of the nervous system, which requires the development of relevant physical fitness such as agility, strength, and reaction speed (Tanaka et al., 2012: 420-434; Abbott et al., 2016: 269-274). Results from systematic reviews focus on the development of cardiorespiratory fitness and musculoskeletal fitness, as well as motor competence during the early years, childhood, and adolescence, and the enhanced increase in strength with age (Cattuzzo et al., 2016: 123-129, Utesch et al., 2019: 541-551). Based on this evidence, it is evident that the importance of physical fitness in preschool children should be the same as in older children (Cadenas et al., 2016: 910-915; Wang et al., 2023)

In the examination of the posttest-pretest score differences of the children in both the experimental and control groups of the study, it was found that there was a difference in favor of the posttest scores in Self-Regulation scores. We can explain the increase in the posttest scores of the children in the control group as the positive contribution of receiving preschool education to their development. In addition, the maturation of children in this process and their development depending on age may also be an indicator of these results.

There has been a notable increase in children's behaviours, including the setting of goals and the exertion of effort to achieve those goals, the waiting for a turn, and the ability to persevere when faced with adversity. The behaviours exhibited by children in waiting patiently, adapting when moving from one activity to another, and their ability to complete tasks with assistance before doing so independently have all improved. A reduction was observed in the tendency to become distracted by external stimuli, an increase in the capacity to remain calm when transitioning from active to passive activities, and an improvement in the provision of necessary materials and the tidying up of materials at the conclusion of tasks. Additionally, there was a notable advancement in the behaviours of perseverance in order to continue and succeed in the work they have commenced, postponing requests when necessary, initiating tasks spontaneously and persevering until the task is completed.

The difference between the posttest scores of the children in the research group in favor of the experimental group was found to be significant. Therefore, it can be said that activities involving balance-coordination exercises improved children's self-regulation skills. In parallel with the research result, Williams and Berthelsen (2019) examined the effect of rhythm and movement intervention on self-regulation skills in preschool period. While the rhythm and movement program consisting of 16 eight-week sessions was applied to the experimental group, the children in the control group continued with their own curriculum. 113 children participated in the study. The results of the study showed that rhythm and movement training was effective in developing self-regulation skills in early childhood, especially on executive functions. Similarly, in a study examining the relationship between gross motor skills and self-regulation and executive function in preschool children, it was found that static balance and inhibition were related (Veldman et al., 2023: 234-246). In another quasi-experimental study examining the effect of self-regulation on motor and social skills in preschool children with developmental coordination disorder, a program consisting of 16 sessions was applied to children with developmental disorders between the ages of four and seven for eight weeks, two days a week. As a result of the study, it was observed that self-regulation was effective in both fine and gross motor skills and social skills (Ebrahimzadeh & Rezaei, 2023:51-70). Wu et al. (2024) found that a ball game-based physical education program was more effective than free play in developing basic motor skills and self-regulation in preschool children.

Donnelly et al. (2016) suggested that the effect of physical activity on cognitive control may vary depending on the type of physical activity. In another study conducted to determine the effects of physical activity on cognitive development; Higuchi (2013) obtained positive results. On the other hand, Palmer et al. (2013) found that preschool children exhibited a significantly better ability to sustain attention compared to the period after being sedentary. Therefore, it would not be wrong to mention that children who can control attention have self-regulation skills and the effects of exercise as a supportive factor for this situation (Ponfitex et al., 2019: 1-22). She observed how physical education practices improve self-regulation and cognitive control in preschool children. Due to the critical role of self-regulation capacity on students' behaviors, he emphasized that physical education can be beneficial when it stimulates children cognitively above a minimum threshold. With this study, it can be said that the posttest scores of the children in the experimental group were significantly different from the pretest scores, so it can be said that the self-regulation skills of the children who received the balance and coordination program improved.

Robinson et al. (2016) emphasized that healthy physical activities improve skills associated with healthy development (i.e., motor skills and self-regulation) in children. They found that physical activities significantly improve motor skills in preschool children. At the same time, they concluded that physical activity programs would help contribute to children's learning-related skills and physical development, and thus to their academic achievement. In a study conducted with six-year-old children, it was found that the exercises contributed positively to children's coordination development and improved their coordinative skills such as hand-eye coordination, balanced use of the body, and holding the pencil

properly (Tuzcuoğlu, 2007). In another study, Badenes et al. (2000) mentioned that preschool education institutions should provide space and time for children to be physically active.

In conclusion, in the evaluation of the results of the research, the balance and coordination activities improve preschool children's self-regulation skills. In fact, balance and coordination exercises, in which cognitive effects are observed, will enable positive gains in terms of self-regulation by positively affecting the individual's attention control and academic achievement. Including exercises to support the development of coordination, especially in the preschool period, will help the child develop coordinative abilities in the future and become a physically healthier individual. Therefore, it is very important to include sportive activities involving balance and coordination in the education of children in this age group and to encourage children. In this line, balance and coordination activities should be included in every stage of education programs, these programs should be implemented carefully and materials should be prepared in accordance with the purpose. In this process, parents and educators will support children both academically and physically in the future by providing effective learning conditions.

In this respect, it is important that families are made aware of this issue and directed to activities where they can improve their children's self-regulation skills. On the other hand, it is essential for the development of children that preschool education institutions plan the areas where children will move correctly and provide them with opportunities to practice physical activity by experts.

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