

## **Examining the Effect of Orienteering on the Development of Attention, Metacognitive Awareness and Problem-Solving Skills of Primary School Students with ADHD<sup>1</sup>**

### **Abstract**

In addition to medical treatment, games, sports or exercises can be used to reduce the symptoms of children diagnosed with ADHD. In this study, the effect of orienteering on the development of attention, metacognitive awareness, and perceptions of problem-solving skills of primary school students diagnosed with ADHD was examined. In the study, orienteering was done on students with ADHD aged 9-10. As a result of the study, it has been observed that orienteering has positive effects on developing of primary school students with ADHD attention, metacognitive awareness, and the perceptions of problem-solving skills.

**Keywords:** ADHD; metacognition; orienteering; problem-solving

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## **Examining the Effect of Orienteering on the Development of Attention, Metacognitive Awareness and Problem-Solving Skills of Primary School Students with ADHD**

### **Introduction**

There are children with typical development as well as children with different developmental characteristics and needs (Ministry of Education, 2011). Children with attention deficit and hyperactivity disorder (ADHD) are among those who show different characteristics in their development (Baykoç-Dönmez, 2017).

ADHD is a psychiatric disorder (Sürücü, 2019) that manifests itself with distractibility, hyperactivity, and impulsivity (Gözeten, 2019; Gümüş, 2015; National Resource Center on ADHD, 2017). This disorder was discovered in 1902 described by Dr. George Still (Kayaalp, 2008; Sadek, 2014; Semerci & Turgay, 2017). Dr. Still identified 20 children who had problems with hyperactivity and attention and differed from their peers (Anastopoulos & Shelton, 2002; Selikowitz, 2009; Sadek, 2014) and documented this (American Academy of Pediatrics, 2019). It is known that there are different naming processes related to ADHD in the historical process (National Resource Center on ADHD, 2017; Selikowitz, 2009). In this context, ADHD is not a newly encountered disorder (Anastopoulos & Shelton, 2002; Cooper & Bilton, 2002; Holowenko, 1999).

Although ADHD is a performance problem rather than an information problem (Selikowitz, 2009), it is a medical diagnosis for a condition involving destructive behaviors (Holowenko, 1999) or for adults and children with cognitive and behavioral difficulties (Cooper & Bilton, 2002). ADHD is a childhood disorder manifested by inattention, hyperactivity, and impulsivity (American Academy of Pediatrics, 2019; Ministry of Education, 2017; Özdoğan, Ak, & Soyutürk, 2005; Waldman & Rhee, 2002; World Health Organization, 2018) and is also a psychiatric problem (Centers for Disease Control of Prevention, 2020; Kayaalp, 2008). In short, ADHD is a problematic behavior pattern that occurs against the will of the individual (Holowenko, 1999) and is common (Harpin, 2017a).

There may be many causes of ADHD (Abalı, 2018; Barkley, 2005). There is no exact information about what is the cause of ADHD (Hallowell & Ratey, 2019; National Institute of Mental Health, 2019; Sadek, 2014). It can be said that ADHD is a result of complex interactions of genes and environmental factors (Franke, 2020; Sadek, 2014). Therefore, it is stated that ADHD can occur due to biological, bio-environmental, and environmental reasons (Doğangün & Yavuz, 2011; Holowenko, 1999). However, it is stated that indirect evidence obtained at the point of causes of ADHD points to hereditary

factors (Barkley, 2005). Besides, it is stated that various factors such as head trauma, referral, and vaccination cause problems with attention and focus as a result of damage to the frontal lobe (Yurttaş, Yiğit, Alpaslan, & Karakoç, 2014).

ADHD caused by genetic and environmental factors (Armstrong, 1999; Parker, 2006; Yurttaş et al., 2014) has different types and these types have their characteristics (American Psychiatric Association, 2014; Sürücü, 2019). These are three: attention deficit type, hyperactivity type (hyperactivity and impulsivity), and combined type (American Psychiatric Association, 2014). Children with ADHD's type of attention deficit can be distracted quickly (Cooper & Bilton, 2002; World Health Organization, 2018), often lose their belongings (Anastopoulos & Shelton, 2002), have difficulty in completing tasks, and become disorganized and forgetful (Ashley, 2005; Kayaalp, 2008; Özdoğan et al., 2005; Selikowitz, 2009). Children with the hyperactive-impulsive type of ADHD have difficulty stopping to think (Centers for Disease Control of Prevention, 2020), act constantly (Ashley, 2005), act without thinking, have insufficient self-control, and speak excessively (Selikowitz, 2009). In the combined type, symptoms of attention deficit and hyperactivity are seen together in the individual (American Psychiatric Association, 2014; Centers for Disease Control of Prevention, 2020; Ercan, 2008; Holowenko, 1999).

ADHD can cause disruptions in the life of the individual and may show common and permanent features (American Academy of Pediatrics, 2019; Holowenko, 1999). Therefore, ADHD is medically diagnosed when it causes problems in a child's life (Abalı, 2018; Holowenko, 1999). The first step of the intervention for ADHD is to correctly diagnose it (Selikowitz, 2009). This requires a well-established structured approach (Harpin, 2017b; Sürücü, 2019). The main components of this process are interviews with parents, psychological evaluation and school evaluation, clinical and medical evaluation (Anastopoulos & Shelton, 2002; Holowenko, 1999; Sadek, 2014). Besides, different assessments (developmental and family history of the child, behaviors in different settings, school records, medical examination, cognitive profile, etc.) are also available (Holowenko, 1999). In this context, early diagnosis and intervention in ADHD is important. Only in this way, positive results can be obtained for the life of the individual with ADHD (National Resource Center on ADHD, 2017; Parker, 2006).

It is understood that ADHD requires a comprehensive intervention (Anastopoulos & Shelton, 2002; Kayaalp, 2008). In this context, medication, psychotherapy, and psychosocial approaches can be used (Doğangün & Yavuz, 2011; Kayaalp, 2008; National Institute of Mental Health, 2019; Sadek, 2014). Medication can be considered as the easiest approach to treat (Ashley, 2005; Panksepp, 2008). However, medicine prepares the ground for teaching skills rather than teaching skills (Holowenko, 1999). Therefore, different approaches may be needed regarding ADHD treatment (Barkley,

2005; Sadek, 2014). These can be defined as psychoeducational approaches (Yazgan, 2011), game (Panksepp, 2008), sports (Dupar, 2018b; Ercan & Aydın, 2014; Spodak & Stefano, 2014) or exercise (Topçu, Yıldız, & Topçu-Bilgen, 2007). One of the approaches that can contribute to the intervention process of children with ADHD and have a therapeutic effect is sports (Ercan & Aydın, 2014). In this context, orienteering sport, which is one of the sports that provide the individual in many ways (Bektaş et al., 2019; Ferguson & Turbyfill, 2013), can be considered to include children with ADHD in the intervention process.

Orienteering is a direction-finding that requires the use of maps and compass (Boga, 1997), nature and cognitive activity sport (Golden, Levy, & Vohra, 1987; Özcan, 2007; Tanrikulu, 2011) and is also a way of teaching (Kelly, 2014). Orienteering involves finding the targets on the map by running or walking as fast as possible (Graham, 2006). Orienteering is limited by one's imagination (Kjellstrom & Kjellstrom-Elgin, 2010) and therefore there are different types of orienteering (Ferguson & Turbyfill, 2013). At the same time, orienteering is an interdisciplinary learning resource (Di Tore, Corona, & Sibilio, 2015). In this context, orienteering contributes to the development of personal, scientific, mathematical, artistic, linguistic, social studies, physical education, and technology skills. For example, orienteering contributes to the development of individual skills such as concentration, problem-solving, management, decision making, and self-esteem (Kelly, 2014).

It is known that children with ADHD have problems with cognitive organization (Ministry of Education, 2017), social interaction (LaRue Jr et al., 2008), and attention (Özdoğan et al., 2005). In this context, the benefits of orienteering can be used to reduce the difficulties experienced by students with ADHD regarding attention, metacognitive awareness, and problem-solving. There is no study on direct orientation and ADHD in the literature. In this respect, when physical activity-based studies on students with ADHD are examined, folklore contributes to medical treatment (Topçu et al., 2007), yoga has positive effects on children's attention and behavior (Jensen & Kenny, 2004), and regular physical activities in addition to stimulation are beneficial (Medina et al., 2010; Türksoylu, Öztürk, Ergün, & Türksoylu, 2017). Besides, it is understood that the tai chi program can be used in ADHD treatment (Dereceli, 2011) and music skipping exercise can reduce ADHD symptoms (Geum-Ju, 2018). Besides, it is stated that orienteering can have positive effects on children's attention and memory (Atakurt, Şahan & Erman, 2017).

## Research Questions

In this research, the following questions were tried to be answered:

1. What is the effect of orienteering in developing primary school students' of attention, metacognitive awareness, and perceptions of problem-solving skills with

ADHD?

2. What are their opinions and their parents' opinions about the effect of orienteering in developing primary school students' of attention, metacognitive awareness, and perceptions of problem-solving skills with ADHD?
3. How is the development process of primary school students with ADHD in orienteering?

## Methods

### Research design

In this study, a mixed research approach was preferred to obtain more reliable results with triangulation, to add depth to the results obtained, to develop different perspectives on complex situations, and to strengthen the effect of the study (Greene, Caracelli, & Graham, 1989). Since the research includes different data types, a nested mixed methods design was adopted (Creswell, 2016a). The quantitative step of the research was designed according to the single group pretest-posttest design, which is one of the pre-experimental designs within the scope of experimental methods (Creswell, 2016b). As part of the case study, the impact of a program was tried to be examined (General Accounting Office [GAO], 1990).

### Participants

The participants of this study are eight primary school students with a diagnosis of ADHD and studying in the 4th grade of primary school. While determining the participants, primary school 4th-grade students who were diagnosed with ADHD were reached using the criterion sampling method (Yıldırım & Şimşek, 2013). Later, among the students who were reached through convenience sampling, individuals who were easily accessible (Ekiz, 2009; Yıldırım & Şimşek, 2013) and volunteers were included in the participants. Four of the participants were female and the other four were male. The average age of the participants is 9.5 and they do not have any health conditions that prevent them from orienteering. Besides, students love games with physical and mental content. Finally, the participants have not participated in any orienteering races or map reading events before.

### Measures

**Personal Information Form:** In the personal information form developed by the researcher, questions investigating the participants' gender, age, class, orienteering, and mapping experiences, and their liking of games with physical and mental content were included.

**Semi-structured Interview:** There is an interview guide in the semi-structured

interview, and unplanned questions can also be included in this process (Robson, 2017). In this study, the opinions of the participants and the parents of the participants about the research process were tried to be obtained through a semi-structured interview. In this process, questions were asked about the feelings and thoughts of the participants about the orienteering process, the benefits of orienteering to the participants, what the participants likened to orienteering, and their wish to have orienteering in their schools. In this context, the parents of the participants were also questioned about the contribution of the orienteering process to their children.

**Observation:** Interactive observation, a type of natural observation, was used in this study (Angrosino, 2017). The behaviors of the participants regarding the orienteering process were recorded by the researcher in writing immediately after the application.

**Head Camera:** Video is one of the data collection tools (Şimşek & Yıldırım, 2011). Head camera also helps in decision making and investigation of psychological processes in a natural environment (Omodei & McLennan, 1994). To follow the orienteering process of the students better and to add depth to the data, a head camera was installed on the students. In this way, the behavior of the students on the track was examined in more detail.

**d2 Attention Test:** The d2 Attention Test was developed by Brickenkamp (1981). This test measures selective attention over time. The d2 Test of Attention was adapted into Turkish by Yaycı (2013). The study group within the scope of adaptation consists of 124 students aged 9-10, who study in the 4th grade. To determine the consistency coefficient of the d2 Attention Test, the significance level of the relationship between test-retest scores, namely Pearson product-moment correlation coefficients, was examined. Accordingly, the d2 Attention Test's TN ( $r = .885$ ;  $p < .001$ ), E1 ( $r = .884$ ;  $p < .001$ ), E2 ( $r = .761$ ;  $p < .001$ ), TN-E ( $r = .831$ ;  $p < .001$ ), CP ( $r = .877$ ;  $p < .001$ ), and FR ( $r = .570$ ;  $p < .001$ ) dimensions were found to be positive and significant. As a result, it was determined that the d2 Attention Test has appropriate psychometric properties (Yaycı, 2013).

**Problem Solving Inventory for Children (PSIC):** PSIC was developed by Serin, Bulut-Serin, & Saygılı (2010) to measure primary school students' perceptions of their problem-solving skills. During the development of the scale, 568 students studying in 4th, 5th, 6th, 7th, and 8th grades were studied. PSIC consists of "Trust in Problem Solving Skills" (12 items), "Self-Control" (7 items), and "Avoidance" (5 items) sub-factors and a total of 24 items. The scale is a five-point Likert (never, rarely, occasionally, often, always) type and has reverse-scored items. For the whole scale, the Cronbach Alpha coefficient was calculated as .80 and the test-retest reliability as .85. As a result of the confirmatory factor analysis (CFA), it was confirmed that the factor structure of the scale

was appropriate ( $X^2= 621.05$ ;  $df= 249$ ;  $X^2/sd= 2.49$ ;  $GFI= .92$ ;  $CFI= .90$ ;  $NNFI: .87$ ;  $AGFI: .90$ ;  $RMSEA= .051$ ). Besides, the item-total correlation coefficients of the scale were examined and these values were calculated as  $.741$  ( $p<.001$ ) for the 1st factor,  $.679$  ( $p<.001$ ) for the 2nd factor, and  $.478$  ( $p<.001$ ) for the 3rd factor. As a result, it has been observed that PSIC has psychometric properties that can measure primary school students' perceptions of problem-solving skills (Serin et al., 2010).

The Metacognitive Awareness Inventory for Children a Form (Jr.MAI-A): Jr.MAI-A was developed by Sperling, Howard, Miller, & Murphy (2002) to measure the metacognitive skills of 3rd-9th grade students. A and B forms of the Metacognitive Awareness Inventory Karakelle & Saraç (2007) were adapted to Turkish. In this research, Jr. MAI-A was used. In the adaptation of Jr.MAI-A, 565 students studying in 3rd, 4th and 5th grades were studied. Jr. MAI-A is a triple Likert-type scale (always, sometimes, never) and consists of 12 items in total. As a result of the exploratory factor analysis (EFA), it was seen that the Kaiser-Meyer-Olkin (KMO) value of the scale was  $.72$  and the Barlett-Sphericity test was significant ( $\chi^2=528.74$ ,  $p<.001$ ). The Cronbach alpha value of Jr.MAI-A was found to be  $.64$ , and the test-retest correlation value was found to be  $.74$  ( $N=356$ ,  $p<.01$ ). It has been concluded that Jr.MAI-A is valid and reliable so that it can be used in evaluating the metacognitive level (Karakelle & Saraç, 2007).

## Procedures

The application of this research was carried out on a university campus. The campus area map drawn by R. Kulakoğlu (orienteering mapper) was provided. By conducting investigations in the campus area, the areas where the participants will orienteering were determined. The provided orienteering map was divided into appropriate parts and small maps of the application areas were arranged. The tracks of the maps are planned to consist of five targets. Participants have applied (orienteering) a total of 12 times for four weeks. Participants completed two courses in the first week, four courses in the second week, three courses in the third week, and three courses in the fourth week. The track length and difficulty level of the map have been increased in each application. During the implementation process, each student was worked on individually and the student was guided where necessary. Besides, the researcher has participated in orienteering training and is an athlete, referee, trainer, and cartographer in the field of orienteering.

## Data Analysis

The qualitative data obtained in the study were analyzed through continuous comparison (Urquhart, 2018). Descriptive analysis was used to analyze the qualitative data obtained from semi-structured interviews and observations. In this process, the data were transcribed, read, encoded (Miles & Huberman, 2016) and the themes were reached

(Creswell, 2016c). In the data obtained from the head camera, inductive content analysis was used by the researcher to reveal the concepts (Patton, 2014). In this context, the data obtained from the head camera for a typical track chosen every week was analyzed. The field of view of all the participants' cameras was adjusted in the same way and the data obtained from the head camera were collected and analyzed in a standard way. Numerical criteria (1: needs to be improved, 2: moderately good, 3: good, 4: very good) were used in the analysis of the data obtained from the head camera. The evaluation criteria of the participants were formed according to their performances on the course. Accordingly, the criterion that should be developed is that the participant fails to achieve any goal; partly good criterion is that the participant can achieve at most two goals; the good criterion is that the participant can achieve three goals, and the very good criterion is that the participant can achieve all goals.

In analyzing quantitative data, nonparametric tests were used because the parametric test assumptions could not be fully met (Salkind, 2015). In this context, Wilcoxon signed ranks test was used in the analyzes. Expert support has also been consulted for the implementation and analysis of the d2 Attention Test.

## Findings

### Findings Regarding the Evaluation of the Results of the Participants' d2 Attention Test, Jr.MAI-A and PSIC

Descriptive findings obtained according to the d2 Attention-test during the evaluation process are given in Table 1.

**Table 1.** Descriptive Findings of the Study Group Regarding the d2 Attention Test

d2 Attention Test dimensions	Pretest		Posttest	
	$\bar{x}$	Sd	$\bar{x}$	Sd
TN (Total number of figures marked)	467.75	94.27	477.25	129.25
E1 (Number of figures skipped without marking)	108	58.43	91	62.12
E2 (Number of incorrectly marked figures)	21.75	32.97	8.25	12.95
TN-E (With errors removed from the total)	338	70.90	378	80.96
CP (Concentration performance)	181.88	68.11	198.5	62.69
FR (Fluctuation rate)	25.88	10.70	19.13	9.19

$\bar{x}$ : Average, Sd: Standard deviation

It is observed that the TN average score increased, the E1 average score decreased, the E2 average score decreased, the TN-E average score increased, the CP average score increased and the FR average score decreased.

During evaluation process, the results of the Wilcoxon signed ranks test according to the d2 Attention Test are given in Table 2.



**Table 2.** Wilcoxon Signed Ranks Test Results of Participants' d2 Attention Test Scores

TN (Total number of figures marked)	n	Average rank	Rank sum	z	p
Posttest-Pretest					
Negative rank	3	4.67	14	.560	.575
Positive rank	5	4.40	22		
Equal	0				
E1 (Number of figures skipped without marking)	n	Average rank	Rank sum	z	p
Posttest-Pretest					
Negative rank	7	4.14	29	1.540	.123
Positive rank	1	7	7		
Equal	0				
E2 (Number of incorrectly marked figures)	n	Average rank	Rank sum	z	p
Posttest-Pretest					
Negative rank	5	4	20	1.014	.310
Positive rank	2	4	8		
Equal	1				
TN-E (With errors removed from the total)	n	Average rank	Rank sum	z	p
Posttest-Pretest					
Negative rank	1	2	2	2.240*	.025
Positive rank	7	4.86	34		
Equal	0				
CP (Concentration performance)	n	Average rank	Rank sum	z	p
Posttest-Pretest					
Negative rank	2	3.75	7.50	1.472	.141
Positive rank	6	4.75	28.50		
Equal	0				
FR (Fluctuation rate)	n	Average rank	Rank sum	z	p
Posttest-Pretest					
Negative rank	7	4.43	31	1.825	.068
Positive rank	1	5	5		
Equal	0				

Based on negative ranks  $p < .05^*$

When Table 2 was examined, a significant difference was found between the scores of the participants regarding only the TN-E dimension ( $z=2.240$ ,  $p<.05$ ) of the d2 Attention Test. It is understood that this observed difference (considering the average rank and total of the difference scores) is in favor of the posttest. It was determined that there was no significant difference between the scores of the participants regarding the TN ( $z=.560$ ,  $p>.05$ ), E1 ( $z=1.540$ ,  $p>.05$ ), E2 ( $z=1.014$ ,  $p>.05$ ), CP ( $z=1.472$ ,  $p>.05$ ) and FR ( $z=1.825$ ,  $p>.05$ ) dimensions of the d2 Attention Test.

Wilcoxon signed ranks test results of the participants according to Jr.MAI-A are given in Table 3.

**Table 3.** Wilcoxon Signed Ranks Test Results of Participants' Jr.MAI-A Scores

Total Jr.MAI-A Posttest-Pretest	n	Average rank	Rank sum	z	p
Negative rank	1	1	1	2.383*	.017
Positive rank	7	5	35		
Equal	0				

Based on negative ranks  $p<.05^*$

When Table 3 is examined, it has been determined that there is a significant difference ( $z=2.383$ ,  $p<.05$ ) between the scores of the participants in the evaluation process. It is understood that this observed difference (considering the average rank and total of the difference scores) is in favor of the posttest.

Results of the Wilcoxon signed ranks test of the participants according to PSIC are given in Table 4.

**Table 4.** Table 4. Results of Participants' PSIC Scores According to Wilcoxon Signed Ranks Test

Total PSIC Posttest-Pretest	n	Average rank	Rank sum	z	p
Negative rank	0	.00	.00	2.524*	.012
Positive rank	8	4.50	36		
Equal	0				

Self Confidence in Problem Solving Ability Sub-Dimension Posttest-Pretest	n	Average rank	Rank sum	z	p
Negative rank	0	.00	.00	2.521*	.012

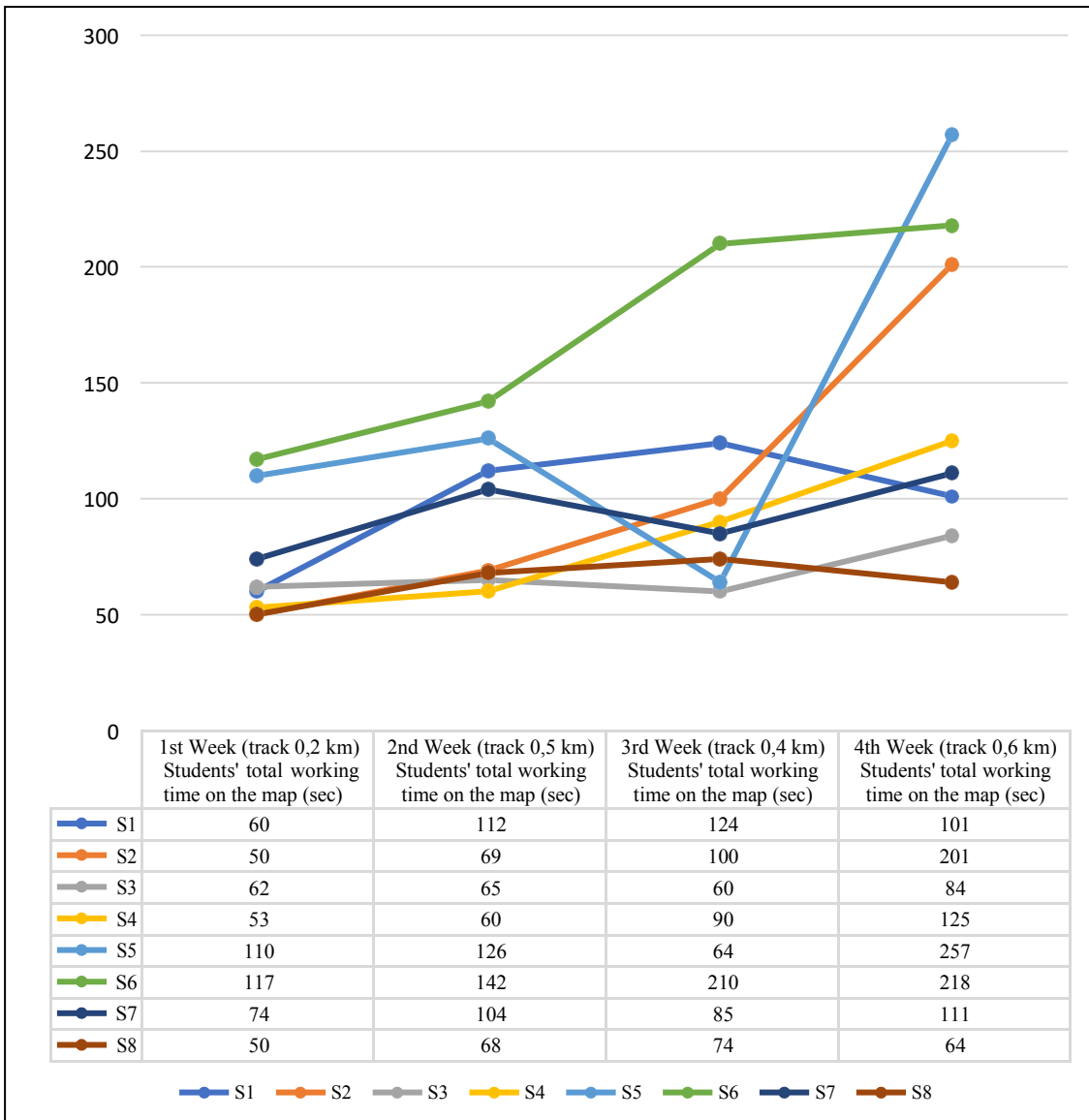
Positive rank	8	4.50	36		
Equal	0				
Self-control sub-dimension Posttest-Pretest	n	Average rank	Rank sum	z	p
Negative rank	1	1.50	1.50	2.325*	.020
Positive rank	7	4.93	34.50		
Equal	0				
Avoidance sub-dimension Posttest-Pretest	n	Average rank	Rank sum	z	p
Negative rank	1	2.50	2.50	2.176*	.030
Positive rank	7	4.79	33.50		
Equal	0				

Based on negative ranks  $p < .05^*$

When Table 4 is examined, it is seen that there is a significant difference ( $z=2.524$ ,  $p < .05$ ) between the total scores of the participants from PSIC. There is also a significant difference between the total scores of the participants in the Self Confidence in Problem Solving Ability ( $z = 2.521$ ,  $p < .05$ ), Self-Control ( $z = 2.325$ ,  $p < .05$ ) and Avoidance ( $z = 2.176$ ,  $p < .05$ ) sub-dimensions. It is understood that this observed difference (considering the average rank and total of difference scores) is in favor of the posttest.

### **Findings Regarding Students' Orienteering Process According to the Data Obtained from the Head Camera**

The data regarding the total working time with the map within the scope of the head camera images of the participants are given in Graphic 1.



Graphic 1. Students' total working time on the map according to weeks

The working time in Graphic 1 consists of the total duration of the cognitive activities of the participants such as orienting the map, finding where they are on the map, finding and showing the paths to the targets on the map, reading the map, answering questions about the map, controlling the accuracy of the goals through the map. When Graphic 1 is examined, it is understood that the duration of the participants' working on the map generally increased from the first week to the fourth week.

During the implementation process, a head camera analysis of a track for each week was made. Accordingly, the findings regarding the orienteering process of the participants for four weeks are given in Table 5.

**Table 5.** Results Regarding the Orienteering Process According to the Head Camera of the Participants

Orienteering skills	A	B	C	D	E	F
	1st, 2nd, 3rd, and 4th week	1st, 2nd, 3rd, and 4th week	1st, 2nd, 3rd, and 4th week	1st, 2nd, 3rd, and 4th week	Total score	Completion time of the tracks (1st, 2nd, 3rd, and 4th week)
Student codes						
S1	1, 2, 2, 3	1, 2, 3, 3	2, 2, 3, 4	1, 2, 3, 3	5, 8, 11, 13	04 dk 01 sn , 09 dk 04 sn 10 dk 03 sn, 12 dk 08 sn
S2	2, 2, 3, 3	2, 2, 3, 3	2, 2, 3, 4	2, 2, 3, 3	8, 8, 12, 13	07 dk 00 sn, 08 dk 30 sn 11 dk 15 sn, 17 dk 57 sn
S3	2, 2, 4, 4	2, 2, 4, 4	2, 3, 4, 4	2, 3, 4, 4	8, 10, 16, 16	05 dk 09 sn, 09 dk 12 sn 07 dk 15 sn, 08 dk 38 sn
S4	2, 2, 3, 4	2, 2, 3, 4	2, 3, 3, 4	2, 2, 3, 4	8, 9, 12, 16	05 dk 26 sn, 09 dk 33 sn 09 dk 40 sn, 11 dk 46 sn
S5	1, 1, 2, 3	1, 1, 2, 3	1, 2, 2, 3	1, 1, 2, 3	4, 5, 8, 12	06 dk 12 sn, 09 dk 32 sn 10 dk 53 sn, 20 dk 30 sn
S6	1, 1, 2, 3	1, 1, 2, 3	1, 2, 3, 3	1, 1, 2, 3	4, 5, 9, 12	06 dk 43 sn, 10 dk 49 sn 12 dk 11 sn, 14 dk 39 sn
S7	1, 2, 3, 3	1, 2, 3, 3	2, 3, 3, 4	1, 2, 4, 4	5, 9, 13, 14	04 dk 52 sn, 09 dk 46 sn 14 dk 15 sn, 09 dk 28 sn
S8	2, 2, 3, 4	2, 2, 3, 4	2, 3, 4, 4	2, 2, 4, 4	8, 10, 14, 16	04 dk 52 sn, 07 dk 09 sn 07 dk 06 sn, 11 dk 23 sn

1: Needs to be improved 2: Moderately good 3: Good 4: Very good

A: The level of orientation of the map

B: Level of locating on the map

C: The level of interpretation for finding goals

D: Level of finding the right goal

E: Total

F: Completion time of the tracks

Lengths of selected tracks: 1. parkur: 0.2 km, 2. parkur: 0.5 km, 3. parkur: 0.4 km, 4. parkur: 0.6 km

When Table 5 is examined, it is seen that the total scores of the participants for the first week vary between 4 and 8 points, and the time to complete the course varies between 04 min 01 sec and 07 min 00 sec. The total scores for the second week vary between 5 and 10 points, and the time to complete the course varies between 07 min 09 sec and 10 min 49 sec. The total scores for the third week vary between 8 and 16 points, and the time to

complete the course varies between 07 min 06 sec and 14 min 15 sec. The total score for the fourth week varies between 12 and 16 points, and the time to complete the course varies between 08 min 38 sec and 20 min 30 sec.

## **Opinions of Participants and Parents of Participants about Orienteering Process and Findings Regarding Researcher's Observation**

As a result of the interview with the participants, all of the participants stated that they liked orienteering, they were happy while orienteering, and they thought about how to find the goals while orienteering. Participants compared orienteering to games (brain teasers, treasure hunts), running, labyrinths and puzzles, and stated that other children should also do orienteering. Besides, the participants stated that orientation contributed to some subjects (attention, thinking, keeping in memory, problem-solving in mathematics, listening, reading comprehension, self-confidence, self-control, orientation, feeling successful, socialization). In this context, S1 comments: *“I'm not swearing. My attention has improved. My self-confidence has risen. I quickly found the sum that is not given in mathematics. This has accelerated. It was faster when solving problems in mathematics”*.

*It helped me concentrate. For example, while I cannot pay attention to certain things, now I can focus better. I also noticed this in my lessons. For example, while I was reading I was always looking somewhere, that was a little less. I used to play with such things in math. I am not playing with erasers and pencils now. I used to mix the aspects, I learned better now. It was very beautiful. (S2)*

*There has been progress in attention. I focus when I find my goals. My math was good while solving the questions. My sister told me you are very good. Those who want to join, because it's fun. There may be no distractions here. He can do the lesson he cannot do by going to orienteering. When he gets there he learns to concentrate. I was in math too. It also happened in reading comprehension. My direction-finding has also improved. (S3)*

While S4 and S6 stated that orienteering partially contributed to them, S5 stated that there was no contribution. S7, on the other hand, said, *“It increased keeping it in my memory, like an intelligence game. It was better when thinking about the questions.”*

*I started reading very well. I started to focus my attention. I listen to the lesson better, I did not listen to the lesson before, now I am listening to the lesson. Thinking got better and confident. I got better at problem-solving, started to understand better. I got along better with my friends. I have better control of myself. (S8)*

Most of the participants stated that orienteering contributed to them. In this context, the opinions of the parents were also examined. S1's parent said:

*For example, when there were six mistakes on a paper before, now it has decreased. Now it is better. Like he absorbed his mischief There is progress in social matters. He was shouting every day, now it has decreased. Same with homework. His attention grew, it slightly affected his school success.*

S2's parent says *“Why is it over, my child? I haven't noticed much, but it's as if it's better than before. I haven't had a lot of observations. But I think the study got better. I noticed improvement in his attention, more attention.”* S3's parent said, *“I think it contributed. It had some effect. Eating habits became too much. At first, he was raising his voice. It was a little more moderate afterward. He got better in his speech and joke. Problem-solving skills got better.”* S4's parent stated that he could not observe his child much during this process and therefore did not have enough idea about the contribution of orienteering. S5's parent said, *“It contributed. She came to the studies fondly; I don't know what she came for. Traveling for her. If it contributes, I might not have understood.”* S6's parents said, *“I could not understand very much. But as far as I can see she made the papers quicker. There is little improvement in focus.”* S7's parent said, *“She loves sports that catch his attention. Yes, when she is willing, no when she is not. I can say that a little more attention has improved.”* Finally, S8's parent stated that *“I could not observe it obviously, but she came to the applications fondly.”* Most of the parents of the students stated that orienteering contributed to their children from different angles and all parents stated that such practices should be increased.

The researcher made some observations about the orienteering process of the participants within the scope of the application. Accordingly, it was observed that the participants were curious and orienteering attracted the attention of the participants in the first week. The participants were informed about basic orienteering skills (the relationship between the map and the environment, the direction of the map and how it should be kept, how to staple the targets, etc.) and the practice was made. Since the first week is a week for both introduction and getting to know students, the number of courses was determined as two. Course level of orienteering was increased to four in the second week. Participants were asked simple questions about basic orienteering skills during the implementation process. For example, *“Why are you going in this direction? Can you show where it is on the map?”* It was determined that the four tracks in orienteering were a little too much for students. For this reason, the number of courses was reduced to three in the third week. That week, it was seen that the students improved their basic orientation skills and were able to better answer the questions directed by the researcher while practicing. In the fourth week, it was observed that the participants were able to answer higher-level questions compared to other weeks (For example, *“What is the shortest way to the*

goal?"). The fourth week can be evaluated as the week in which students show the best performance in the orienteering process. It was observed that the skills of the participants to establish a connection between the map and the environment developed from the beginning to the last week. In inverse proportion to this development of the participants, the level of guidance of the researcher gradually decreased each week.

It is understood that all the qualitative and quantitative findings obtained support each other. The opinion of most of the participants and parents of the participants that orienteering contributes to them and their children and the statistically significant difference reached in most of the quantitative analyzes may be an indication of the data confirming each other. Besides, it is understood that this confirmatory indicator is also present in the observations of the researcher.

## **Discussion and Conclusions**

In this study, it was seen that orienteering had positive effects on attention, metacognitive awareness, and the perceptions of problem-solving skills of primary school students with ADHD. The findings obtained regarding this have been tried to be examined.

In this study, it has been tried to reveal how effective orientation is in the development of attention skills of primary school students with ADHD. In this context, according to the results of the statistical evaluation, it was observed that there was an improvement in students in the dimension (TN-E) of the d2 Attention Test subtracting errors from the total. In other parts of the test, it was observed that there was no statistically significant difference, but the average scores of most of the students showed an improvement. Therefore, according to these results, it is concluded that orienteering is beneficial to a certain extent in the development of attention skills of primary school students with ADHD. It is stated in the studies that orienteering can have positive effects on children's attention and memory (Atakurt et al., 2017) and physical activities have positive effects on the attention of children with ADHD (Silva et al., 2015). In this context, the effect of orienteering, which includes physical activity, on attention should be examined more descriptively. First of all, it can be said that attention is an important skill in the orienteering process. The student uses attention skills in processes such as holding the map, reading the map, finding its location on the map, finding the target, determining the paths to the target, choosing the shortest path. In the data obtained from the head camera, the increase in the study time of most of the students on the map indicates that the time of attention also increased. However, some students found the targets in a short time because they were more goal-oriented and perceived quickly. On the other hand, some of the students and parents of the students stated in the interview that orienteering increases the attention. As a result, the students did some attention exercises by orienteering in a fun game format.

Another purpose of this research is to examine the effect of orienteering on the development of the metacognitive awareness of students with ADHD. It is stated by their



parents that children with ADHD have more problems in behavior regulation and metacognitive abilities than those without ADHD (Schroeder & Kelley, 2009). Besides, it is said that various games have positive effects on the executive processes and visual perception of children with ADHD (Çakıcı, 2018). In this context, the research has shown that orienteering also has positive effects on the cognitive awareness of children with ADHD. This effect can be explained according to the cognitive intervention elements of Flavell (1979). Accordingly, the data obtained from the head camera during the orienteering process showed that the students made progress in orienting the map (metacognitive knowledge and experience), finding the location on the map (metacognitive knowledge and experience), making comments to find the goals (metacognitive knowledge and experience), and finding the right goal (goal, action). Students' expressing their thoughts on how to find the target while orienteering is supportive of this. Similarly, students' getting better and better answers to the questions asked by the researcher during the orienteering process may be an indicator of the development of some cognitive skills. All these can be used as a clue to explain the positive effect of orienteering on the metacognitive awareness of students with ADHD.

In this study, it was also aimed to improve the perceptions of students with ADHD about problem-solving skills by orienteering. It is stated that orienteering has positive effects on problem-solving skills (Bektaş et al., 2019; Kelly, 2014). In this context, as a result of the statistical evaluation, it was seen that orienteering positively affected students' perceptions of problem-solving skills according to PSIC. Therefore, it can be said that within the scope of the scale, students' confidence in their problem-solving skills and their level of self-control increased, and their avoidance behaviors from problematic situations decreased. Considering that the problem occurs when obstacles are encountered while trying to reach the goal (Cüceloğlu, 2017), it can be said that the students go through a continuous problem-solving process while doing orienteering. It can be stated that orienteering involves the solution of many problems and problems faced by the student, from finding himself on the map to finding the target. Besides, students and their parents expressed problem-solving skills or skills that may be related to the contribution of orienteering. The researcher also observed that the students performed better in each practice on the track.

Finally, the students stated that they liked orienteering and compared this sport to games (treasure hunt, intelligence game), running, entertainment, maze, and puzzle. Besides, students stated that orienteering contributed to attention, thinking, memorizing, problem-solving in mathematics, listening, reading comprehension, self-confidence, providing self-control, finding direction, feeling successful, and socializing. It has been revealed that the parents' views (in terms of attention, social problem solving, and school success) also support these views of the students. As a result of these, the students said that orienteering should be practiced in their schools and that other children should also benefit from this sport. The parents of the students also emphasized that such practices

should be increased.

The limitations of the study are working with eight students, including 12 applications, not forming a control group, and not reaching scales prepared for children with ADHD. Therefore, it may be suggested to consider these limitations in future studies. Besides, due to the pandemic that had an impact all over the world, students were worked individually within the framework of hygiene rules. In this context, the implementation was carried out under slightly more challenging conditions than the normal (before the pandemic). Finally, planning the researches to be conducted by considering these issues can be presented as a suggestion.

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