COMPARISON OF SPATIAL VISUALIZATIONS OF INDIVIDUAL SPORTS AND TEAM SPORTS BRANCHES

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ABSTRACT

Objective

This research aims to compare the spatial visualizations of children interested in individual and team sports branches.

Method

Spatial visualization test was applied as a data collection tool. The spatial visualization test was developed by Lappan et al. (1983). This test was adapted to Turkish by Dursun (2010). The Spatial Visualization questionnaire was applied to 300 child athletes in the study. In statistical operations, a t-test and a one-way ANOVA test were applied.

Results

A statistically significant difference was found in comparing spatial visualization scores according to the gender variable ($p<0.05$). It was determined that there was no significant difference between gender groups in terms of spatial visualization of secondary education achievements of male and female child athletes ($p> 0.05$). The spatial visualization success of child athletes with a score between 85 and 100 is higher than those with a score of 84 and below ($p<0.05$). It is seen that there is a significant difference in spatial visualization scores between children who are interested in individual and team sports ($p<0.05$). It was determined that there was a statistically significant difference between the branches according to the spatial visualization scores ($p<0.05$).

Conclusion

The spatial visualization success of the children dealing with individual sports branches was higher than those dealing with team sports. Studies that will improve spatial visualization can be given more space in training children engaged in team sports. Exceptionally, including studies in the orienteering branch may be beneficial to train other branches. More concrete activities that improve spatial ability can be included to eliminate mediocrity in trainers' training.

KEYWORDS

Individual sport, Team sports, Spatial Visualization, Secondary Education Achievement Score

INTRODUCTION

Spatial skill Widely used in fields such as graphic design, topographic engineering, architecture, and X-ray interpretation. It requires mental rotation and spatial visualization skills as spatial skills (Yurt, 2011). Spatial skills can be used to find a way using a map, store excess items, choose an appropriately sized storage container for leftovers, replace a car seat, or use a diagram. Spatial thinking is both an innate and an acquired skill. *Spatial skill* can be defined as the ability to recognize objects from different aspects, visualize two-dimensional structures in three dimensions in mind, or move the parts that make up the objects (Altıner, 2018; Yıldız & Tüzün, 2011). Children with high spatial skills have a high ability to understand, explain and evaluate the world of geometry, math and science skills, mental map development skills, the ability to change the arrangement and location of household items, and interest in fields (Rafi et al., 2008; Yıldız, 2009).

Spatial thinking is a set of cognitive skills, including using representation and presentation tools and the process of comparison and understanding spatial concepts. Spatial ability, another sub-concept related to visualization, is the movement of objects in the mind. It can be expressed as understanding how objects look from different angles and their relationship with other objects (Sarıkaya,2019). Spatial visualization is the ability to visualize new situations in space by moving two-dimensional and three-dimensional objects consisting of one or more parts and their three-dimensional parts (Sevimli, 2009). Spatial ability is seen as spatial reasoning as three-dimensional thinking, mental imagination, and object manipulation in mind and imagination (Shepard, 2004). According to studies on spatial skills, it is primarily stated that children's spatial skills are not at a sufficient level (Kösa,2011; Martin-Dorta et al.,2014; Turğut & Yılmaz, 2012; Özcan et al.,2016). It is suggested that this skill can be improved with educational interventions. In this sense, sports activities have a good place in children's spatial skills development. Playing with toys that can be created in childhood, playing 3D computer games, and practising certain sports branches can develop these skills (Sorby, 1999). Students can develop different features by using many intelligence areas simultaneously while doing sports. For example, while a football player develops kinesthetic intelligence while running, he uses visual-spatial intelligence while hitting the ball (Şengör, 2018). Intelligence has a relationship with education (Işık & Darı,2023). Even people's dissatisfaction with their external appearance can cause them to think positively (Yamak et al.,2018).

Spatial ability is a problem to be investigated for two reasons. First, there is a positive relationship between spatial abilities and the success of positive sciences and geometry. Secondly, perceiving displacement, reconstructing, and understanding three-dimensional objects become more practical for a child living in a world equipped with three-dimensional objects (Turgut, 2007). The development of spatial visualization levels in different sports branches is significant for skill learning and reflecting the characteristics of sports branches. This study aimed to compare the spatial visualization levels of children who do individual sports and those who do team sports and to investigate which sports branches affect spatial ability more.

MATERIALS AND METHODS

Participants

Children engaged in Orienteering (n=50), Tennis (n=50) and Karate (n=50), which are called individual sports within the sports clubs of Muğla Province and Fethiye District, and football (n=50), and basketball as team sports. Three hundred child athletes, aged 14-18 and above, participated in licensed sports activities in the branches of (n=50) and Volleyball (n=50).

Data Collection Tool

The bill form contains personal information consisting of questions such as gender, age, academic achievement score and branch. A spatial visualization test was applied as a data collection tool. The spatial visualization test was developed by Lappan et al. (1983). This test was adapted to Turkish by Dursun (2010). In this study, the reliability coefficient of the test was obtained as 0.74. The spatial visualization test consists of 10 types (mind separation and integration, mental rotation, etc.) and 32 questions. The lowest score that can be obtained from the test is zero, while the highest score is 32.

Analysis of Data

SPSS 25.00 program was used in the evaluation and statistical analysis of the data. The Kolmogorov-Smirnov normality test was applied according to the data obtained from the children. The data showed a normal distribution. T-Test and ANOVA tests were used for comparisons between groups. Considering the results of the ANOVA test, the post-doc (Tukey) test was used to determine which group created the difference. The statistical significance level of the study was accepted as "p<0.05".

Ethical report: This study was approved under the letter dated 27.11.2019 and numbered 923408882-050.04.04 of the Research Ethics Committee of the Non-Invasive Clinic of the Faculty of Health Sciences of Aydın Adnan Menderes University.

RESULTS

The gender, age and branches of the participants are given in Table 1. Comparisons of test scores according to some parameters are given in Tables 2 and 3. In Table 4, the comparison of test scores according to branches is given.

Table 1. Frequency and percentage values results according to the demographic characteristics and success scores of the athletes.

Independent Variables	Groups	N	%
Gender	Male	181	60,3
	Female	119	39,7
Age (Year)	14	83	27,7
	15	75	25,0
	16	72	24,0
	17	70	23,3
Branches	Orienteering	50	16,7
	Tennis	50	16,7
	Karate	50	16,7
	Football	50	16,7
	Basketball	50	16,7
	Volleyball	50	16,7
Secondary Education Achievement Score	84 and below	211	70,3
	85 -100 scores	89	29,7

A total of 300 athletes participated in the study, 181 (60.3%) male and 119 (39.7%) female athletes with a mean age of 15.43±1.12 years. Looking at the branch distribution, there are 50 orienteering, 50 tennis, 50 karate, 50 football, 50 basketball and 50 volleyball players. When the secondary education success score of the athletes is examined, there are 211 athletes who are 84 and below and 89 athletes who are 85 and above.

Table 2. Comparison of the secondary education achievement scores of the athletes according to some variables

Parameter		n	Mean	SD	t	p
Gender	Male	181	1,55	0,09	-3,10	,002
	Female	119	1,52	0,09		
Children interested in individual sports	Male	98	1,31	0,46	1,64	,103
	Female	52	1,19	0,39		
Children interested in team sports	Male	91	1,39	0,46	1,64	,125
	Female	59	1,20	0,39		

A statistically significant difference was found in the comparison of spatial visualization scores according to the gender variable (p<0.05). It is seen that male athletes have significantly better spatial visualization scores than female athletes. It is seen that there is no significant difference between gender groups in terms of spatial visualization secondary education achievements of male and female athletes in the branches of children interested in individual sports and children interested in team sports (p> 0.05).

Table 3. Children interested in individual sports and the team Comparison of secondary education achievement score variable and spatial visualization success of children interested in individual sports

		n	Mean	SD	t	p
Secondary Education Achievement Score	84 and below	211	1,51	0,08	13,24	,000 **
Secondary Education Achievement Score	85 -100 scores	89	1,62	0,05		
Sport type	Children interested in individual sports	150	1,55	0,10	2,38	,018*
Sport type	Children interested in team sports	150	1,53	0,08		

*p<0,05 and **p<0,001

According to the data obtained from children who are interested in individual sports and children who are interested in team sports, it is seen that there is a statistically significant difference in favor of the group with 85 -100 points when the secondary education achievement scores are compared with the spatial visualization scores (p<0.05). Athletes with 85 and above points have higher spatial visualization success than athletes with 84 and below points. There is a significant difference in spatial visualization scores between individual and team sports (p<0.05). Athletes interested in individual sports branches have a higher spatial visualization score than athletes dealing with team sports branches.

Table 4. ANOVA test results in the comparison of spatial visualization scores of data obtained from athletes according to branches (n=50).

Dimension	Branches	Mean	SD	F	p	SG
Spatial visualization	Orienteering (1)	1,66	0,04	80,12	,000	2-3-4-5-6
	Tennis (2)	1,54	0,05			3-6
	Karate (3)	1,46	0,07			-
	Football (4)	1,56	0,05			3-6
	Basketball (5)	1,56	0,04			3-6
	Volleyball (6)	1,46	0,08			-

SG= Significant Difference

It was determined that there was a statistically significant difference between the branches according to the spatial visualization scores (p<0.05). According to the Post-Hoc test, it was observed that the athletes interested in the orienteering branch made a statistically significant difference compared to all other sports branches (p<0.05). In addition, a significant difference was found between the Karate and Volleyball players of the Tennis players, the Karate and Volleyball players of the Football players, and a significant difference on the Karate and Volleyball players of the Basketball players (p<0.05). It was determined that karate and volleyball athletes did not make a statistically significant difference against any sports branch (p>0.05).

DISCUSSION

In this study, it was thought that the development of spatial visualization levels in different sports branches is significant for skill learning and reflecting the characteristics of sports branches. Our study aims to compare the spatial visualization levels between children who are interested in individual sports and children who are interested in team sports and to determine which sports branches affect spatial ability more. When the literature is examined, it is seen that there are many studies examining the relationship between spatial ability and gender. Different and contradictory results were obtained in these studies. Different results were obtained since the studies were conducted at various age levels, most at different scales. There are claims that gender difference gives different results in various age groups. It has been suggested that the spatial abilities of boys and girls before puberty are the same (Yıldız, 2009).

Similarly, they applied spatial ability tests at different developmental levels of children and found that the gender difference emerged after age 10. As a result of Turgut's (2007) study, while there was a difference between the genders of the 6th-grade students, no difference was found at the 7th and 8th-grade levels. In addition to gender-neutral studies, many studies have found that boys outperform girls. These studies have included discussions about why men achieve better results. For example, while some attribute the reason for the gender difference to the higher spatial abilities of boys, some studies link this difference to the fact that boys are more confident in themselves than girls (Turgut, 2007). Rafi et al. (2008) found that girls developed more spatial visualization skills than boys. Kaufman (2006) investigated whether the gender difference in mental rotation and spatial visualization abilities is valid for working memory. In the study, there were differences according to gender in terms of spatial visualization and mental rotation abilities. When we look at the findings we obtained in our study, a statistically significant difference was found in comparing spatial visualization scores according to the gender variable ($p<0.05$). It is seen that male athletes have significantly better spatial visualization scores than female athletes. As a result, we see that there are various and contradictory results regarding gender differences, and these results are attributed to different causes. The most important of these reasons is that the studies are conducted in various age groups and that different measurement tools are used. While no grouping was made regarding the measurement tools, some inferences were made according to age, and it was reported that there was mostly no gender difference before adolescence.

According to Güven (2019), and Gürdal (2011), adolescents' abilities, learning and thinking styles, academic motivations, and interests differ. More than one parallel factor affects the learning level and academic success. It is assumed that academic achievement is positively related to intelligence. Some studies have shown that young people's school success is not only intelligence but also skills, personality, family characteristics, parental education, average monthly family income, mother's job, family relationships, student achievement in classes, and family kinship, general degree. A study found significant differences between verbal, logical, visual, musical, physical, social, internal, and naturalistic intelligence areas between students who do not play sports and those who do golf and wrestling (Ermiş et al., 2018). Especially for developing multiple intelligences, schools should be equipped with more sports facilities, and necessary studies and support should be provided to direct students to sports more (Ermiş et al., 2012). Factors associated with low achievement that create social tragedy may include parental disinterest, personality mismatches, cultural deprivation, and lack of a social group that adolescents can adopt or accept. According to the findings we obtained in our study, it is seen that there is no significant difference between gender groups in terms of secondary education achievement of spatial visualization of children, male and female athletes who are interested in individual sports ($p> 0.05$). It is seen that there is no significant difference between gender groups in terms of secondary education achievements of spatial visualization of male and female athletes who are interested in team sports ($p> 0.005$).

According to the data obtained from the children who are interested in individual and team sports, it is seen that there is a statistically significant difference in favour of the 85 and above group when the secondary education achievement scores are compared with the spatial visualization scores ($p<0.05$). Athletes with 85 to 100 points have higher spatial visualization success than athletes with 84 and below points.

In a study by Schmidt et al. (2016), they examined mental Rotation (rotation) abilities. According to the research results, significant differences were found in mental rotation between those who do sports and those who do not. The

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most significant difference between orienteering and gymnastics athletes and sedentary individuals was found.

The mental and physical performance of students is affected by many factors. Sports have a positive effect on the physical and mental development of students. For example, it has been observed that students with high physical activity have higher attention performance (İmamoğlu et al., 2018; Aslan et al., 2020; Uzun & İmamoğlu, 2020). Kakmaci O. (2009) stated that Werthessen (1999) investigated the effects of using materials that can be played with hands for three-dimensional (3D) shapes on the performance of tasks involving spatial visualization and mental rotation of gifted primary school students to determine the difference between genders and the change in spatial abilities. The Space Relation subtest of the Mental Rotation Test and the Space Relation Subtest of DAT was used in the research. The students in the research group received ten weeks and forty minutes of training as required by the research. The students in the comparison group were taught from textbooks without using tools. According to the results, it was revealed that the students in the study group showed positive developments in the tests, but there was no difference between the genders. Jansen and Lehmann (2013) found that gymnasts performed better in mental rotation tests than the sedentary group, with 120 participants consisting of gymnasts, football players and sedentary groups. In the same study, football players and gymnasts did not significantly differ in the tests. In our study, it is seen that there is a significant difference between children who are interested in individual sports and children who are interested in team sports in terms of spatial visualization scores ($p<0.05$). The spatial visualization score of the athletes interested in individual sports branches was higher than those involved in team sports branches.

It was determined that there was a statistically significant difference between the branches according to the spatial visualization scores ($p<0.05$). The study showed that the athletes interested in orienteering sports made a statistically significant difference compared to all other sports branches ($p<0.05$). In addition, a significant difference was found between the karate and volleyball players of the tennis players, the karate and volleyball players of the football players, and a significant difference between the karate and volleyball players of the basketball players ($p<0.05$). It was determined that karate and volleyball athletes did not make a statistically significant difference against any sports branch ($p>0.05$).

Their research has shown with many studies whether spatial ability can be improved. In this process, some research that determines the cognitive approach has revealed that spatial ability cannot be developed, and practitioners and researchers in the education community have revealed that spatial ability can be improved with their studies. Spatial ability and spatial ability are different concepts (Sorby, 1999). Spatial ability is a skill that a person is born with; Spatial skill is a skill that can be learned, attained and developed through education. Spatial skills: He stated that it could be developed with activities that require hand-eye coordination, such as sports activities, material development, and free technical drawing activities. Smith et al. (2003) also stated that spatial skills are a skill that can be learned, developed, and increased with appropriate training and methods. Connolly et al. (2005) emphasized that spatial ability can be improved with appropriate practices and practice-based training. Yurt (2011) stated that using concrete objects improves hand-eye coordination and increases students' spatial skills. Bakker (2008) found that concrete objects used according to age play an active role in developing students' spatial skills. Yolcu (2008) reported that activities with computers and concrete materials (unit cubes) increase students' spatial skills. According to Yurt (2011), Çakmak (2009) stated that developing models with concrete objects (Origami) develops positive attitudes towards the lesson, increases self-confidence, and these contribute positively to the development of spatial skills. Yıldız (2009) stated that the virtual environment is superior in developing spatial skills against concrete manipulatives.

Olkun (2003), in his experimental study investigating the effect of concrete manipulatives on virtual environments in two-dimensional geometry teaching, found that students who had experience with virtual environments had higher performance. However, he stated that the effect of the virtual environment or concrete manipulative use in two-dimensional geometry teaching might vary according to the grade level.

CONCLUSION

According to the gender variable, the spatial visualization scores of male and female child athletes are higher in males than females. There was no significant difference between the spatial visualization achievement scores of male and female athletes interested in individual and team sports branches and their secondary education achievement scores. A significant difference was found in the effect of the spatial visualization achievement scores of the children interested in individual and team sports branches on the secondary education achievement score in the athletes with a score range of 85-100. The spatial visualization scores of the children who are interested in individual sports and the spatial visualization achievements obtained from the athletes were higher than those who are interested in team sports. According to the inter-branch variable, it was observed that there was a significant difference between the spatial visualization achievements of the athletes interested in the orienteering branch compared to the other branches. Knowing that spatial visualization is complex in the training of branches, visuality is at the forefront in the materials to be used in teaching team sports, and studies that will improve spatial visualization can be included. It may be beneficial to include the studies in the orienteering branch in the training of other branches. Training for the development of visual/spatial intelligence can be selected under the cognitive levels of the athletes. Attention can be paid to the personal characteristics of the effect of the concrete materials in the branches and the perceptions and tendencies arising from individual differences. More concrete activities that improve spatial ability can be included to eliminate mediocrity in trainers' training.

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