Education and Science

Original Article

Vol 46 (2021) No 206 303-316

The Effects of Yoga Education on the Cognitive Functions of Children in Early Childhood *

Songül Yasemin Özgün [1], Betül Özkul [2], Ezgi Oral [3], İlgi Şemin [4]

Abstract

The aim of this research study is to analyze the effects of yoga education on the cognitive functions in early childhood. This study is a semi-experimental study with Pretest Posttest Control Group Experimental Design. The research sample comprises 28 children between the ages of 4-5 years, 10 in the experimental and 18 in the control group, who are currently enrolled in separate preschool programs in the city of Izmir. "Application of Cognitive Functions Scale (ACFS)" and "Personal Information Form" were used in the research in order to identify the children's cognitive functions. In the study, children in the experimental group were provided with 1 hour a week of yoga education given by a certified, expert yoga instructor for 12 weeks, while the control group children were left without intervention. Mann Whitney-U test and Wilcoxon Signed Rank Test were used for data analysis. The research findings showed that the experimental group's total ACFS scores and average posttest scores for the Tasks Section Subscales were significantly higher than their average total pretest scores. No significant difference was found between the pretest and posttest score averages of the control group. A comparison of the total posttest scores of experimental and control groups showed no statistically significant differentiation in the subscales of short term auditory memory, perspective-taking, and verbal planning; while the differentiation was statistically significant between the subscales of classification, sequential short term auditory memory, short term visual memory, and pattern completion, as well as the total ACFS posttest scores. The research findings are discussed in relation to the literature.

Keywords

Yoga
Early Childhood Period
Cognitive Functions

Article Info

Received: 10.09.2019
Accepted: 11.30.2020
Online Published: 12.30.2020

DOI: 10.15390/EB.2020.9088

* This article is orally presented at the IX. International Multidisciplinary Congress of Eurasia (IMCOFE).

[1] İzmir University of Economics, Vocational School of Health Services, Dept. of Child Development, Turkey, songul.ozgun@ieu.edu.tr
[2] İzmir University of Economics, Vocational School of Health Services, Dept. of Child Development, Turkey, betul.ozkulcura@ieu.edu.tr
[3] İzmir University of Economics, Vocational School of Health Services, Dept. of Child Development, Turkey, ezgi.oral@ieu.edu.tr
[4] İzmir University of Economics, Faculty of Medicine, Turkey, ilgi.semin@ieu.edu.tr

Introduction

School plays a crucial role in creating environments and opportunities appropriate for children's physical, cognitive and mental health. Institutions of preschool education focus on activities aimed at developing cognitive functions in the early ages. A child's performance at school is influenced by various intrinsic factors, such as attention, memory, mobility (Das, Deepeshwar, Subramanya, & Manjunath, 2016; Gulati, Sharma, Telles, & Balkrishna, 2019). Children are faced not only with academic challenges, but also with the need to develop self-regulation skills, such as awareness, flexibility, and anger management (Nanthakumar, 2018). It is important that children learn how to relax emotionally and physically while dealing with such expectations. Recently, yoga has become noted as a powerful tool in helping children overcome daily life difficulties and problems (Balkrisna, 2010).

Yoga has been one of the most favored mind-body disciplines among meditative movements in the world (Nanthakumar, 2018). In recent years, preschool education programs in our country have started to include different approaches to supporting children's physical and cognitive development. One such practice, yoga for children is suitably adapted for their level of development, and contributes to their motor skills and mental processes (Ertem Gürhan, 2018). Yoga comprises basic teachings, includes breathing and meditation that enables mental focusing and relaxation, and specific poses that ensures concentration (Feuerstein, 2003). Yoga changes the physiology of the body through respiratory manipulation (breathing exercises), cognitive control and body stance exercises (Eggleston, 2015; Farahani, Hekmatpou, Khonsari, & Gholami, 2019). In addition, activities that incorporate physical exercises such as yoga contribute to cognitive functions (Galantino, Galbavy, & Quinn, 2008; Ploughman, 2008; Telles, Singh, Bhardwaj, Kumar, & Balkrishna, 2013). Components such as motivation, interaction, flexibility, and attention control are influential on children's cognitive functions. Researches consider such activities that enable control of emotional and cognitive impulses should start at a young age for the effective development of social and academic skills, both in the short and long run (Stapp &Wolff, 2019).

Yoga is used as an effective method in gaining certain skills that increase physical flexibility as well as improving self-control. One of the most important features of yoga is its contribution to children's physical, cognitive, and emotional development in a balanced way (Aydın & Özgen, 2018; Gillen & Gillen, 2008). Pandya (2018) points out the influence of yoga education for children on emotional awareness and positive feelings. Research demonstrates that yoga helps to diminish various problematic situations in children, such as negative behaviors, mood disorders, anger, anxiety, fatigue, and body image perception (Halliwell, Jarman, Tylka, & Slater, 2018; Smith, Hancock, Blake-Mortimer, & Eckert, 2007). Yoga activities were also shown to be relevant to academic performance, social and academic self-confidence (Gulati et al., 2019).

Recently, it has been emphasized that school-based yoga programs develop children's behavioral and academic skills. Improving physical and cognitive flexibility, yoga allows children to relax and focus, and, as a result, influences children's academic achievements (Eggleston, 2015). It is believed that yoga has a positive effect on self-regulation, attention enhancement, and self-confidence, which influence physical and emotional well-being (Hagen & Nayar, 2014). Self-regulation skills are defined as a series of behavioral skills that involve working memory, preventative control, and attention (Vygotsky, 1978). It is argued that children who are able to regulate their emotions and behaviors in accordance with the situations and make appropriate decisions about the problems of their daily life skills are more successful in school and beyond (Payton et al., 2008). In that sense, Bersma and Visscher (2003) believe that yoga increases children's preparedness for learning and allows personal development to be monitored in a non-competitive way.

Cognitive functions are the sum of executive functions. These functions include skills like perception, comparison, the understanding of differences, classification, grouping, coding, and

information recall (Akşin Yavuz, 2016). It is stated that cognitive functions also include hereditary disposition, learning habits, and attitudes toward learning (Tzuriel, 2001). Each cognitive function reflects the capacity that the human brain possesses innately, develops through experiences and gradually guided by meta cognitive processes. (Haywood & Lidz, 2007). This research study adopts the dynamic assessment approach that allows the discovery of mental processes. In the dynamic assessment approach, it is aimed to interact with the child via questions, and contribute to learning through the use of cognitive tools (objects, blocks, patterns, etc.) during this interaction process as well (Akşin Yavuz, 2016; Haywood & Lidz, 2007; Tiekstra, Minnaert, & Hessels, 2016). The assessment process of cognitive functions is based on the interactive learning approach discussed in Vygotsky's zone of proximal development, and Feuerstein's Mediated Learning Experience. Vygotsky identifies the difference between tasks that a child can perform independently, and those that can be performed with adult assistance as the zone of proximal development (Lidz, 1995). The learning that takes place within the zone of proximal development supports a child's learning process (Akşin Yavuz, 2016). In parallel with Vygotsky's standpoint, Feuerstein emphasizes the differences between a child's direct experiences, and those gained through support of an adult. Feuerstein emphasizes the importance of mediated learning experiences in shaping a child's cognitive skills (attention, memory, etc.) (Feuerstein, Rand, & Hoffman, 1979).

The development of cognitive functions that involve organization, impulse control, planning, and working memory can be encouraged by activities such as yoga. In this context, yoga is used as an effective method in supporting the development of cognitive functions (Beattie, 2014; Diamond & Lee, 2011). Research conducted on yoga generally focuses on adults, while studies on children are quite limited (Birdee et al., 2009; Nanthakumar, 2018). Researches demonstrate that breathing exercises and focus techniques, which are the major themes of yoga, improve children's self-control skills, thus the children gain new physical, emotional and cognitive skills, and develop academic skills needed to be prepared for school (Razza, Bergen-Circo, & Raymond, 2015; Wolff & Stapp, 2019; White, 2009). A study that analyzed yoga's contribution to child development from a teacher's perspective, it is stated that yoga supports children's physical development, social-emotional skills, self-regulation skills, and cognitive development (Wolff & Stapp, 2019). In the literature, it has been observed that many studies have been conducted on elementary school children in terms of mindfulness-based yoga interventions (Biegel & Brown, 2012; Napoli, Krech, & Holley, 2005). This research study follows this approach by analyzing the effects of yoga training on the cognitive functions in early childhood. Accordingly, the hypotheses below were tested:

1. There is a significant difference between the total ACFS pretest and posttest scores of children in the experimental group.
2. There is a significant difference between the total ACFS posttest scores of children in the experimental group and the control group.

Method

This research is a semi-experimental designed study with pretest-posttest control group aiming to investigate the effects of yoga education on the cognitive functions of children between the ages of 4-5 years. "Application of Cognitive Functions Scale" was administered to the experimental and control groups prior to and following the yoga education.

Study Group

The research study group was comprised of 28 children aged 4-5 years – 7 girls and 3 boys in the experimental group, and 13 girls and 5 boys in the control group – who were enrolled in a pre-school institution. The scale used in this study was only for children of at least 4 years old. Therefore, age criteria was considered while determining the study group. In identifying the research study group, it was very important to ensure that the experimental and control groups have similar characteristics. The

experimental group and the control group were of similar proportions in terms of age and gender, although the control group was almost twice. Since it was a semi-experimental study, the experimental and control groups were formed from different pre-school institutions in order to reduce the interaction of children in the experimental group where yoga education was applied and those in the control group where no training was performed. Both schools were private pre-school institutions with similar physical conditions in terms of the physical structure of the school, the number of students, as well as their education programs. Furthermore, none of the children in either group had previously received any type of yoga education. The research study was completed with 26 children, since 1 in the experimental group did not participate in the training regularly, and 1 in the control group did not take the posttest.

Data Collection Tools

Application of Cognitive Functions Scale

The Application of Cognitive Functions Scale (ACFS) was developed by Lidz and Jepsen, and detailed by Haywood and Lidz (2007). The validity-reliability study was conducted in 2004 by Doctor Lidz. The Turkish application of the scale was conducted by Akşin Yavuz and Zembat (2017).

The ACFS is a rating tool that includes curriculum-based dynamic assessment process applied to normally-developed children of 36-66 months, and to children with special needs of 36-96 months (Haywood & Lidz, 2007). The ACFS is comprised of six subscales. These subscales are classification, short term auditory memory, short term visual memory, pattern completion, perspective-taking, and verbal planning. Each subscale is comprised of a pretest, intervention, and posttest stages. In the pretest stage, children are scored based on individual achievement; they are trained via semi-structured and structured methods during the intervention stage; and finally in the posttest stage, scoring is based on the re-application of the same activity (Akşin Yavuz & Zembat, 2017). In the subscales where children receives full points from the pretest stage, the intervention stage is not applied. Due to a special rule applied only in the pattern completion subscale, the number of children who do not have the intervention stage may be high (Haywood & Lidz, 2007). The highest possible scores in the ACFS subscales are: 12 points for Classification Subscale, 17 points for Short Term Auditory Memory, 13 points for Short Term Visual Memory, 18 points for Pattern Completion, 16 points for Perspective-Taking, and 15 points for Verbal Planning.

A "Behavior Rating Scale" comprising seven components is performed for each subscale of the ACFS, which assesses the child's performance at each activity. The components of this rating scale are: self-regulation, persistence, frustration tolerance, flexibility, motivation, interactivity, and responsivity. The Behavior Rating Scale is applied to all subscales as a standard, and the highest possible score is 14.

While the ACFS provides qualitative and quantitative data, it lacks normative data. The data derived from this rating scale indicate the development of cognitive functions present in the pre-school curriculum and of learning skills (Akşin Yavuz & Zembat, 2017).

The construct validity of the scale for its Turkish adaptation determined that there was significant difference at a level of 0.001 in each subscale of the activities section, while this difference was at a level of 0.05 in the total score. The validity of ACFS was tested by analyzing the relationship between "the subscales of activities" and "the behavior rating scale", and positive-oriented, medium and high level correlations were observed (Akşin Yavuz & Zembat, 2017). The total reliability co-efficient for the activities section of the scale was determined as .749, and for the behavior rating scale, .997.

Data Collection Process

Prior to the data collection process, signed parental consent forms were collected and furthermore researchers provided detailed information to the parents of experimental group children on the process of yoga education, as well as the rating of cognitive functions.

Since the application of the rating scale required expertise, researchers first received an implementer training and then applied a pilot study with 15 children in order to ensure the implementer reliability of the scale. These performed tests were evaluated and provided feedback by the consultant who taught the scale. After completing the necessary preliminary assessment, researchers were found qualified to initiate the actual application process.

It was important to ensure that the application process of this scale was performed face-to-face individually with each child. In order to allow children to perform comfortably, they were introduced to the researchers a few days before the application process. Furthermore, special attention was given to ensuring that the pretest and posttest applications were implemented by the same researcher. During the application of the rating scale, researchers arranged a special test room which allowed limited interaction among children and helped them to focus. The researchers created an adjacent sitting arrangement allowing children to view test materials from the same perspective as the researcher and making them feel comfortable.

During the application of the scale, children were presented only with the materials for the relevant scale. Researchers had previously planned the order of questions, the process for moving on to the intervention stage, and ways to support the child during this stage. In the meantime, the Behavior Rating Scale for each subscale was appropriately coded by researchers in the pretest and intervention stages. The application process of the scale took approximately 45-60 minutes for each child, therefore it was necessary to divide the process into two sessions for children with shorter attention spans. Each child's scale was scored by two different researcher to ensure the most accurate assessment. In order to resolve any differences, the implementer's guidebook was used as reference. Furthermore, when needed, necessary adjustments were made based on the opinion of the expert instructor. In this way, discrepancies in scorings were resolved in order to ensure objectivity in the assessment process. The scoring of the scale took 30 minutes for each child.

The first ranking (pretest application) for every children was performed in March 2019 prior to the yoga education. Following the 12 weeks of yoga education, the second ranking (posttest application) took place in June 2019. During the application process, if children were unwilling to continue the test, or became bored, the ranking application was spread across the day. The pretest and posttest applications were completed within 2 weeks by 3 researchers.

Yoga Education

In yoga education for the period of early childhood, it is necessary to make the exercises appealing, to use play as often as possible, to integrate music and dance into the yoga exercises, and to use a variety of movements (Yogapoint, 2019). It is essential to create a yoga class environment where children are encouraged to be creative, rather than strictly enforcing a particular program. Yoga for children focuses on the acknowledgement of connection between poses and breathing without demanding perfection in the poses (White, 2009). In other words, poses and breathing exercises allow children to relax physically and mentally, and balance these two aspects. Yoga for children does not exhibit a competitive attitude, and each individual is evaluated based on their own personal improvements (Toscano & Clemente, 2008).

In the study, the experimental group children were given yoga education under the leadership of a certified, expert instructor for 1 hour a week, for 12 weeks. The methods used were explaining the meaning of yoga, pranayamas (breathing exercises), relaxation exercises, intimate asanas (physical poses), and meditation (focusing). In order to enable children carry over yoga into their daily lives, and transform it into a lifestyle, exercises were performed using accessible items such as walls and chairs, and partners, such as a sibling. Because children's fragile bone structure, each pose was held for no more than 10 seconds. In addition, since concentration of preschoolers is different than adults, yoga

sessions were elaborated with animal impressions, dance, and play, making the practice appropriate for their level of development.

Analysis of the Data

In order to test whether there was a significant difference between children in the experimental and control groups, Mann Whitney-U test and the Wilcoxon Signed Rank Test were used for data analysis. Mann Whitney-U test is used to test the significance of difference between two groups with small samples and when the data do not have normal distribution (Fay & Proschan, 2010; Nachar, 2008). Wilcoxon signed rank test is used in place of paired sample t-test in cases where the data do not have normal distribution (Alpar, 2012). The SPSS 21 packaged software was used in data analysis and margin of error in the interpretation of findings was considered 0.01 and 0.05.

Results

Mann Whitney -U test was performed to determine whether there was a significant difference in total pretest scores of Application of Cognitive Functions Scale of the experimental and control groups. The results are shown in Table 1 and Table 2.

Table 1. Mann Whitney-U Test Results Applied to The Experimental and Control Groups' Pretest Total Scores

Groups	N	$\bar{X}$	Sd	Mean R.	U	Z	p
Experimental Group	9	42.88	14.95	12.22	88.00	0.62	0.56
Control Group	17	45.05	10.65	14.18			

Table 1 shows that there was no statistically significant difference between the total pretest scores of children in the experimental and control groups (U= 88.00, z= 0.62, p>0.05).

Tablo 2. Mann Whitney-U Test Results of the Experimental and Control Groups' Pretest ACFS Subscale Scores

Subscales	N	$\bar{X}$	Sd	Mean R.	U	Z	p
Classification							
Experimental Group	9	5.00	2.95	11.44	95.00	1.06	0.33
Control Group	17	5.00	0.79	14.59			
Short-Term Auditory Memory							
Experimental Group	9	4.11	2.02	11.61	93.50	0.92	0.36
Control Group	17	5.64	3.16	14.50			
Short-Term Auditory Memory-Recall							
Experimental Group	9	4.33	3.27	14.22	70.00	-0.35	0.75
Control Group	17	3.82	2.48	13.12			
Short-Term Visual Memory							
Experimental Group	9	6.88	2.26	15.17	61.50	-0.82	0.42
Control Group	17	6.58	2.80	12.62			
Pattern Completion							
Experimental Group	9	9.55	5.12	13.00	81.00	0.24	0.83
Control Group	17	10.17	5.70	13.76			
Verbal Planning							
Experimental Group	9	9.44	3.24	13.17	79.50	0.16	0.87
Control Group	17	9.70	2.91	13.68			
Perspective Taking							
Experimental Group	9	7.88	4.98	13.89	73.00	-0.19	0.87
Control Group	17	7.94	4.08	13.29			

Table 2 shows that there was no statistically significant difference between the total pretest scores of children with regards to the subscales of ACFS Activities Section in the experimental and control groups (p>0.05).

Wilcoxon Signed Rank Test was performed in order to determine whether there was a statistically significant difference between total pretest scores and total posttest scores of experimental group. The results are shown in Tables 3 and 4.

Table 3. Wilcoxon Matched Pair Signed-Rank Results of The Experimental Group's Pretest / Posttest Total Tasks Section Scores

Tasks Section	N	$\bar{X}$	Sd	Z	p
Pretest	9	42.88	14.95	2.67	0.00*
Posttest	9	66.33	9.76		

Table 3 shows that the average pretest score of experimental group is 42.88, while the average posttest score is 66.33. According to the results, there is a statistically significant difference between the pretest and posttest average scores (Z= 2.67, p<0.05).

Table 4. Wilcoxon Matched Pair Signed-Rank Results of The Experimental Group's Pretest / Posttest Subscale Scores

Subscales	N	$\bar{X}$	Sd	Z	p
Classification					
Pretest	9	5.00	2.95	2.03	0.04*
Posttest	9	7.00	3.00		
Short-Term Auditory Memory					
Pretest	9	4.11	2.02	-2.71	0.00*
Posttest	9	6.88	3.01		
Short-Term Auditory Memory-Recall					
Pretest	9	4.33	3.27	1.82	0.06
Posttest	9	6.11	1.45		
Short-Term Visual Memory					
Pretest	9	6.88	2.26	2.32	0.02*
Posttest	9	8.44	1.58		
Pattern Completion					
Pretest	9	9.55	5.12	-2.36	0.01*
Posttest	9	15.88	1.90		
Perspective Taking					
Pretest	9	7.88	4.98	2.52	0.01*
Posttest	9	10.66	3.27		
Verbal Planning					
Pretest	9	9.44	3.24	2.26	0.02*
Posttest	9	11.33	2.64		

* p<0.05

Table 4 shows a statistically significant difference between pretest-posttest scores of the experimental group for the subtests of classification, short term auditory memory, short term visual memory, pattern, perspective taking, and verbal planning (p<.05). There was no statistically significant difference between the pretest-posttest scores of short-term auditory memory and recall subtest (p>.05).

Table 5 presents the results of Wilcoxon Signed Rank Test performed in order to determine whether there was a statistically significant difference between pretest and posttest scores of the control group.

Table 5. Wilcoxon Matched Pair Signed-Rank Results of The Control Group's Pretest / Posttest Tasks Section and Subscale Scores

Subscales	N	$\bar{X}$	Sd	Z	p
Classification					
Pretest	17	5.00	0.79	-1.40	0.16
Posttest	17	4.70	0.91		
Short-Term Auditory Memory					
Pretest	17	5.64	3.16	-0.44	0.65
Posttest	17	5.52	2.52		
Short-Term Auditory Memory-Recall					
Pretest	17	3.82	2.48	1.54	0.12
Posttest	17	3.47	1.87		
Short-Term Visual Memory					
Pretest	17	6.58	2.80	-0.19	0.84
Posttest	17	6.41	3.24		
Pattern Completion					
Pretest	17	10.17	5.70	1.40	0.16
Posttest	17	11.88	4.19		
Perspective Taking					
Pretest	17	7.94	4.08	-0.55	0.57
Posttest	17	7.88	3.58		
Verbal Planning					
Pretest	17	9.70	2.91	-0.70	0.48
Posttest	17	8.82	4.18		
Tasks Section					
Pretest	17	45.05	10.65	1.54	0.12
Posttest	17	48.70	10.27		

According to Table 5, there was no statistically significant difference between the pretest-posttest subscales and tasks section scores of control group ($p>.05$).

Mann Whitney -U test was performed in order to determine whether there was a significant difference in total posttest scores of Application of Cognitive Functions Scale of the experimental and control groups. The results are shown in Table 6 and Table 7.

Table 6. Mann Whitney-U Test Results of The Experimental and Control Groups' Posttest Total Scores

Groups	N	$\bar{X}$	Sd	Mean R.	U	Z	p
Experimental Group	9	66.33	9.74	20.28	15.50	-3.29	0.00*
Control Group	17	48.70	10.27	9.91			

* $p<0.05$

The average posttest score of the experimental group was $\bar{X}$ =66.33 and of the control group was, $\bar{X}$ =48.70. A statistically significant difference was determined between the total posttest scores of experimental and control groups ($U=15.50$, $z=-3.29$, $p<.05$). The level of cognitive functions varied depending on whether the children participated in yoga education, in other terms, it had an impact on cognitive functions.

Table 7. Mann Whitney-U Test Results of The Experimental and Control Groups' Posttest ACFS Subscale Scores

Subscales	N	$\bar{X}$	Sd	Mean R.	U	Z	p
Classification							
Experimental Group	9	7.00	3.00	18.39	32.50	-2.45	0.01*
Control Group	17	4.70	0.91	10.91			
Short-Term Auditory Memory							
Experimental Group	9	6.88	3.01	15.67	57.00	-1.06	0.31
Control Group	17	5.52	2.52	12.35			
Short-Term Auditory Memory-Recall							
Experimental Group	9	6.11	1.45	19.83	19.50	-3.10	0.00*
Control Group	17	3.47	1.87	10.15			
Short-Term Visual Memory							
Experimental Group	9	8.44	1.58	19.50	22.50	-2.96	0.00*
Control Group	17	6.41	3.24	10.32			
Pattern Completion							
Experimental Group	9	15.88	1.90	18.28	33.50	-2.34	0.01*
Control Group	17	11.88	4.19	10.97			
Perspective Taking							
Experimental Group	9	10.66	3.27	16.78	47.00	-1.60	0.12
Control Group	17	7.88	3.58	11.76			
Verbal Planning							
Experimental Group	9	11.33	2.64	16.56	49.00	-1.50	0.14
Control Group	17	8.82	4.18	11.88			

* $p<0.05$

According to Table 7, comparison of the posttest scores of experimental and control groups showed no statistically significant difference in the subscales of short term auditory memory, perspective taking and verbal planning ($p>.05$); while there was a statistically significant difference between the subscales of classification, sequential short term auditory memory, short term visual memory and pattern completion ($p<.05$).

Discussion, Conclusion and Suggestions

This study analyzed the effects of yoga education on the cognitive functions during early childhood. With this purpose in mind, preschool children were given a yoga program with breathing exercises, physical poses and meditation. The research results showed that yoga education has an impact on children's cognitive functions, and is influential on organization, impulse control and visual memory, consistent with the literature (Abadi, Madgaonkar, & Venkatesan, 2008; Farahani et al., 2019; Shavanani & Udupa, 2003). Yoga is reported to develop focusing skills, and has positive impact on academic performance (Gillen & Gillen, 2008; Kauts & Sharma, 2009). Research shows that yoga education improves children's attention span, and that they are more successful in performing academic tasks (Peck, Kehle, Bray, & Theodore, 2005). In their comparative research study, Chaya, Nagendra, Selvam, Kurpad, and Srinivasan (2012) examined the effects of yoga intervention and physical activity intervention on cognitive activities, and found that both of them had an impact on cognitive functions. Additionally, in a follow-up study conducted 3 months later, they found that these interventions were especially influential on the cognitive functions like attention and visual-spatial perception. In another study, it was demonstrated that yoga and physical activities had positive effects on cognitive functions and social self-respect (Telles et al., 2013). A study which assessed children's perceptions on the physical, cognitive and emotional benefits of a yoga program reported that, children improved in areas such as focusing, flexibility and stress management (Rashedi, Wajanakunakorn, & Hu, 2019).

In this study, it was shown that the yoga education had an impact on children's skills in classification, visual memory, auditory memory, pattern completion, verbal planning, and perspective taking. There was no significant difference between the average pretest and posttest scores of control group children. In fact, the control group's average posttest scores were lower than the average pretest scores, probably because of the short attention span in early childhood due to their developmental characteristics, and the consequent loss of motivation due to the repetition of the implemented scale 14 weeks later. However, it is possible to say that the experimental group's cognitive functions were improved by yoga education in terms of attention, memory, and pattern completion.

When the posttest scores were compared, no statistically significant difference was found between the experimental and control groups' subscales for short term auditory memory, perspective taking, and verbal planning. In early childhood, cognitive activities such as classification and pattern completion are acquired earlier than cognitive and emotional activities such as empathy and reasoning (Berk, 2013). In other words, the learning related to internal, emotional feelings, impulses and thought processes is more gradual than that of cognitive skills (Trawick-Smith, 2013). Therefore, and in relation to the findings of this research, the more abstract verbal cognitive skills (such as short-term auditory memory) are learned later than concrete cognitive skills (such as pattern completion, and classification). Yoga is well-known for its contribution to skills of internal motivation, such as focusing, relaxation and memory support, but has a much more limited impact on environmental processes such as empathy and communication. In fact, Beattie (2014) denies that yoga education has no significant effect on children's communication skills, or skills such as self-management and self-control.

There was a statistically significant difference in subscales of classification, sequential short-term auditory memory, short term visual memory, and pattern completion, and the total ACFS posttest scores of experimental and control group children. This particular finding of the study demonstrates that yoga improves physical and cognitive focusing skills. Especially in the Application of Cognitive Functions Scale used in this study, children were expected to employ their classification skill in three different areas (color, shape, and size). According to Piaget, preschool children are generally able to classify objects based on a single characteristic, but are not able to consider multiple features (Trawick-Smith, 2013). This unidimensional view on cognitive development contrasts with Vygotsky, who draws attention to children's learning experience via social interaction; and states that children can improve their learning skill by starting from something familiar, with the assistance of an adult or peer support (Blake & Pope, 2008). In this regard, the results of this study support Vygotsky's point of view, and it can be claimed that learning environments like yoga, which involve cooperation between adults and children, support the development of children's cognitive skills. In their study where they examined the effects of yoga on visual and auditory reaction, Shavanani and Udupa (2003) found improvement in the sensory-motor area. In another study, in which a yoga group and a control group were compared in terms of artistic activities, it was determined that yoga had a significant impact on spatial and auditory memory (Manjunath & Telles, 2004). In parallel to this, breathing exercises in yoga education was found to have an effect on spatial and verbal memory (Naveen, Nagendra, & Telles, 1997). A similar study reported that compared to other physical exercises, yoga was more influential on visual-spatial perception and attention skill (Chaya et al., 2012). However, Beattie (2014) analyzed the effect of yoga on cognitive functions (attention, visual memory) in the preschool period, and found no significant difference between two intervention groups (yoga education and reading education).

Following an assessment of results of the current study, and those of similar studies into the impact of yoga education on children, it is possible to suggest that yoga practice can be promoted, especially starting from early childhood, in order to support cognitive, physical, psychological, and social development. Specifically, parents and teachers have important roles in the development of

children. Considering the results of this study, teachers and parents are recommended to incorporate yoga discipline into exercises and educational materials in efforts to support children's cognitive functions (Tokcan, 2010). Parents and teachers should include online programs and card games regarding yoga for children in a child's education process.

School sport activity curriculums can incorporate meditation, relaxation exercises and breathing exercises, which can constitute basis for yoga. In addition, yoga can be used as an alternative and supplementary method in the education and interventions dealing with academic and behavioral problems. In this study, results of a 12-week long yoga education were presented. Future studies can focus on the analysis of the effect of longer exposure to yoga on cognitive functions. Additionally, effects can be compared among children of various educational levels.

Limitations

One of the limitations of the study is that children cannot be assigned randomly to the control and experimental groups, this study included only children who volunteered for yoga education. Therefore, the generalizability of the research results is limited. Since yoga education can only be performed in small groups, the sample size of this study is considered limited. Some research studies on yoga education of children showed that the full effects of yoga appear only in the long run (Pandit & Satish, 2014). The current study is limited in the sense that the aim was to analyze the short term, rather than long-term effect on children's cognitive functions, and the longer term effects is an important area for future research.

Another limitation of this study is the similar socio-economic level of the children. In order to increase the validity of the findings, studies should include children from different socio-economic levels.

Acknowledgments

We would like to thank Dr. Ezgi Akşin-Yavuz for her support during the training phase and evaluation process of the scale used in the study. We would also like to thank Ayfer Seferinoğlu for her contribution by teaching yoga to the students.

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