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Investigation of Physical Literacy Attitudes of Secondary School Students

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Abstract

This study was conducted to examine the physical literacy attitudes of secondary school students. The study group of the research consisted of 458 secondary school students who continued their education in the Balçova district of Izmir province in the 2023-2024 academic year, and who were selected by simple random sampling. "Personal information form" and "Physical literacy attitude scale for secondary school students" were used as data collection tools. Information about the participants' gender, age, grade, and participation in school sports teams was obtained through the personal information form. The 5-point Likert type "Physical Literacy Attitude Scale for Secondary School Students," consisting of 34 items developed by Özgül, Semiz and Kangalgil (2023) was used. Since the data showed normal distribution, an independent samples t-test was used to analyze gender, and school sports participation variables, and a one-way analysis of variance (ANOVA) was used to analyze age and grade level variables. The statistical significance level was accepted as $p<0.05$. When the results are examined, male students' physical literacy attitudes are higher than female students'. The physical literacy attitudes of 11-year-old students were higher than those of 13-year-old students. The physical literacy attitudes of 5th grade students were higher than those of 7th grade students. The physical literacy attitudes of students in the school team were higher than those of students who were not.

Keywords: Physical Literacy, Attitude, Secondary School, Student

Introduction

Today, the rapid development of the internet and technology has radically changed the lifestyles of individuals. Especially with digitalization, working styles, entertainment and daily activities have become largely dependent on screens. Smartphones, computers, and digital media tools reduce the physical mobility of individuals and promote sedentary lifestyles. This situation directly affects both physical and psychological health and paves the way for many health problems such as obesity, musculoskeletal disorders and stress (Carl et al.,2022:2968). One of the ways to reduce the risks of this sedentary lifestyle is to improve the physical literacy of individuals. Physical activity is an important concept, especially for children in adolescence. The studies show that adolescents often spend their free time on the internet, on the phone, or in online games. (Chou & Chou, 2019; Sureda et al., 2020). At this point, physical literacy emerges as a concept that positively affects quality of life (Aksoy et al., 2024:142). Physical literacy is a concept that includes the knowledge, comprehension, motivation, self-confidence, and physical competence required to sustain participation in physical activity throughout one's life (Whitehead, 2010). According to Dudley (2015), physical literacy can be defined as a multifaceted concept encompassing a broad spectrum of knowledge, skills, understanding, and values. This comprehensive definition pertains to the ability to take ownership of purposeful physical activity and human movement throughout one's life, irrespective of physical or psychological boundaries. A different definition states that physical literacy is related to lifelong physical activity participation (Cale & Harris, 2018:284). The term physical literacy is defined as an individual's capacity for a physically active lifestyle (Longmuir & Tremblay, 2016:28). Physical literacy is considered a multidimensional concept that includes physical competence, motivation, self-confidence, knowledge, and understanding necessary for the individual to maintain lifelong participation in physical activity. It also refers to the individual's capacity to participate confidently and competently in different physical activities.

When the literature is examined, it reveals that physical literacy provides versatile and comprehensive benefits to individuals (Taş & Hürmeniç Altunsöz, 2021:116). Physical literacy helps individuals reach their potential by supporting mental and emotional development (Gehris et al., 2018; Lysniak, 2020), improves self-esteem and self-worth by increasing motivation and confidence (Whitehead et al, 2018; Almond,2013), positively contributes to academic success, improves the individual's physical literacy by increasing participation in physical activity, and supports safe physical activity (Savelsbergh & Wormhoudt,2018:33), It is stated that children's improving basic movement skills helps them adopt a lifelong active lifestyle (Rudd et al., 2020:2).

A physically literate individual is a skilled, confident, and motivated person who participates in physical activities throughout life (Aslan & Ünlü, 2023:67). Therefore, in addition to movement skills, physical literacy supports emotional development such as confidence and motivation, social development such as cooperation and sharing, and cognitive development such as problem solving and creativity (Aksoy et al., 2024:143). The development of students' physical literacy comprises specific steps. This process refers to a productive and useful period in which the habit of participating in physical activity throughout life is encouraged, starting from an early age. This is achieved by creating environments where experiences and important learning are presented, enriched in lesson environments such as physical education lessons (Castelli et al., 2014; Hastie, 2017). Therefore, experiencing a quality physical education lesson, especially for students at the secondary school level, and thus achieving holistic development have recently become one of the important issues both in the world and in our country (Liu & Chen, 2021:100). In this context, physical literacy is emphasized by the

Ministry of National Education (MEB) as a basic skill that should be acquired within the scope of physical education classes (MEB, 2018). It is planned that this concept will be included more in educational programs and will support the physical and mental health of young people. In a study by Cairney et al. (2019), more than 2,000 students in 5th and 7th grades in Canada were examined. It was determined that providing an inclusive physical education and sports class environment for children and adolescents, while drawing attention to motor skills and motivation, can prevent a lack of physical competence and self-confidence when associated with positive emotional behaviors. Supporting this perspective, Shortt et al. (2019) stated that physical literacy is affected by psychological and environmental factors along with physical skill levels. Therefore, the attitudes towards physical literacy of secondary school students play a critical role in their adoption of a lifelong active lifestyle. Supporting physical literacy for this age group is of great importance for both physical and psychosocial development.

The role of multifaceted stakeholders is important in the meaningful development of physical literacy levels in individuals, especially during the most critical developmental stages primary and secondary school, in terms of holistic development (Taş & Hürmeniç Altunsöz, 2021:118). At this stage, individual and environmental factors play an important role in shaping students' attitudes towards physical literacy. Among these factors, variables such as gender, class level and participation in school sports teams are thought to have significant effects. Gender differences in physical activity participation are widely discussed in the literature, and it is observed that male students generally have higher rates of physical activity participation than female students (Stodden et al., 2008:302). Physical literacy development is different in childhood and adolescence. When movement skills are not acquired at a young age, attitudes towards physical activity can be negatively affected at older ages. This situation reveals that participation in physical activity may decrease with age (Cairney et al., 2019:377). In parallel, it is expected to also affect, with age, class levels. Students who take part in school sports teams lead a physically active lives. Therefore, it is possible to expect that the physical literacy levels of participants in school teams will be high (Çalı, 2024:113).

In this context, the study aims to examine the physical literacy attitude levels of secondary school students by considering the variables of gender, age, class level, and participation in school teams. When the literature is examined, studies on attitudes towards physical literacy of secondary school students are limited. This situation reveals the importance of the research.

Material and Method

Research Model

This research is a quantitative study and was conducted using the survey method. The survey method is defined as an approach that explains a past or current situation as it exists (Büyüköztürk,2018:102). In the descriptive research process, the stages of determining the research problem and objectives, defining the variables, selecting the sample, collecting data, and analyzing the data are carried out systematically. In this study, an attempt was made to reveal whether the physical literacy attitudes of secondary school students show differences according to the variables of gender, age, grade level, and participation in the school team.

Research Group

As a result of the calculation performed with a 5% margin of error (p) and a 5% deviation (q), using the simple random sampling method, a sample size of 384 students was determined to be appropriate (Yazıcıoğlu & Erdoğan, 2004:49). In this context, permission was obtained

from the Izmir Provincial Directorate of National Education, and a total of 458 secondary school students studying in the Balçova district of Izmir constituted the sample group.

Table 1. Demographic characteristics of the participants

Variables	Sub-Groups	N	%	Total
Gender	Female	231	50,4	458
	Male	227	49,6	
Age	10	23	5	458
	11	125	27,3	
	12	148	32,3	
	13	135	29,5	
	14	27	5,9	
Class	5	110	24	458
	6	168	36,7	
	7	140	30,6	
	8	40	8,7	
Participation in The School Team	Yes	132	28,8	458
	No	326	71,2	

Data Collection Tools

"Personal information form," prepared by the researchers, and "Physical literacy attitude scale for secondary school students," developed by Özgül, Semiz, and Kangalgil (2023), were used. With the personal information form, information about the participants' gender, age, grade level, and participation in the school team variables was obtained.

Physical Literacy Attitude Scale For Secondary School Students

The physical literacy attitude scale consists of 34 items and 8 sub-dimensions. The sub-dimensions are Purposiveness (6 items), Being Healthy and Active (4 items), Cooperation and Partnership (6 items), Processing (5 items), Process (5 items), Barriers (3 items), Behavior (3 items), and Practices (2 items). The total variance explained is 66.81%. There were no reverse-scored items. Cronbach's alpha coefficient was used for reliability analysis. This coefficient was found to be 0.85 for the Purposefulness dimension, 0.78 for the Health and Being Active dimension, 0.74 for the Collaboration and Partnership dimension, 0.77 for the Processing dimension, 0.81 for the Process dimension, 0.74 for the Barriers dimension, 0.73 for the Behavior dimension, and 0.71 for the Practices dimension. The overall reliability coefficient of the scale was found to be 0.93.

Table 2. Descriptive statistics related to the research

Scale	N	$\bar{x}$	Skewness	Kurtosis	Cronbach's Alpha

Physical Literacy Attitude	458	3,47	-,634	,695	,910

Data Analysis

The data were analysed using SPSS 29.0 statistical package program. The reference values of skewness (-3) and kurtosis (+3) were considered in evaluating the data distribution's suitability for normality (Karagöz, 2021). As the reference values were derived from the scale employed in the study, parametric tests were employed for both pair-wise and multiple comparisons. Descriptive statistics, t-tests, and analysis of variance (ANOVA) were conducted a significance level of 0.05. In the comparisons, the effect size power was expressed by the η^2 formula, with the criteria ".01 small; .09 medium; .25 large" taken into consideration (Tabachnick & Fidell, 2015:55).

Findings

Table 3. T-test Table Results For The Variable of Gender

Gender	N	x̄	Sd	t	p	η^2
Female	231	3,36	,614	-3,423	**,001***	**,032**
Male	227	3,56	,656			

Table 3 shows the t-test results for the gender variable. When the physical literacy scores were examined, the difference in favour of male students was found to be significant ($p<0.05$). The gender difference has a weak effect (η^2) on the total scale score.

Table 4. T-test Table Results For The Variable Of Participation in The School Team

Participation in The School Team	N	x̄	Sd	t	p	η^2
Yes	132	3,69	,613	4,974	**,001***	**,051**
No	326	3,37	,632			

Table 4 shows the t-test results based on participation in the school team. When the total score of the scale was analyzed, a significant difference was found in favor of those who participated in the school team ($p<0.05$) The difference in participation in school teams has a weak effect size (η^2) on the total scale score.

Table 5. Analysis of Variance (ANOVA) table Results for age variable

Age	N	x̄	Ss	f	p	η^2
10	23	3,43	,604	2,540	**,039*** **11-13***	**,022**
11	125	3,57	,631			
12	148	3,51	,671			
13	135	3,34	,628			
14	27	3,36	,569			

Table 5 shows ANOVA results according to the age level variable. According to the age variable, a significant difference, between 11- and 13-year-olds was reported ($p<0.05$). 11-year-old students have higher physical literacy attitude scores than 13-year-old students. The difference between the ages has a weak effect (η^2) on the total scale score.

Table 6. Analysis of Variance (ANOVA) table Results for class variable

Class	N	$\bar{x}$	Ss	f	p	η^2
5	110	3,58	,689	4,009	**,008*** **5-7***	**,026**
6	168	3,53	,608			
7	140	3,35	,671			
8	40	3,32	,458			

Table 6 shows the ANOVA according to the class level variable. A significant difference was found between the 5th and 7th classes according to the class level variable ($p<0.05$). 5th grade students have higher physical literacy attitude scores than 7th grade students. The difference between the classes has a weak effect (η^2) on the total scale score.

Discussion and Conclusion

This research aims to examine how attitudes toward physical literacy differ according to variables such as gender, age, grade, and participation in school sports teams. The findings obtained have been discussed in light of these variables.

When physical literacy attitude scores were examined, a significant difference was found in terms of the gender variable in favor of male students. When the literature was examined, Iğdır et al. (2024) found that the mean scores of male students' perceived physical literacy levels were higher than those of female students in their study on children aged 10-14 years. The study conducted by Chen et al. (2024) revealed that boys scored higher than girls in the sub-dimensions of physical literacy (sports knowledge, emotion, and athletic capacity). In the research conducted by Gerger (2022), it was found that the physical literacy levels of male high school students were higher than those of female students. A study conducted by Arnett (2017) similarly revealed that male students have higher levels of physical literacy than female students. These studies support the findings of the current study. This may be associated with traditional gender roles that associate physical ability with masculinity and provide boys with more incentives and opportunities to participate in physical activities (Luo,2024). According to the Social Ecological Model, these differences are related to the social environment (Zhang et al., 2023:196), family expectations, and cultural norms that encourage more physical activity in boys than in girls (Si et al., 2017; Zong & Si, 2022). In addition, Self-Determination Theory suggests that boys may receive more support from their environment for autonomy, which in turn encourages higher intrinsic motivation for physical activity (Peng & Wu, 2024:176). The cultural expectation that boys should be physically active and competitive may also contribute to higher physical literacy levels (Cheng & Fan, 2022:136). In the study conducted by Cengiz (2023), no significant difference was found in the perceived physical literacy levels of high school students, according to gender. The fact that the sample group included in the study consists of high school students, that the scale used is different, and that the students reside in various geographical locations can be evaluated as factors that create a difference from the findings of the current study.

The study found that 11-year-old children have higher physical literacy attitudes than 13-year-old children. When examined in terms of grade variables, fifth-grade students have higher

physical literacy attitude scores compared to seventh-grade students. Since age level and grade level progress in the same direction, the two findings support each other. For this reason, these two variables were evaluated in the same paragraph and discussed in relation to the literature findings. In a study by Chen et al. (2024), it was found that 5th and 6th-grade students have higher levels of physical literacy compared to 7th, 8th, and 9th-grade students. In a study, conducted by Liu (2020), the physical competence scores for physical literacy among 6th-grade students were found to be higher than those of 7th-grade students, while 7th-grade students scored higher in the knowledge/cognitive domain compared to 6th-grade students. When examining the findings, the scores for attitudes towards physical literacy decrease as age and grade level increase. This decrease may be related to the decrease in students' time spent on physical activities due to the increasing school load and exam stress with higher grade level. The decrease in physical literacy attitude levels with increasing grade level may be attributed to increasing exam stress and decreasing time spent on physical activities as students progress through school. As students grow older, the decrease in their levels of physical activity may contribute to the observed decline in physical literacy, as they transition towards academic performance (Hu et al., 2020:72).

When the physical literacy attitude scores were examined in the study, it was found that the scores of the students who participated in the school team were higher than those who did not participate. Çalı (2024) stated in his study that the physical literacy levels of secondary school students participating in school sports were high. Yılmaz, Zorlu, and Aslantürk (2023) found that the levels of physical literacy, physical literacy perception, attitudes, and behaviors towards physical activity were high in individuals who engage in sports. In addition, in a study examining the perceived physical literacy of high school students, it was observed that participation in sports activities also increased the level of perceived physical literacy (Cengiz, 2023:89). Parpa et al. (2023) stated that in their study on female young athletes, there was a significant difference in perceived physical literacy scores compared to non-athletes. Sunda et al. (2022) reported that a study conducted in Croatia, on adolescents aged 14-18, found that students participating in sports activities had higher physical literacy scores than those who did not. The studies conducted in the field confirm the findings of our current study. Participation in school sports teams helps individuals develop physical awareness, movement competence, and active living awareness. This situation can be considered a factor contributing to the increase in physical literacy attitude levels.

As a result, it was observed that students who participated in school sports teams had higher attitude scores, physical literacy attitudes were higher in male students, and scores decreased as age and grade level increased, and attitude scores of students who participated in school sports teams were higher.

In order to increase girls' participation in physical activity, parents should not limit it to boys only but also support girls. In addition, it is recommended that teachers and families direct children to activities that develop physical literacy outside of school in order to reduce the stress of exams and school that increases with age and grade level.

This research is limited to secondary school students aged between 10 and 14 and residing in the Balçova district of Izmir. It is thought that expanding the sample by including individuals educated in different provinces, detecting regional differences, and broadening the research by adding adult individuals to the population can reveal possible different results and the reasons for these differences in detail.

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The Effects of Ball Recovery Times on Match Results in Football

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Abstract

The aim of this study is to analyze the ball recovery times of the teams in the Turkish Super League. The sample group of the research consists of the teams that finished the league in the first 4 and last 4 places in the 2021-2022 season. For the analysis of the research, a total of 2 matches of the 8 football teams in the sample were selected randomly. The relationship between the ball recovery times and the number of goals scored and conceded, ball possession rate, total number of shots, goal expectation and number of corners were examined using the video analysis method, and comparisons were made between the variables according to the match result. Also, the relationship between these five parameters and the ball recovery times discussed. In the research findings, it was seen that there is a significant negative relationship between the ball recovery times and the number of goals scored, total number of shots, ball possession percentages, goal expectations and points received by the teams. Moreover, the findings show that the ball recovery times of the winning teams were much lower than the losing teams. On the other hand, there is a significant positive relationship between the ball recovery times and the number of goals they concede. In addition, no statistically significant relationship was found between the ball recovery times and the number of corners taken by the teams. In conclusion, this research reveals that recovering the ball back faster is an important parameter for winning a match in football.

Keywords: Football, Match analysis, Ball recovery, Ball recovery time, Match winning-losing

Introduction

Football is a team sport in which two teams try to score as many goals as possible into the opponent's goal within a certain playing time and by complying with the game rules (Bakır and Müniroğlu, 2020: 393). Therefore, football teams compete on the field to achieve goals such as winning points and matches, winning cups, becoming champions, or avoiding relegation by defeating their opponents. Because football is a sports branch with an ultimate goal, that is, it is a game in which one gains superiority by scoring more points against the opponent and describes this superiority as success (Yıkmış, 2022: 273). In addition, according to Yıkmış (2022), football is a game in which various formations and game approaches are reflected on the field thanks to the different tactics and systems it contains, and football players are always looking for the performance that will win the match, and coaches are always looking for the tactics and systems that can help their team reach the ultimate goal (Yıkmış, 2022: 274). There are various methods to achieve this ultimate goal, that is, success, in football. At this point, match analysis is one of the methods used to be successful in today's football.

Match analysis means objectively recording and examining behavioral events that occur during a match (Carling, Williams & Reilly, 2007: 2). However, the most important benefit of match analysis is that it provides the opportunity to quantitively evaluate the movements of team players during the match (Bakır & Müniroğlu, 2020: 393). In this context, analysis is an important aid for coaches, as it shows the direction and how of an athlete or a team's development with numerical data. Thanks to the analysis, coaches have the opportunity to evaluate the match, training or seasonal variables of athletes or teams by determining the parameters they want to examine. Regarding this, Carling et al. (2007) state that match analysis can be handled in a multifaceted way, from the effectiveness of an individual player or each member of the team as an individual profile to a synthesis of the interaction between individuals in accordance with a team plan (2007: 2). One of the elements that provide this diversity in match analysis is “the ball recovery”.

In football, teams engage in many actions to win against each other or not to lose. The action of winning the ball in football is also one of the actions that teams can have superiority over each other. According to Borge and McNamee (2017), the constructive side of a constructive-destructive sport such as football, which has scoring in its nature, aims to create, set up ways to score goals or produce new goal positions. At the same time, the destructive side of football aims to prevent or prevent the opposing team from scoring a goal (2017: 250; Yıkmış, 2022: 39). Therefore, winning the ball in football both creates a new chance for your team to score a goal and appears as a parameter that allows the opponent to lose their current chance to score a goal. Emphasizing the importance of winning the ball in football, Barreira et al. (2014) states that the most important purpose of the defensive phase, winning the ball, is a short and even momentary action and at the same time it is the first stage of the attack (2014: 37). In other words, winning the ball in football is a football action that ends the opponent's attacking action and starts the attacking action of the team that wins the ball at the same time, regardless of the area of the field. Therefore, it is crucial to be aware of the conditions that influence ball recovery patterns, that is, how and where the ball is recovered and its impact on subsequent attacking play patterns (Barreira, Garganta, Machado and Anguera, 2014: 37).

Ball recovery time in football is a FIFA metric that calculates the amount of time it takes for a team to regain possession of the ball, and it indicates how efficient a team is at winning the ball back (EFI Metric: Ball Recovery Time, 2022). In football, ball possession is a strong predictor for team success, and it is hard to control the game without having control over the

ball (Bundesliga Match Fact Ball Recovery Time: Quantifying Teams' Success in Pressing Opponents on AWS | Amazon Web Services, 2023). In this context, ball possession begins when the team recovers the ball. When we look at examples of the importance of ball recovery, firstly, in the past three Bundesliga seasons, as well as in the current season (at the time of this writing, 2023), Bayern Munich is ranked first in the table and in ball possession percentage, followed by Dortmund being second in both (Bundesliga Match Fact Ball Recovery Time: Quantifying Teams' Success in Pressing Opponents on AWS | Amazon Web Services, 2023). Another example of ball recovery in football shows the importance of recovering the ball for Manchester City and doing it as quickly as possible. In an interview in 2018, Pep Guardiola's assistant at the time, Domenec Torrent, emphasized the importance of ball recovery time in football by saying, "Five seconds is so, so long in football.", and "When you lose the ball, the most important thing is not to drop but react, go forward and try to regain the ball again." (Bajkowski, 2018). In addition, Torrent stated "Many teams go back or drop, we prefer to regain the ball again and if you are able to regain the ball, attack quickly." (Bajkowski, 2018). As we see, the coach must prepare the player technically, tactically, physically and mentally and ensure his development (Güler & Şarvan Cengiz, 2018: 19). In other words, for these instructions and tactics for regaining the ball to be carried out flawlessly, it is important for the coach to prepare the players in every way. Thus, it has been revealed that regaining the ball back as quickly as possible and recovering the ball is a kind of game mentality and a philosophy in modern football.

There are various studies on ball possession and ball recovery in football. The result of Jamil's (2019) case study, which examined the ball possession patterns of an elite English Premier League team for three seasons from the 2015-16 season to the 2017-18 season, is an example of this. In the relevant study, it was revealed that the ball regaining actions in the opponent's half, the ball regaining actions on the left side of the opponent's half and the quality of the opponent factors had a significant and positive effect on the number of ball possessions and the attacking performance of the examined team during the match. Another example of this issue is the study conducted by Cooper and Pulling (2020) in which they examined matches in both the English Premier League and the Spanish La Liga and investigated the effects of the type of ball recovery, the location where the ball was recovered, and the duration of teams' possession on the results of possession. The results of this study show that La Liga teams mostly scored goals by gaining possession as a result of a physical struggle, while Premier League teams mostly gained possession due to the opponent's ball losses and thus scored more goals. In addition, the study revealed that while the English teams had less than 5 seconds to recover the ball in attacks that end with a goal or a shot opportunity, the Spanish teams had more than 12 seconds, and as a result, the EPL teams reached the score much faster than the La Liga teams.

In the light of all the examples mentioned above, when the relevant literature is reviewed, it is seen that the studies on the parameters of ball winning and possession in football, especially the analysis of the ball recovery times, are limited.

To sum up, it is expected that this research will support the development of the understanding that the ball recovery time is an important parameter for teams in football. It is also expected that the research will help raise awareness about what kind of feedback and advantages ball recovery time in football will provide for the football teams in the short and long term.

Material and Method

Purpose of the Study

The aim of this study is to analyze the ball recovery times of teams, specifically in the Turkish Super League. In this season the top 4 teams qualified for various UEFA Tournaments (Champions League, Europa League and Conference League) and the last 4 teams were relegated from the Turkish Super League. In this context, analyzes were made regarding the effects of the ball recovery times of teams that finished the league in the top 4 and bottom 4 at the end of 2021-2022 season of the Turkish Super League on the rate of ball possession, total number of shots, goal expectation and the number of corners. In addition, our research also examined the relationship between these five parameters and ball recovery times, and why teams finished the league in the top 4 or bottom 4.

Research Group

Turkey Super League football teams in the 2021-2022 season constitute the population of the study. In the research, the sample of the research is the football teams that are thought to represent the universe, compete in the same league, and finish the league in the first 4 and last 4 places in the 2021-2022 season. The selected teams for this study were Trabzonspor (1^{st}), Fenerbahçe, (2^{nd}) Konyaspor (3^{rd}) and Başakşehir (4^{th}), Rizespor (17^{th}), Altay (18^{th}), Göztepe (19^{th}) and Yeni Malatyaspor (20^{th}). A total of 2 matches were selected by lottery method from among the matches played at home by a total of 8 football teams in the study, one match among the matches they won and one match among the matches they lost. One of the away matches of a team that never lost a home match was also selected randomly and a total of 16 matches included in the study.

Data Collection

These matches were evaluated using the video analysis method in line with the determined parameters by two experts match analysts who has certification by Turkish Football Federation. The ball recovery time was monitored and recorded in the entire football field. In the study, the relationship between the ball recovery time and the number of goals scored and conceded, possession percentage, total number of shots, expected goal and number of corners were examined, and comparisons were made between the variables according to the match result (win-loss).

The matches were observed by obtaining a subscription from the website of Beinsport, which has the right to broadcast the matches of the Turkish Super League, after they made the entire 2021-2022 season available. The ball recovery times for each match were manually entered into a Microsoft Office Excel file using an ALTIS SV-30 60-memory digital stopwatch. After each of the ball recovery times of the teams' matches were recorded in a Microsoft excel file, they were analyzed separately according to the parameters included in the study such as possession percentage, total number of shots, goal expectancy, data on meeting the ball in the opponent's penalty area and number of corners. In this study, the teams' ball recovery time (“regaining control of the ball”) was evaluated and analyzed as: balls directly taken from the opponent and set plays (free kicks, crown, corner, offside, penalty) won as a res ult of pressure or regaining control of the ball.

Data Analysis

In this study, SPSS 26.0 package program was used for statistical analysis and $p<0.05$ was accepted as significance level. Before analyzing the data, normal distribution was checked by using Kolmogorov-Smirnov and Shapiro-Wilk normality tests according to numbers of

analyzed actions. Then parametric analyses were applied to normally distributed data by using the Independent Samples t Test. Finally, the correlation analysis were done by using Spearman's correlation test for normally distributed data.

Findings

In this section, the results of correlation analysis are given and explained in tables.

Table 1. Analysis of the relationship between ball recovery time and goals scored/conceded, corners used and team's points with Spearman's correlation test

	Number of goals scored		Number of goals conceded		Corners		Point	
	r	p	r	p	r	p	r	p
Ball recovery time (sec)	-,652	0,006*	,671	0,040*	,093	0,733	-,705	0,020*

When Table 1 is analyzed, it is seen that there is a statistically significant negative correlation between the ball recovery time of the teams and the number of goals scored (r=-,652; p<0,05) and the points scored (r=-,705; p<0,05). On the other hand, there is a statistically significant positive correlation between the ball recovery time and the number of goals conceded (r=,671; p<0,05). On the other hand, there is no statistically significant relationship between the ball recovery time and the number of corners used by the teams (r=,093; p>0,05).

Table 2. Analysis of the relationship between ball winning time and pass accuracy percentage, total shots, expected goals and possession percentage with Pearson correlation test

	Pass accuracy percentage		Total shots		Expected goals		Possession percentage	
	r	p	r	p	r	P	r	p
Ball recovery time (sec)	-,068	0,803	-,493	0,040*	-,639	0,008*	-,558	0,020*

When Table 2 is examined, it is seen that there is a statistically significant negative relationship between the teams' ball recovery time and the total number of shots (r=-.493; p<0.05), expected goals (r=-.639; p<0.05), and the percentage of possession (r=-.558; p<0.05). On the other hand, there was no statistically significant relationship between the ball recovery time and the passing accuracy percentage of the teams (r=-.068; p>0.05).

Table 3. Analysis of the differences between the matches won and lost by the teams according to the time to win the ball by T Test

	Match result	Arithmetic mean	Standard deviation	t	p
Ball recovery time (sec)	Lost	26,65	4,84	3,355	,005*
	Won	19,48	3,60		
Goals scored	Lost	0,62	0,51	-5,245	,000*

	Won	2,25	0,70		
Goals conceded	Lost	2,00	0,53	5,612	,000*
	Won	0,50	0,53		
Pass accuracy percentage	Lost	83,87	4,85	0,265	,795
	Won	83,12	6,35		
Total shots	Lost	12,37	5,06	0,246	,809
	Won	11,75	5,09		
Expected goal (xG)	Lost	1,17	0,62	-1,468	,164
	Won	1,65	0,68		
Corner	Lost	5,50	2,87	2,118	0,53
	Won	3,00	1,69		
Possession percentage	Lost	49,50	12,17	-0,850	,410
	Won	53,75	7,20		

According to the results of the match given in Table 3, there were statistically significant differences in the ball recovery time ($t(14)=3,355$; $p<0,05$), the number of goals scored by the teams ($t(14)=-5,245$; $p<0,05$) and the number of goals conceded by the teams ($t(14)=5,612$; $p<0,05$). However, there was no statistically significant difference in the teams' pass accuracy percentage ($t(14)=0,265$; $p>0,05$), total number of shots ($t(14)=0,246$; $p>0,05$), goal expectancy ($t(14)=-1,468$; $p>0,05$), number of corners ($t(14)=2,118$; $p>0,05$), and percentage of possession ($t(14)=-0,850$; $p>0,05$).

Discussion and Conclusion

There are limited number of studies analyzing the effects of the ball recovery time on match results (Barreira et al., 2014; Cooper & Pulling, 2020; Bundesliga Match Fact Ball Recovery Time, 2023). That is why the discussion part was written just using these references. Considering Table 1, which contains the data on the matches examined in the study, it is seen that the number of goals scored by the teams increases as the time to win the ball decreases. This situation can be thought that it happens because one team regains possession of the ball quickly from the opponent team and catches its opponent off guard, and the team that catches the ball quickly from the opponent finds a goal with transition plays and counterattacks. In addition, as the ball recovery time teams to win the ball increases, the number of goals conceded decreases; It may be related to the fact that teams that regain the possession of ball faster cut off their opponents' attacks faster, giving their opponents fewer scoring opportunities. On the other hand, it is thought that the decrease in the number of goals scored as the time to regain the ball increases, causes the ball control to be left to the opponent, to move away from the opponent's goal and to have fewer scoring opportunities. However, it is seen that the points received by the teams increase as the time to regain possession of the ball decreases. This situation shows that teams that regain the ball faster exert pressure in the opponent's area and in areas closer to the opponent's goal, therefore scoring more goals and

get more points than their opponents. Regarding this, the results of Cooper and Pulling's (2020) study on both the English Premier League and the Spanish La Liga; It reveals that in both leagues, most of the goals are scored after the possession of ball is regained in the offensive zone of the field. In addition, Barreira et al. (2014) found that approximately 60% of the attacks that lead to scoring opportunities come because of the ball being snatched in the opponent's half, and that most of the attacks that result in goals by the best teams in Europe start in the third zone of the field. These studies mentioned above, which state that regaining the possession of the ball influences the number of goals, support the result of the research.

Considering Table 2 in the study, it is seen that the total number of shots, ball possession percentages and goal expectations increase as the teams' ball recovery time decreases. This result can be thought that it is since the balls that are regained quickly disrupt the defensive setup of the opponent, the teams that regain the ball quickly catch their opponents off guard in defense and are the side closer to the penalty area. However, as the teams' ball recovery time decreased, their ball possession percentages increased. This situation shows that the teams that press and possess the lost ball faster increase their possession percentages and therefore the time they play the ball. Regarding this, the results of the study by Sarmento et al. (2018) investigated the effect of tactical and situational variables on the offensive actions of the teams during the matches in the Spanish La Liga, Italian Serie A, German Bundesliga, English Premier League and Champions League; It demonstrates the importance of regaining the ball, especially in offensive zones, in increasing the effectiveness of offensive sequences. This study, which states that grabbing the ball influences getting more scoring opportunities, supports the result of the research. The study conducted by Barreira, Garganta, and Anguera (2011) in which they examined the connection between the attacking play patterns of the national teams in the 2008 European Football Championship, the match situation (winning, drawing, and losing), and the types of ball recovery and possession. The results of this study show that teams showed performances aimed at developing the understanding of having the ball in the opponent’s half of the midfield when losing the match. On the other hand, the results also show that when teams win a match, they often show defensive/offensive transitions by directly stealing the ball from the opposing team to approach the opponent's goal, and during a draw, teams exhibit various offensive methods to score goals.

When Table 3 examined in the study, it is revealed that there is a direct relationship between the time of the team’s regaining possession of the ball and the winning-losing of the match. In the findings, it is seen that the time of the ball recovery of the teams that won the match was much lower than the time of recovery of the ball of the teams that lost the match. The situation of regaining the ball; Teams that regain the ball faster are expected to win the match, as it affects match-winning factors such as catching the opponent off guard in defense, finding more scoring opportunities and scoring more, finding more shooting opportunities, and conceding fewer goals in the own goal. Regarding this, the average goals scored by the teams that won the match were 2.25, while the average goals of the teams that lost the match were 0.62, and the average goals conceded by the teams that won the match were 0.5 and the average goals conceded by the teams that lost the match were 2.00. It shows that regaining the ball faster has a direct effect on scoring more goals and conceding fewer goals, thus winning the match. In the research on the teams that were successful in the World Cup, it was revealed that the four most successful teams in the 2010 World Cup, Germany, the Netherlands, Spain and Uruguay, had similar situations and statistics regarding regaining the ball (Barreira, Garganta, Guimarães, Machado, Anguera, 2014: 69). This study, which shows that the ball recovery time has a direct effect on the team's winning the match and the team's success, supports the result of the research.

Moreover, in the 2022-2023 German Bundesliga, Borussia Dortmund was the league leader in this area, winning the ball back with an average of 12.5 seconds. In the same season, Bayern Munich ranked second with 13.6 seconds. These two teams scored the most goals and won the most matches in the German Bundesliga in the 2022-2023 season (Bundesliga, 2023). These findings show that the ball recovery time has a direct effect on the team's winning the match and the team's success, supports the result of the research.

In conclusion, Ball Recovery Time (BRT) calculates the amount of time it takes for a team to regain possession of the ball, indicates how hungry a team is at winning the ball back and is measured in average ball recovery time in seconds (Bundesliga Match Fact Ball Recovery Time: Quantifying Teams' Success in Pressing Opponents on AWS | Amazon Web Services, 2023). As a result, this research reveals that recovering the ball faster is an important parameter for winning a match in football, and that recovering the ball faster influences winning the match.

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The Relationship Between Netlessphobia and Leisure Satisfaction: A Study on Students of the Faculty of Sports Sciences

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Abstract

The present study aimed to examine the relationship between netlessphobia and leisure satisfaction among students enrolled at the faculty of sport sciences, and to determine whether there were any differences according to their independent variables. The study group was comprised of students from Istanbul University-Cerrahpaşa Faculty of Sport Sciences who met the inclusion criteria (n=202) and were of a descriptive and relationship-seeking research type. The data were collected using the Personal Information Form, the Fırat Netlessphobia Scale (FNS) and the Leisure Satisfaction Scale (LSS). The suitability of the data collected for the sample group was evaluated using Confirmatory Factor Analysis (CFA). For normally distributed data, t-tests, ANOVA and Pearson correlation analysis were employed. The findings revealed that the average age of the students was 21.36(±5.18) and 50.5% of them were female. The variables of gender, age and weekly leisure duration were found to have no effect on both netlessphobia and leisure satisfaction. It was observed that the fear of netlessphobia was affected by the variables of daily internet usage time and frequently used technological devices. In addition, various sub-dimensions of leisure satisfaction were affected by independent variables such as class, department, income, and academic perception level. The study concluded that there was no relationship between netlessphobia and leisure satisfaction among students at the faculty of sport sciences. It is recommended that further investigation be conducted into the factors that may influence students' fear of netlessphobia in leisure.

Keywords: Netlessphobia, Fear of being without internet, Leisure satisfaction

Introduction

The remarkable evolution of technology has precipitated a shift in human behaviour, with an increasing reliance on the internet and social media platforms (Drago, 2015). The advent of new information technologies has had a profound impact on all aspects of daily life (Durmuş Sarıkahya et al., 2024). However, in addition to the conveniences brought about by the rapid development of technology, some concerns have begun to emerge. One such situation is netlessphobia, which can be defined as 'the fear of being without the internet' (Gezgin & Türk Kurtça, 2024). This concept encompasses two distinct forms: individuals' excessive use of the internet and the anxiety experienced due to the lack of internet access in places where it is unavailable (Kanbay et al., 2021). The presence of symptoms such as constant internet usage, restlessness in the absence of internet access, and the pursuit of alternative internet-free activities are indicative of a netless phobia (Güney, 2017; Durmuş Sarıkahya et al., 2024). Those with netless phobia tend to spend the majority of their time online during the day. Such individuals habitually access their email accounts and consistently disseminate content from their social media profiles (Öztürk, 2015). In the absence of these activities, the individual experiences significant restlessness (Kadan, 2023). A review of the literature reveals that individuals who are unable to function without the internet are prone to developing a range of addictions and are at risk of experiencing a variety of psychological, social and physical issues (Batıgün & Hasta, 2010; Alaçam et al., 2015; Aslan, 2019; Tohumcu et al., 2019). It has been posited that the utilisation of the internet has become a pastime for individuals during their leisure time (Karakoç & Taydaş, 2013).

The term 'leisure' is defined as the period of time that individuals have after fulfilling their working and compulsory needs, which they then utilise for various activities (Türker et al., 2016). The level of satisfaction experienced by individuals is contingent upon the nature of the activity in which they engage. This sentiment is also referred to as leisure time satisfaction, which is characterised as a positive emotional state (Akay & Yaşartürk, 2023). It is of great importance to gain an understanding of leisure needs and satisfaction in order to gain awareness of how individuals choose leisure activities and how they continue to participate in these activities (Kim et al., 2024). In summary, leisure satisfaction can be defined as the level of enjoyment or satisfaction experienced by individuals with regard to their leisure activities. In order to achieve satisfaction with life in general, individuals must be satisfied in various areas of their lives. Leisure satisfaction is one such area (Zhao et al., 2024).

Leisure satisfaction, which is purported to be associated with numerous facets of life, constitutes a proximal determinant of subjective well-being (Schimmack, 2008). The objective of this study is to ascertain the extent to which satisfaction derived from leisure activities impacts internet usage. While this question remains unanswered, some studies have addressed similar issues. For example, in a study conducted by Khan and Hamad (2023), a negative relationship was identified between university students' leisure satisfaction and social media addiction. Furthermore, another study has demonstrated the beneficial impact of leisure time experiences on mobile phone addiction (Xia et al., 2024). The positive influence of leisure time satisfaction on technology-related addictions has led to the formulation of a hypothesis concerning its potential to influence the fear of being unable to function without the internet in individuals. Based on this, the present study aims to investigate the relationship between netlessphobia and leisure satisfaction.

Material and Method

Purpose and Type of Research

The present study was designed as a descriptive and correlational study with the objective of examining the correlation between netlessphobia and leisure satisfaction of students enrolled at the Faculty of Sport Sciences. In line with the determined purpose, answers were sought to the following questions.

Research Questions

-What is the level of netlessphobia of the students studying at the faculty of sport sciences?

-What is the level of leisure satisfaction of the students studying at the faculty of sport sciences?

-Is there a difference between netlessphobia and leisure satisfaction of students studying at the faculty of sport sciences according to their independent variables?

-Is there a relationship between netlessphobia and leisure satisfaction of students studying at the faculty of sport sciences?

Research Group

The study population comprised students enrolled at Istanbul University-Cerrahpaşa Faculty of Sport Sciences. The sample comprises students who met the inclusion criteria between October and November 2024. A total of 214 individuals were required for the research, with a 95% confidence interval and a 5% margin of error within the faculty of 480 students. The data collected through the face-to-face survey method were distributed to all students. Following the exclusion of individuals who did not meet the specified criteria, the study was completed with 202 students (n=202).

Inclusion Criteria

- Being a Turkish citizen,
- Over 18 years of age,
- At least 1 hour of leisure per week,
- Use the internet for at least 1 hour a day,
- To be an active student in the autumn term of the 2024-2025 academic year,
- Volunteering to participate in the research.

Table 1. Demographic characteristics of the participants

		F	%	X̄±Sd
Gender	Male	100	49,5	
	Female	102	50,5	
Grade	1st grade	79	39,1	
	2nd grade	47	23,3	
	3rd grade	30	14,9	
	4th grade	46	22,8	
Department	Physical Education and Sports Teaching	38	18,8	
	Coaching Education	50	24,8	
	Sport Management	114	56,4	
Academic Perception	Low	6	3,0	

Level	Middle	108	53,5	
	High	88	43,6	
	Income Less than Expense	43	21,3	
Income	Income Equals Expense	125	61,9	
	Income Exceeds Expense	34	16,8	
	1-5 hours	49	24,3	
Weekly Leisure Period	6-10 hours	91	45,0	
	11-15 hours	38	18,8	
	16 hours and over	24	11,9	
	1 hours and less	9	4,5	
	2-4 hours	93	46,0	
Daily Internet Usage Time	5-7 hours	63	31,2	
	8 hours and over	37	18,3	
	Mobile phone	191	94,6	
	Computer or Other	11	5,4	
Age				21,36±5,18
Total		202	100,0	

Table 1 illustrates the distribution of personal information among the participants. The mean age of the participants was 21.36(±5.18) years, and 50.5% were female. The participants were distributed as follows: 39.1% were in their first year, 56.4% were in the Department of Sport Management, 53.5% had an academic perception at the orda class, and 56.4% were in the Department of Sports Management. The average level was that 61.9% of the participants had an income equal to their expenses, 45.0% had free time between 6 and 10 hours per week, 46.0% used the internet between 2 and 4 hours per day, and the most frequently used technological tool was the mobile phone (94.6%).

Data Collection Tools

The Personal Information Form, Fırat Netlessphobia Scale (FNS) and Leisure Satisfaction Scale (LSS) were employed as data collection instruments in the study.

The Personal Information Form was developed in accordance with the extant literature and comprises nine questions, eliciting information on gender, age, grade, income, department, academic achievement perception, weekly free time duration, daily internet usage time and frequently used technological tools during the day.

The FNS was developed by Kanbay et al. (2021) as a means of measuring the extent of netlessphobia in individuals. The scale comprises 12 items with responses recorded on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The Cronbach alpha reliability coefficient of the scale was calculated as 0.93. While the lowest score that can be obtained from the scale is 12, the highest score is 60 points. An increase in the score is interpreted as an elevated level of netlessphobia in the individual (Kanbay et al., 2021). The internal consistency coefficient of the current study was calculated as .91.

The LSS was developed with the objective of measuring the satisfaction level of individuals in their leisure (Beard & Ragheb, 1980). The scale was adapted into Turkish in 2011 and comprises six sub-dimensions. The sub-dimensions are as follows: psychological, educational, social, relaxation, physical and aesthetic. The scale comprises 24 statements, which are rated on a 5-point Likert scale (1 = almost never true, ..., 5 = almost always true). An increase in score is indicative of an increase in leisure time satisfaction. The internal consistency coefficients of the sub-dimensions of the scale were calculated as 0.77, 0.77, 0.76, 0.80, 0.79 and 0.79, respectively. The Cronbach Alpha value for the overall scale was found to be 0.90 (Gökçe & Orhan, 2011). In the current study, the internal consistency

coefficient for the overall scale was calculated as .94, while the sub-dimensions were calculated as .75, .85, .84, .87, .83, .88 respectively.

Validity and Reliability of the Scales

The validity and reliability of the scales used in this study were tested through the analysis of Confirmatory Factor Analysis and Cronbach's Alpha values. The results of this analysis are presented in Table 2.

Table 2: CFA results on the validity and reliability of the scales

Scale	$\Delta\chi^2$/sd	RMSEA	CFI	AGFI	GFI	IFI	α
FNS	2,06	,07	,96	,87	,91	,96	,91
LSS	1,97	,06	,92	,91	,90	,92	,94

The CFA was conducted with the objective of verifying the one-factor structure of the FNS and the six-factor structure of the LSS. It was understood that the FNS model fit indices (χ2/df=2.06; RMSEA=0.07; CFI=0.96; AGFI=0.87; GFI=0.91; IFI=0.96) and the LSS model fit values (χ2/df=1.97; RMSEA=0.06; CFI=0.92; AGFI=0.91; GFI=0.90; IFI=0.92) were within the excellent or acceptable limits and the model structures were confirmed. Cronbach alpha coefficients were calculated to assess the reliability of the scales. The internal consistency coefficients of the scales were found to be 0.91 and 0.94, respectively. The findings demonstrated that the FNS and LSS are valid and reliable measurement tools that can be utilised for this study.

Ethical Aspects of the Research

The conduct of this research was discussed at the meeting of the Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee on 01.10.2024. Following this discussion, it was decided that the research was ethically appropriate and that the number 2024/443 should be assigned to it. The permission to use the scales and the consent of the participants were obtained, and the research was carried out in accordance with the ethical principles set out in the Declaration of Helsinki.

Data Evaluation

The data were analysed using the IBM SPSS 20 and AMOS 18 software programmes. Descriptive statistical techniques were employed in the course of the analyses. The initial step involved assessing the compatibility of the employed scales with the data. To this end, a Confirmatory Factor Analysis (CFA) was conducted. The following fit indices were taken as reference for the fit values that emerged in the CFA analysis: Chi-Square Goodness/Degree of Freedom (X2/df ≤ 5), Root Mean Square Error of Approximation (RMSEA ≤,08), Goodness of Fit Index (GFI ≥ ,90), Comparative Fit Index (CFI ≥,95) and Incremental Fit Index (IFI ≥,90) (Schermelleh-Engel et al., 2003; Tabachnick & Fidell, 2013). The suitability of the tests to be used in the analysis of the data was evaluated based on the examination of skewness and kurtosis values. It was ensured that the values obtained were between ±1 (Huck, 2012). Consequently, the t-test, ANOVA and Pearson correlation test were applied to analyse the normally distributed data. The difference between the groups was analysed by Tukey test. The research data were analysed within the 95% confidence interval, and the significance level was accepted as 0.05.

Findings

Table 3. Scale score distribution

Scale	Number of items	n	$\bar{X}$	SD	Skewness	Kurtosis

FNS	12	202	2,65	,76	,29	-,19
LSS	24	202	3,61	,61	-,18	,23
Psychological	4	202	3,42	,75	-,24	,03
Educational	4	202	3,68	,81	-,38	,01
Social	4	202	3,63	,77	-,35	,46
Relaxation	4	202	3,91	,73	-,62	,55
Physical	4	202	3,41	,82	-,09	-,20
Aesthetics	4	202	3,58	,76	-,19	,21

Table 3 presents the mean scores obtained from the total and sub-dimensions of the FNS and the LSS. The mean score for the total FNS was found to be 2.65±0.76. The mean total score of the LSS was found to be 3.61±.61, with the highest mean score obtained in the 'Relaxation' sub-dimension (3.91±.73) and the lowest mean score obtained in the 'Physical' sub-dimension (3.41±.82). The skewness kurtosis values ranged between -.62 and .55.

Table 4: T-test results according to gender

	Gender	**n**	$\bar{X}$	**SD**	**t**	**p**
FNS	Male	100	2,6358	0,80740	-,346	,729
	Female	102	2,6732	0,72484		
LSS	Male	100	3,6375	0,64499	,589	,557
	Female	102	3,5862	0,59293		
Psychological	Male	100	3,4325	0,74861	,079	,937
	Female	102	3,4240	0,76817		
Educational	Male	100	3,7200	0,83958	,591	,555
	Female	102	3,6520	0,79615		
Social	Male	100	3,7100	0,79433	1,300	,195
	Female	102	3,5686	0,75137		
Relaxation	Male	100	3,8950	0,77946	-,326	,745
	Female	102	3,9289	0,69686		
Physical	Male	100	3,5000	0,89188	1,435	,153
	Female	102	3,3333	0,75398		
Aesthetics	Male	100	3,5675	0,80234	-,394	,694
	Female	102	3,6103	0,73926		

p<0.05*

Table 4 illustrates the results of the t-test conducted to assess the differences in the total scores and sub-dimensions of the FNS and the LSS between male and female participants. The findings indicate that there is no statistically significant difference between the total scores and sub-dimensions of the FNS and the LSS based on gender (p>0.05).

Table 5: ANOVA results according to grade level

	Class	**n**	$\bar{X}$	**SD**	**F**	**p**	**Tukey**
FNS	1st grade[a]	79	2,6076	0,83836	,740	,529	
	2nd grade[b]	47	2,5922	0,68877			
	3rd grade[c]	30	2,8278	0,62089			
	4th grade[d]	46	2,6866	0,79644			
LSS	1st grade[a]	79	3,6677	0,66513	2,088	,103	
	2nd grade[b]	47	3,4734	0,59774			
	3rd grade[c]	30	3,4861	0,54341			
	4th grade[d]	46	3,7382	0,57666			
Psychological	1st grade[a]	79	3,4272	0,83795	,613	,607	
	2nd grade[b]	47	3,3564	0,68909			
	3rd grade[c]	30	3,3583	0,69692			
	4th grade[d]	46	3,5489	0,71999			

Educational	1st grade[a]	79	3,7025	0,83116	,747	,525	
	2nd grade[b]	47	3,5798	0,76986			
	3rd grade[c]	30	3,6083	0,83739			
	4th grade[d]	46	3,8152	0,83072			
Social	1st grade[a]	79	3,7816	0,79397	2,774	**,043***	a>b
	2nd grade[b]	47	3,3989	0,76018			
	3rd grade[c]	30	3,5333	0,64905			
	4th grade[d]	46	3,7065	0,78405			
Relaxation	1st grade[a]	79	3,9399	0,69823	4,464	**,005***	b<d c<d
	2nd grade[b]	47	3,7926	0,75419			
	3rd grade[c]	30	3,6083	0,68444			
	4th grade[d]	46	4,1848	0,73868			
Physical	1st grade[a]	79	3,4399	0,91831	,282	,839	
	2nd grade[b]	47	3,3511	0,73658			
	3rd grade[c]	30	3,3500	0,73578			
	4th grade[d]	46	3,4837	0,82395			
Aesthetics	1st grade[a]	79	3,7152	0,78419	2,695	**,047***	
	2nd grade[b]	47	3,3617	0,79709			
	3rd grade[c]	30	3,4583	0,64355			
	4th grade[d]	46	3,6902	0,74756			

p<0.05*

Table 5 illustrates the outcomes of the analysis of variance (ANOVA) between the total score and the sub-dimensions of the FNS and LSS, classified according to grade level. The findings indicated that no statistically significant difference was observed between the total score, psychological, educational and physical sub-dimensions of the LSS and FNS according to the grade level of the individuals (p>0.05). Nevertheless, a notable discrepancy was observed between the social (F=2.774; p=0.043), relaxation (F=4.464; p=0.005) and aesthetic (F=2.695; p=0.047) sub-dimensions of the LSS according to class level. A notable discrepancy was observed in the social sub-dimension between the 1st and 2nd grade students. In the relaxation sub-dimension, the mean scores of the 4th grade students surpassed those of the 2nd and 3rd grade students. While a statistically significant difference was identified in the aesthetic sub-dimension, this discrepancy was not deemed significant when comparing groups.

Table 6: ANOVA Results According to Deparment

	Deparment	**n**	**X̄**	**SD**	**F**	**p**	**Tukey**
FNS	Physical Education and Sports Teaching[a]	38	2,7368	0,69439	1,323	,269	
	Coaching Education[b]	50	2,5050	0,72948			
	Sports Management[c]	114	2,6930	0,79941			
LSS	Physical Education and Sports Teaching[a]	38	3,5592	0,57911	1,932	,148	
	Coaching Education[b]	50	3,4875	0,54054			
	Sports Management[c]	114	3,6835	0,65607			
Psychological	Physical Education and Sports Teaching[a]	38	3,4079	0,76322	4,692	**,010***	c>b
	Coaching Education[b]	50	3,1650	0,75019			
	Sports Management[c]	114	3,5504	0,73335			
Educational	Physical Education and Sports Teaching[a]	38	3,5526	0,74923	2,750	0,066	
	Coaching Education[b]	50	3,5200	0,77893			
	Sports Management[c]	114	3,8026	0,84106			
Social	Physical Education and Sports Teaching[a]	38	3,5658	0,72987	1,484	0,229	

	Coaching Education[b]	50	3,5100	0,71063		
	Sports Management[c]	114	3,7193	0,81070		
Relaxation	Physical Education and Sports Teaching[a]	38	3,8947	0,69659	1,067	0,346
	Coaching Education[b]	50	3,7900	0,64949		
	Sports Management[c]	114	3,9715	0,78408		
Physical	Physical Education and Sports Teaching[a]	38	3,4079	0,78289	0,097	0,908
	Coaching Education[b]	50	3,3750	0,79097		
	Sports Management[c]	114	3,4364	0,86271		
Aesthetics	Physical Education and Sports Teaching[a]	38	3,5263	0,70899	0,245	0,783
	Coaching Education[b]	50	3,5650	0,63850		
	Sports Management[c]	114	3,6206	0,84222		

p<0.05*

The results of the analyses, which tested the difference between the total score and the sub-dimensions of the FNS and LSS according to department, are presented in Table 6. The results of the ANOVA indicated that there was no statistically significant difference between the total score, relaxation, educational, social, physical and aesthetic sub-dimensions of the FNS and LSS according to the department (p>0.05). However, a significant difference was observed in the psychological sub-dimension of the LSS (F=4.692; p=0.010), with a notable distinction evident between students enrolled in the sports management and coaching departments.

Table 7: ANOVA results according to academic perception level

	Academic Perception Level	n	X̄	SD	F	p	Tukey
FNS	Low[a]	6	2,4167	0,79931	,356	,701	
	Middle[b]	108	2,6790	0,71612			
	High[c]	88	2,6411	0,82480			
LSS	Low[a]	6	3,3264	0,55928	4,091	**,018***	c>b
	Middle[b]	108	3,5177	0,58810			
	High[c]	88	3,7462	0,63627			
Psychological	Low[a]	6	3,5000	0,70711	2,342	0,099	
	Middle[b]	108	3,3218	0,72831			
	High[c]	88	3,5540	0,78184			
Educational	Low[a]	6	3,5000	0,70711	1,538	0,217	
	Middle[b]	108	3,6042	0,75049			
	High[c]	88	3,7983	0,89206			
Social	Low[a]	6	2,7917	1,11149	7,011	**,001***	a<b
	Middle[b]	108	3,5440	0,72249			a<c
	High[c]	88	3,8125	0,76211			b<c
Relaxation	Low[a]	6	3,9583	0,69672	2,172	0,117	
	Middle[b]	108	3,8125	0,73793			
	High[c]	88	4,0313	0,72893			
Physical	Low[a]	6	3,3750	0,72024	2,037	0,133	
	Middle[b]	108	3,3102	0,75417			
	High[c]	88	3,5483	0,90565			
Aesthetics	Low[a]	6	2,8333	0,70119	5,152	**,007***	a<c
	Middle[b]	108	3,5139	0,66876			
	High[c]	88	3,7330	0,84995			

p<0.05*

The difference between the total scores and the sub-dimensions of the FNS and LSS was evaluated by ANOVA analysis, with the aim of determining the academic perception level of

the students. The results are presented in Table 7. No statistically significant difference was observed between the psychological, educational, relaxation and physical sub-dimensions of the LSS according to the level of academic perception (p>0.05). A difference was identified in terms of the total score (F=4.091; p=.018), social (F=7.011; p=.001) and aesthetic (F=5.152; p=.007) sub-dimensions of the LSS. Students with a high academic perception level exhibited greater leisure satisfaction than those with lower levels of perception.

Table 8: ANOVA results according to income

	Income Level	n	X̄	SD	F	p	Tukey
FNS	Income Less than Expense[a]	43	2,6085	0,82326	,986	,375	
	Income Equals Expense[b]	125	2,7093	0,72336			
	Income Exceeds Expense[c]	34	2,5123	0,83790			
LSS	Income Less than Expense[a]	43	3,4167	0,66865	3,522	**,031***	a<b
	Income Equals Expense[b]	125	3,6950	0,57964			
	Income Exceeds Expense[c]	34	3,5515	0,64575			
Psychological	Income Less than Expense[a]	43	3,2733	0,70882	1,395	0,250	
	Income Equals Expense[b]	125	3,4920	0,75063			
	Income Exceeds Expense[c]	34	3,3897	0,82616			
Educational	Income Less than Expense [a]	43	3,4244	0,89731	3,815	**,024***	a<b
	Income Equals Expense[b]	125	3,8020	0,78114			
	Income Exceeds Expense[c]	34	3,5882	0,77088			
Social	Income Less than Expense[a]	43	3,5174	0,80066	0,918	0,401	
	Income Equals Expense[b]	125	3,6940	0,76587			
	Income Exceeds Expense[c]	34	3,5882	0,77333			
Relaxation	Income Less than Expense [a]	43	3,6395	0,86138	4,514	**,012***	a<b
	Income Equals Expense [b]	125	4,0200	0,64414			
	Income Exceeds Expense[c]	34	3,8603	0,81462			
Physical	Income Less than Expense[a]	43	3,2326	0,82447	1,702	0,185	
	Income Equals Expense[b]	125	3,4940	0,82273			
	Income Exceeds Expense[c]	34	3,3603	0,83073			
Aesthetics	Income Less than Expense[a]	43	3,4128	0,89290	1,933	0,147	
	Income Equals Expense[b]	125	3,6680	0,72733			
	Income Exceeds Expense[c]	34	3,5221	0,73177			

p<0.05*

Table 8 presents the results of the ANOVA test conducted to ascertain whether there is a statistically significant difference between the total score and the sub-dimensions of the FNS and LSS according to the income of the students. The findings revealed no statistically significant correlation between income and FNS, LSS, psychological, social, physical and aesthetic dimensions (p>0.05). Nevertheless, a discrepancy was observed between the total score (F=3.522; p=0.031), educational (F=3.815; p=0.024) and relaxation (F=4.514; p=0.012) sub-dimensions. The students whose income was less than their expenses exhibited a lower level of leisure satisfaction than those whose income was equal to their expenses.

Table 9: ANOVA results according to weekly leisure duration

	Weekly Leisure Period	n	X̄	SD	F	p
FNS	1-5 hours	49	2,7398	0,85368	1,770	,154
	6-10 hours	91	2,7088	0,76632		
	11-15 hours	38	2,4013	0,67251		
	16 hours and over	24	2,6771	0,66044		
LSS	1-5 hours	49	3,5672	0,77158	1,116	,344
	6-10 hours	91	3,5861	0,62838		
	11-15 hours	38	3,7741	0,46202		
	16 hours and over	24	3,5417	0,39222		

p<0.05*

The analysis of variance (ANOVA) test was employed to ascertain whether there was a statistically significant difference between the total score and the sub-dimensions (psychological, educational, social, relaxation, physical, aesthetic) of the FNS and LSS, according to the weekly duration of free time available to students. According to the results of the analyses presented in Table 9, it was seen that there was no statistical difference between the total scores and sub-dimensions of the FNS and the LSS according to the weekly leisure duration (p>0.05).

Table 10: ANOVA results according to daily internet usage time

	Daily Internet Usage Time	n	X̄	SD	F	p	Tukey
FNS	1 hours and less[a]	9	2,4630	1,24102	4,602	**,004***	d>b
	2-4 hours[b]	93	2,4955	0,67481			
	5-7 hours[c]	63	2,7050	0,79633			
	8 hours and over[d]	37	3,0158	0,67639			
LSS	1 hours and less[a]	9	3,9167	0,76688	,946	,419	
	2-4 hours[b]	93	3,6237	0,64323			
	5-7 hours[c]	63	3,5952	0,59023			
	8 hours and over[d]	37	3,5349	0,56207			

p<0.05*

The analysis of the relationship between the total score and the sub-dimensions (psychological, educational, social, relaxation, physical, aesthetic) of the FNS and the LSS, as a function of the daily of internet usage by students, was conducted using an ANOVA test. According to Table 10, no difference was found between the LSS total score and sub-dimensions of the students (p>0.05). However, a statistically significant difference was identified between the FNS according to the duration of daily internet use (F=4.602; p=.004). The significant difference was observed between those whose daily internet usage time was between 2-4 hours and those whose daily internet usage time was 8 hours or more.

Table 11: T-test results according to technological tool variable

	Technological Tool	n	X̄	SD	t	p
FNS	Mobile phone	191	2,6828	0,75228	2,196	**,029***
	Computer or other	11	2,1667	0,85878		
LSS	Mobile phone	191	3,6119	0,60909	,030	,976
	Computer or other	11	3,6061	0,79612		

p<0.05*

The differences between the technological tool variable used by the students and the total scores and sub-dimensions of the FNS and LSS were analysed using a t-test. The results of the related analysis are presented in Table 11. The findings indicate that no statistically significant difference was observed between the total score and sub-dimensions (psychological, educational, social, relaxation, physical, aesthetic) of the LSS according to the technological tool variable (p>0.05). However, a statistically significant difference was identified between the FNS according to the technological tool variable (t=2.196; p=0.029).

Table 12: Correlation results between age, FNS, LSS total score and sub-dimensions

		Age	FNS
Age	r	1	0,068
	p		0,339
FNS	r	0,068	1
	p	0,339	

LSS	r	-0,026	0,088
	p	0,713	0,215
Psychological	r	0,069	0,142
	p	0,330	0,054
Educational	r	0,021	0,053
	p	0,765	0,451
Social	r	-0,103	0,107
	p	0,144	0,131
Relaxation	r	0,005	0,009
	p	0,945	0,897
Physical	r	-0,039	0,035
	p	0,583	0,620
Aesthetics	r	-0,075	0,072
	p	0,289	0,311

Table 12 shows the results of the relationship between age, netlessphobia, and the LTSS and its sub-dimensions. According to the findings, no statistically significant relationship was found between all variables ($p>0.05$).

Discussion

The aim of the study was to investigate the relationship between netlesphobia and leisure satisfaction among students studying at the faculty of sport sciences. The results showed that students' netlesphobia ($\bar{x}=2.65$) was at a moderate level and their leisure satisfaction ($\bar{x}=3.61$) was at a high level. In the study conducted by Aydın Kartal and Bulut (2022), midwifery students' netlesphobia was found to be at a moderate level. Similar results were found in another study conducted with students (Sarıtepe, 2024). It was observed that many studies on individuals' leisure satisfaction supported the findings of this study (Cho, 2023; Ma & Li, 2023). Therefore, it can be said that the literature supports the findings of the current study.

No gender difference was found between students' netlesphobia and leisure satisfaction. In the study conducted by Ülger and Ersoy (2023) with students from the faculty of sport sciences, no difference was found between internet addiction according to gender. However, contrary to the findings, there were also studies that showed differences in studies conducted with students from different faculties (Aslan & Yazıcı, 2016; Karasu et al., 2017). The differences between individuals are believed to be due to their socio-demographic characteristics. Different results were found between leisure satisfaction according to gender (Hur et al., 2019; Gürkan et al., 2021; Kuo et al., 2021; Sönmez & Gürbüz, 2022; Khan & Hamad, 2023). This situation may vary depending on the type, place, time and personal characteristics of leisure activities (Siyahtaş, 2024).

The investigation revealed no significant correlation between students' netlessphobia and the variables associated with their class and department. The study conducted by Atilgan (2020) revealed that the prevalence of nomophobia among university students was consistent across different class levels. Similarly, no significant differences were observed in the prevalence of internet addiction among students of the sports sciences faculty, irrespective of their respective departments (Ülger & Ersoy, 2023). It can be stated that the findings of the current research are supported by the existing literature. There was a difference in leisure social and relaxation activities according to the class variable and in psychological satisfaction according to the department. In the study conducted by Serdar and Demirel (2020), a significant difference was found in the sub-dimension of leisure satisfaction relaxation according to the department of sports sciences faculty students. The satisfaction of students in different dimensions may be due to the diversity of activities.

The level of academic perception was found to be inconsequential in determining the extent of netlessphobia. The paucity of existing literature made it challenging to draw comparisons between the findings of the current study and those of previous research. However, given that fear is an emotional state that can vary significantly between individuals, it is thought that there may be a number of different factors affecting this situation. It was determined that individuals with high academic perception achieved greater satisfaction in leisure time across a range of dimensions. This may be due to the fact that these individuals also have high awareness of leisure time activities. However, the homogeneous distribution of the data may have affected the results. Therefore, further research is recommended to strengthen the interpretations on the effect of academic perception level on leisure time satisfaction.

The analysis revealed no statistically significant correlation between netlessphobia and income status among students enrolled in the faculty of sport sciences. It was observed that the results of the studies in the literature (Eryılmaz et al., 2020; Yılmaz Alarçin & Şirin, 2021) align with the current research findings. Given the pervasive accessibility of the Internet in contemporary society, income status may not be a significant predictor of the fear of being unable to connect to the Internet. A discrepancy was identified with regard to educational and recreational activities, with income status influencing satisfaction levels in these domains. Individuals with lower incomes exhibited lower levels of satisfaction in their leisure time. These findings were partially corroborated by existing literature (Cengiz & Yaşartürk, 2020; Bae, 2022).

The results indicated that there was no statistically significant correlation between netlessphobia and leisure satisfaction, when the weekly leisure duration variable was taken into account. It can be inferred that weekly free time duration has no impact on netlessphobia, given that individuals already engage with the internet to a significant extent during their free time (Özel & Önal, 2023). In a study conducted with students at the Faculty of Sports Sciences, no difference was found between students' weekly free time satisfaction according to the weekly free time duration variable (Serdar & Demirel, 2020). Siyahtaş (2024) posited that the benefit obtained from the activities may positively affect satisfaction, and thus, the duration may not have a direct effect.

A notable discrepancy in netlessphobia levels was observed among students of sports science, contingent on the category of technological devices they utilize. The results indicated that students who primarily use smartphones exhibited higher levels of fear regarding the absence of internet access. This finding is to be expected, given the increasing integration of smartphones into everyday life. The absence of a smartphone has been identified as a factor contributing to the development of anxiety disorders among individuals (Bekaroğlu & Yılmaz, 2020). Given that smartphones are typically used in conjunction with internet access, the emergence of netlessphobia can be regarded as a foreseeable consequence. However, it is recommended that future studies encompass individuals who utilise a range of technological devices throughout the day to re-examine the phenomenon of netlessphobia.

The investigation yielded no statistically significant correlation between students' ages and their levels of netlessphobia and leisure satisfaction. In a study conducted by Çağın (2021), the relationship between the age of students enrolled in the faculty of sport sciences and their levels of digital addiction was examined. The findings indicated a low, negative correlation between the two variables. In contrast with the findings of the present study, other research on the impact of age on digital addiction has identified relationships or differences between the concepts (Kuyucu, 2017; Akın, 2018). The results of this study indicate that age is not a direct determinant of digital addiction, netlessphobia, nomophobia, or internet addiction. It is

possible that other variables may also exert an influence. Conversely, research examining the relationship between age and leisure satisfaction has yielded findings that are consistent with those of the present study (Jun & Song, 2016; Lee et al., 2022).

The present study examined the relationship between netlessphobia and leisure satisfaction among students in the faculty of sport sciences. The analysis yielded no statistically significant correlation between netlessphobia and leisure satisfaction, including its subdimensions. In other words, it can be stated that the satisfaction gained during leisure time does not affect netlessphobia. A review of the literature, however, revealed studies indicating that increased leisure satisfaction is associated with decreased digital gaming addiction (Satılmış et al., 2023). Similarly, Güler and Özmaden (2023) found that as leisure satisfaction increased, awareness of digital gaming addiction also rose among students in the Faculty of Sport Sciences. Consequently, the findings of existing literature do not support the results of the present study.

Conclusion

The findings of the study indicated that students in the faculty of sport sciences exhibited a moderate level of netlessphobia and a high level of leisure satisfaction. It was established that the duration of daily internet usage and the type of technological device most frequently used by students had a significant impact on their levels of netlessphobia. Furthermore, it was found that leisure satisfaction was influenced by a number of independent variables. However, when the hypothesis was tested to ascertain whether there was a relationship between leisure satisfaction and netlessphobia, it was concluded that no significant relationship existed between these variables.

In the present era, concerns pertaining to digital, internet, and gaming addiction have reached a critical point. While a considerable proportion of the population engages in leisure activities that confer biopsychosocial benefits, a notable proportion of the younger generation allocates their leisure time to internet use. The time spent online is sometimes perceived as leisure time and at other times as part of the routine activities of daily life. This has resulted in an increasing inability to function without internet access. In this context, it is considered important to identify the factors that influence or drive individuals toward using the internet, smartphones, or gaming during their leisure time. Based on this premise, the relationship between netlessphobia and leisure satisfaction was examined. However, the present study was limited to students in the faculty of sport sciences. It is recommended that future research explore this topic with different sample groups and larger populations. Additionally, it is suggested that future studies investigate the relationship between netlessphobia during leisure time and other factors such as boredom, motivation, and engagement, which may potentially influence this fear among students.

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The Relationship Between Stress Coping and Aggression Levels of Faculty of Sports Sciences Students

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Abstract

This study aims to examine the relationship between stress coping and aggression levels among students of the Faculty of Sports Sciences. The sample of the study consisted of 305 students from the Faculty of Sports Sciences. The "Aggression Scale" adapted into Turkish by Madran (2012) and the "Coping with Stress Methods Scale" adapted into Turkish by Ballı & Kılıç (2016) were used as data collection instruments. Differences in the total scores of the scales and their sub-dimensions according to gender were determined using the Student's t-test, while differences based on age, income, department, and class status were analyzed using One-Way Analysis of Variance (ANOVA) and Tukey's post hoc test. The results indicated that the overall aggression levels of male participants were higher than those of female participants. However, it was found that females had higher anger levels than males. Regarding age and aggression levels, it was observed that participants aged 18-21 exhibited higher overall aggression levels than those aged 26 and above. No relationship was found between income and stress coping, but students with higher income levels showed higher aggression levels compared to those with lower income levels. Fourth-year students had higher scores in problem-solving and environmental support compared to first- and second-year students. No relationship was found between class status and aggression. To better understand and reduce tendencies toward stress coping and aggression, it is recommended to examine the effects of factors such as income, gender, and age, and to strengthen educational programs and social support accordingly.

Keywords: Student Stress, Student Violence, Anger Control

Introduction

Sport can be considered as a culture of a society, a tradition, a nation's expression of strength, a unifier of societies with different lives and perspectives, a means of expressing emotions and thoughts, and even an economic sector from which individuals, societies, and countries gain financial benefits. It also provides both mental and physical benefits to individuals (Öz et al., 2023). It is known that the most significant population density in our country falls within the age range considered as the young population, primarily consisting of university students (Barut & Demirci, 2024). In this context, sport can be viewed as a phenomenon that contributes to well-being. Students studying at the Faculty of Sports Sciences, which serves as the educational institution for sports and athletes, possess an in-depth understanding of various aspects of sport, equipped with disciplined education and specialized areas of expertise. These students are capable of effectively understanding and applying the physical, mental, and social benefits of sport through both theoretical knowledge and practical experience. Additionally, students at the Faculty of Sports Sciences are significant due to their ability to develop various strategies to meet the needs of athletes in areas such as health, performance, and rehabilitation. In this way, students of the Faculty of Sports Sciences grow into qualified individuals who have the potential to guide society in maximizing the positive impacts of sport. It is well known that such education is generally provided in the Sports Sciences faculties or the School of Physical Education and Sports at universities (Canpolat & Akyol, 2022). However, despite the considerable positive effects of sport on mental health, the stress brought about by modern life has become an inseparable part of daily existence. This stress is often the result of high expectations, which, while not necessarily troubling others, can have significant physical and psychological effects on individuals.

Stress is an integral part of daily life. In today's world, as life becomes increasingly complex, avoiding stress has become almost impossible (Özel & Karabulut, 2018). Stress is defined as the state of strain or discomfort experienced as a result of events encountered in daily life or pressures arising from interpersonal relationships. It refers to an emotional, physical, or cognitive response triggered by environmental pressures, conflicts, tensions, or similar stimuli (Kaba, 2019). Intense pressure, anxiety, stress, health problems, financial difficulties, and family issues in personal life can also lead to burnout (Derelioğlu & Sabah, 2023). Considering factors such as career planning and employment anxiety levels, intensity of classes, and teachers' expectations from students during their academic lives, students studying at sports science faculties are likely to have stress in their lives and to experience aggressive symptoms that are a result of stress. It is known that students, especially those under intense stress, may tend to exceed their limits and prefer to express their negative emotions in the form of physical or verbal aggression.

Aggression is a universal impulse that has existed from the beginning of human existence to the present day. Nowadays, it has become an increasing problem in the family, on the street, at school and even in sports competitions. Aggression leads to not only physical harm but also psychological damage. For this reason, it is defined as an individual's inclination to inflict physical or psychological harm and is recognized as a personality disorder (Algur, 2019). Aggression is a behavior that is usually carried out for a purpose, and its target can usually be a person, a society or a group. Individuals who encounter such behaviors may generally react such as avoidance or struggle. Aggression often occurs as a result of conflict and can be expressed in different ways, influenced by various factors. Therefore, it is important to understand the environmental, social and individual factors that affect aggression. Especially in competitive sports, it may sometimes be necessary to use violence tactically to gain superiority over the opponent. However, when sports ethics and fair-play rules are violated,

behavior that harms the opponent is considered aggression. In the competitive atmosphere among students, the effort to gain superiority over their peers can sometimes manifest itself in the form of aggression. However, sports science students should keep their aggressive tendencies under control and act within the framework of sports ethics by adhering to the ethical and fair-play rules of sports. This will help them maintain both their academic success and sports ethics. The relationship between sports science students' coping with stress and aggression levels is closely related to the nature of the field they study and the nature of the sport. These students often study in a competitive and performance-oriented environment. Therefore, various factors may influence stress coping skills and aggression tendencies. In this context, educational institutions that train physical education and sports teachers, coaches, and managers should develop their curricula in a way that transforms the principles of sports ethics and philosophy into behavior (Pehlivan & Konukman, 2004).

The focus of this study is to examine the relationship between stress coping skills and aggression levels of students studying at sports science faculties in terms of some socio - demographic characteristics. Faculties of sports sciences are educational institutions that focus on sports and its multidisciplinary aspects, offering students the opportunity to comprehensively learn and understand the different dimensions of sports. In this context, understanding the stress coping abilities and aggression levels of students studying at the faculty of sports sciences is important to evaluate both the psychological effects of sports and the leadership potential of future professionals in the field of sports education. This study aims to provide valuable insights into how sports science faculties can support their students in improving their stress coping mechanisms and reducing possible aggressive tendencies.

Material and Method

Ethics committee approval was received for the research with the decision of Giresun University Social Sciences, Science and Engineering Sciences Research Ethics Committee dated 08.05.2024 and numbered 05/31.

Research Model

The survey used the survey research model, which is generally used to understand the current situation about a subject or population. Screening models can be used to get a general idea about the current situation before conducting more comprehensive research on a topic (Karasar, 1999).

Research Group

The population of the study consists of students enrolled in the Faculty of Sports Sciences at universities, while the sample was determined using a random sampling method from among 305 students studying at the Faculty of Sports Sciences of Ondokuz Mayıs University, Yaşar Doğu Sports Sciences Faculty during the 2023/2024 academic year.

Data Collection Tools

As data collection tools, the personal information form developed by the researchers, the "Aggression Scale" adapted to Turkish Culture by Madran (2012), whose validity and reliability studies were conducted by Buss & Perry, (1992) and the "Aggression Scale" developed by Moos (1993) and Ballı & Kılıç (2016) were used. "Stress Coping Methods Scale" adapted to Turkish by was used. In the personal information form, questions such as the age, gender, class, income status and legal criminal history of the sports sciences faculty students participating in the research were asked. “Aggression Scale” is a scale used to examine the aggression levels of individuals. The scale consists of 29 items and is evaluated

in 4 sub-dimensions. Sub-dimensions: Physical aggression, hostility, verbal aggression, and there are no reverse-scored items in the scale. A 5-point Likert -type scale such as "1: Strongly Disagree" and "5: Completely Agree" is used to answer each item in the scale, and higher scores indicate higher levels of the relevant dimension. Methods of Coping with Stress Scale: 24 statements are rated on a 5-point Likert type consisting of 4 sub-dimensions (logical analysis, positive evaluation, seeking guidance and support, problem solving) and the answer options are; It was scored as 1-Never, 2-Rarely, 3-Sometimes, 4-Often, 5-Always. Rising scores on the scale indicate high levels of the relevant dimension.

Collection of Data

Before asking the scale items to the students of the faculty of sports sciences, who constituted the research group, the purpose of the research was explained and the necessary information was given about the factors to be taken into consideration. The research scales were applied to the students of the faculty of sports sciences between 15.10.2023 and 15.12.2023, through Google forms and by hand physical survey method, based on voluntary participation.

Data Analysis

To check the internal consistency of the responses given by the participants to the scale items, reliability coefficients (Cronbach Alpha) were calculated (Table 1).

Table 1. Internal Consistency Coefficients of Participants' Answers to Scale Items

Scale	Internal Consistency Coefficient	Evaluation
Coping with Stress Scale Total	0.920	Highly Reliable
Problem solving	0.884	Highly Reliable
Position Evaluation	0.890	Highly Reliable
Analytics	0.897	Highly Reliable
Professional Support	0.645	Moderately Reliable
Environmental Support	0.820	Highly Reliable
Aggression Level Scale Total	0.870	Highly Reliable
Physical Aggression	0.710	Moderately Reliable
Hostility	0.854	Highly Reliable
Anger	0.675	Moderately Reliable
Verbal Aggression	0.810	Highly Reliable

In the study, the internal consistency of the answers given to the total items and subscale items of the coping with stress and aggression levels scale was found to be moderately and highly reliable.

In the statistical evaluation of the data, the assumption of normality was first examined with the Kolmogorov-Smirnov and Shapiro-Wilk tests ($P>0.05$). In the study, whether the total scores of the scale differed according to gender, being a national athlete, or having received a criminal sanction was determined by Student's t test, income level, department, class, age were determined by One-Way Analysis of Variance, and differences between groups were determined by Tukey's multiple comparison test. SPSS 22.0 V. statistical package program was used in all statistical calculations. Research findings are given as frequency (%), mean and standard deviation values, and the findings were considered significant at the $P<0.05$ level.

The demographic characteristics of the students from Ondokuz Mayıs University Yaşar Doğu Faculty of Sports Sciences who voluntarily participated in the research are provided in Table 2.

Findings

Table 2. Frequency and Percentage Distributions Regarding Demographic Characteristics of Participants

Gender	**n**	**%**	**Punishment procedure**	**n**	**%**
Woman	139	45.6	Yes	24	7.9
Male	166	54.4	No	281	92.1
Total	305	100	**Total**	305	100

Age (years)	**n**	**%**	**Income rate**	**n**	**%**
18-21	185	60.7	Low (Income<Expense)	66	21.6
22-25	104	34.1	Medium (Income=Expense)	206	67.5
26 and over	16	5.2	High (Income>Expense)	33	10.8
Total	305	100	**Total**	305	100

Section	**n**	**%**	**Class**	**n**	**%**
Teaching	35	11.5	1st Class	154	50.5
Coaching Training	52	17.0	2. Class	78	25.6
Sports Management	186	61.0	3rd Class	58	19.0
Recreation	32	10.5	4th grade	15	4.9
Total	305	100	**Total**	305	100

Of the individuals who voluntarily participated in the research, 54.4% were male, 92.1% had not received any criminal action, 60.7% were between the ages of 18-21, 67.5% had a middle income level, and 61% were department of sports management and 50% of them are first year students (Table 2).

Table 3. Participants' Stress Coping and Aggression Levels by Gender Status

Scale and Sub-Dimensions	**Gender**	**n**	**Average**	**SS**	**P-value**
Coping with Stress Scale	Woman	139	88.39	14.48	0.013
	Male	166	90.43	12,19	
Problem Solving	Woman	139	21.96	3.95	0.103
	Male	166	22.51	3.56	
Positive Evaluation	Woman	139	22.75	3.94	0.097
	Male	166	22.81	3.46	
Analytics	Woman	139	22.06	3.89	0.021
	Male	166	22.97	3.36	
Professional Support	Woman	139	5.82	1.93	0.540
	Male	166	6.25	1.82	
Environmental Support	Woman	139	7.88	1.65	0.938
	Male	166	7.74	1.61	
Aggression Level Scale	Woman	139	79.28	14.39	0.004
	Male	166	80.04	17.69	
Physical Aggression	Woman	139	21,29	5.61	0.015
	Male	166	23.55	6.54	
Hostility	Woman	139	24.11	4.85	0.234
	Male	166	23.09	5.00	
Anger	Woman	139	20.05	4.35	0.001
	Male	166	19,14	5.17	
Verbal Aggression	Woman	139	13.83	2.40	0.002
	Male	166	14.25	3.25	

In the study, a statistically significant difference was found in the students' stress coping scale total score, problem solving and logical analysis sub-dimensions according to gender. No statistically significant difference was detected between the total scores of the positive evaluation, professional support and environmental support subscales. A statistically significant difference was detected between the aggression level scale total and all other subscale total scores (except hostility). In the study, male participants' total scores of the scales and all other subscale total scores with significant differences were found to be higher than female participants. In the anger subscale, female participants' subscale total scores were found to be higher than male participants (P<0.05; Table 3).

Table 4. Students' Stress Coping and Aggression Levels According to Penal Sanction Status

Scale and Sub-Dimensions	Criminal sanctions	n	Average	SS	P-value
Coping with Stress Scale	Yes	24	87.25	15.96	0.145
	No	281	89.69	13.06	
Problem Solving	Yes	24	21.88	4.23	0.232
	No	281	22,29	3.71	
Positive Evaluation	Yes	24	22.08	4.15	0.271
	No	281	22.84	3.64	
Analytics	Yes	24	21.50	4.30	0.193
	No	281	22.64	3.56	
Professional Support	Yes	24	6.58	1.95	0.851
	No	281	6.01	1.87	
Environmental Support	Yes	24	7.42	1.53	0.979
	No	281	7.84	1.64	
Aggression Level Scale	Yes	24	90.75	14.64	0.769
	No	281	78.75	16.05	
Physical Aggression	Yes	24	28.42	4.75	0.081
	No	281	22.01	6.08	
Hostility	Yes	24	25.08	4.20	0.403
	No	281	23.42	4.99	
Anger	Yes	24	22,21	4.10	0.566
	No	281	19.33	4.82	
Verbal Aggression	Yes	24	15.04	3.10	0.291
	No	281	13.98	2.87	

In the study, no statistically significant difference was detected between the students' coping with stress scale total score and aggression level scale total score and the sub-dimension total scores of the scales, depending on whether they received criminal sanctions (P>0.05; Table 4).

Table 5. Students' Stress Coping and Aggression Levels by Age

Scale and Sub-Dimensions	Age	n	Average	SS	P-value
Coping with Stress Scale	18-21	185	87.26b	12.02	p <0.001
	22-25	104	91.88b	14.76	
	over 26	16	99.94a	9.91	
Problem Solving	18-21	185	21.65b	3.63	0.001
	22-25	104	23.05ab	3.80	
	over 26	16	24,13a	3.30	
Positive Evaluation	18-21	185	22,25b	3.10	0.001
	22-25	104	23,31b	4.51	
	over 26	16	25.50a	1.86	

Analytics	18-21	185	21.97b	3.37	p <0.001
	22-25	104	23,13b	3.91	
	over 26	16	25.56a	2.63	
Professional Support	18-21	185	5.90b	1.83	0.013
	22-25	104	6.13b	1.86	
	over 26	16	7.31a	2.18	
Environmental Support	18-21	185	7.58a	1.66	0.006
	22-25	104	8.07ab	1.60	
	over 26	16	8.63b	0.96	
Aggression Level Scale	18-21	185	80,92a	16.25	0.018
	22-25	104	79.13a	15.95	
	over 26	16	69.13b	15.05	
Physical Aggression	18-21	185	22.84b	6.32	0.060
	22-25	104	22.48b	6,11	
	over 26	16	19.00a	5.05	
Hostility	18-21	185	23.91b	4.94	0.030
	22-25	104	23.38b	4.73	
	over 26	16	20.56a	5.64	
Anger	18-21	185	19.97a	4.91	0.019
	22-25	104	19.29a	4.47	
	over 26	16	16.56b	5.21	
Verbal Aggression	18-21	185	14,19	2.89	0.274
	22-25	104	13.99	2.88	
	over 26	16	13.00	3.06	

In the study, a statistically significant difference was found between the students' stress coping scale total score and sub-dimension total scores and the aggression level scale total and all sub-dimension total scores (except for verbal aggression) according to age. (P<0.05; Table 5). In general, it was determined that students who declared that they were 26 years old and above had higher stress coping scores than students between the ages of 18-21. In the total and subscale total scores of the aggression level scale, it was determined that the scores of students aged 18-21 were higher than those of students aged 26 and over.

Table 6. Participants' Stress Coping and Aggression Levels by Income Status

Scale and Sub-Dimensions	Income	n	Average	SS	P-value
Coping with Stress Scale	Low (Income<Expense)	66	90.05	12.96	0.215
	Medium (Income=Expense)	206	89.94	13.54	
	High (Income>Expense)	33	85.67	12,12	
Problem Solving	Low (Income<Expense)	66	22.03	3.62	0.535
	Medium (Income=Expense)	206	22.41	3.85	
	High (Income>Expense)	33	21.73	3.29	
Positive Evaluation	Low (Income<Expense)	66	23,23	3.78	0.062
	Medium (Income=Expense)	206	22.85	3.49	
	High (Income>Expense)	33	21.42	4.40	
Analytics	Low	66	23.00	3.50	0.374

	(Income<Expense)				
	Medium (Income=Expense)	206	22.51	3.67	
	High (Income>Expense)	33	21.94	3.64	
Professional Support	Low (Income<Expense)	66	5.83	1.93	0.343
	Medium (Income=Expense)	206	6.17	1.87	
	High (Income>Expense)	33	5.82	1.84	
Environmental Support	Low (Income<Expense)	66	7.79	1.40	0.160
	Medium (Income=Expense)	206	7.89	1.71	
	High (Income>Expense)	33	7.30	1.49	
Aggression Level Scale	Low (Income<Expense)	66	80.65b	14.20	p <0.001
	Medium (Income=Expense)	206	77.65b	16.61	
	High (Income>Expense)	33	90.55a	13.41	
Physical Aggression	Low (Income<Expense)	66	22,18b	5.36	p <0.001
	Medium (Income=Expense)	206	21.87b	6.17	
	High (Income>Expense)	33	27,21a	6.35	
Hostility	Low (Income<Expense)	66	24,30b	5.04	0.017
	Medium (Income=Expense)	206	23.03b	5.05	
	High (Income>Expense)	33	25,33a	3.42	
Anger	Low (Income<Expense)	66	19.97b	4.43	0.014
	Medium (Income=Expense)	206	18.98b	4.95	
	High (Income>Expense)	33	22,33a	3.69	
Verbal Aggression	Low (Income<Expense)	66	14,20b	2.33	0.002
	Medium (Income=Expense)	206	13.76b	3.01	
	High (Income>Expense)	33	15.67a	2.73	

In the study, no statistically significant difference was detected between the stress coping scale total score and subscale total scores according to the income status declared by the students. A statistically significant difference was detected between the aggression level scale total score and subscale total scores ($P<0.05$; Table 6). As a result of the findings, the aggression levels of students who declared themselves to be high-income were found to be higher than those of students with lower income.

Table 7. Students' Stress Coping and Aggression Levels by Department

Scale and Sub-Dimensions	Section	n	Average	SS	P-value
Coping with Stress Scale	Teaching	35	89.03	14.43	0.051
	Coaching Training	52	85.62	13.63	
	Sports Management	186	89.97a	13.21	
	Recreation	32	93.59	10.71	
Problem Solving	Teaching	35	21.80	4.20	0.139
	Coaching Training	52	21.44	3.55	
	Sports Management	186	22.40	3.74	
	Recreation	32	23.25	3.40	
Positive Evaluation	Teaching	35	23.03ab	4.15	0.013
	Coaching Training	52	21,29b	4.49	
	Sports Management	186	23.03ab	3.39	
	Recreation	32	23.47a	2.74	
Analytics	Teaching	35	22.60	4.01	0.199
	Coaching Training	52	21.71	4.06	
	Sports Management	186	22.63	3.54	
	Recreation	32	23.41	2.78	
Professional Support	Teaching	35	5.66	1.92	0.132
	Coaching Training	52	6.35	1.75	
	Sports Management	186	5.96	1.90	
	Recreation	32	6.56	1.81	
Environmental Support	Teaching	35	7.87ab	1.51	0.018
	Coaching Training	52	7.21b	1.65	
	Sports Management	186	7.87ab	1.67	
	Recreation	32	8.28a	1.28	
Aggression Scale	Teaching	35	74.86b	15.46	p <0.001
	Coaching Training	52	89.56b	15.36	
	Sports Management	186	77.68b	15.32	
	Recreation	32	80.63a	17.96	
Physical Aggression	Teaching	35	19.89bc	5.82	p <0.001
	Coaching Training	52	26.67a	6.35	
	Sports Management	186	21.73c	5.76	
	Recreation	32	23,25b	6.17	
Hostility	Teaching	35	23,23b	5.19	0.006
	Coaching Training	52	25.75a	3.91	
	Sports Management	186	23.04b	4.97	
	Recreation	32	23,31b	5.32	
Anger	Teaching	35	18.77b	5,10	0.019
	Coaching Training	52	21.38ab	4.25	
	Sports Management	186	19,15ab	4.74	
	Recreation	32	19.84a	5.35	
Verbal Aggression	Teaching	35	12.97c	2.98	p <0.001
	Coaching Training	52	15.75a	2.91	
	Sports Management	186	13.77b	2.68	
	Recreation	32	14.22b	3.03	

The study found no statistically significant differences in the total scores of the stress coping scale and its sub-dimension scores (except for the positive evaluation sub-dimension) based on the departments in which students were enrolled (P>0.05; Table 7). However, statistically significant differences were identified in the total scores of the aggression scale and all its sub-dimensions (P<0.05; Table 7). According to the findings, recreation department students scored higher in the positive evaluation and environmental support sub-dimensions compared to coaching department students. Conversely, coaching department students scored higher than teaching department students in the total aggression scale score, as well as the sub-dimensions of physical aggression, anger, and verbal aggression. Additionally, in the hostility

sub-dimension, coaching department students scored higher than management department students.

Table 8. Participants' Stress Coping and Aggression Levels by Class

Scales and Sub-Dimensions	Class	n	Average	SS	P-value
Coping with Stress Scale	1 (one)	154	88.07	12.29	0.067
	2 (two)	78	91.06	14,17	
	3 (three)	58	89.34	14.70	
	4 (four)	15	96.60	10.70	
Problem Solving	1 (one)	154	21.76c	3.66	0.047
	2 (two)	78	22.88b	3.91	
	3 (three)	58	22,29b	3.76	
	4 (four)	15	23.93a	2.96	
Positive Evaluation	1 (one)	154	22.63	2.98	0.106
	2 (two)	78	22.69	4.02	
	3 (three)	58	22.71	4.86	
	4 (four)	15	25.07	2.40	
Analytics	1 (one)	154	22,23	3.45	0.357
	2 (two)	78	22.88	3.76	
	3 (three)	58	22.71	3.88	
	4 (four)	15	23.60	3.70	
Professional Support	1 (one)	154	5.92	1.85	0.118
	2 (two)	78	6,12	1.96	
	3 (three)	58	6.07	1.81	
	4 (four)	15	7.13	1.88	
Environmental Support	1 (one)	154	7.56b	1.64	0.006
	2 (two)	78	8.27b	1.56	
	3 (three)	58	7.67b	1.70	
	4 (four)	15	8.40a	0.91	
Coping with Stress Scale	1 (one)	154	80.68	15.57	0.765
	2 (two)	78	78.63	17.94	
	3 (three)	58	78.88	15,17	
	4 (four)	15	78.27	18.81	
Physical Aggression	1 (one)	154	22.50	6.13	0.517
	2 (two)	78	23,10	6.61	
	3 (three)	58	22,29	6.03	
	4 (four)	15	20.53	6.05	
Hostility	1 (one)	154	24,10	4.68	0.131
	2 (two)	78	22.64	5.18	
	3 (three)	58	23.09	4.75	
	4 (four)	15	24.53	6.51	
Anger	1 (one)	154	19.86	4.76	0.751
	2 (two)	78	19,21	5.08	
	3 (three)	58	19.29	4.47	
	4 (four)	15	19.33	5.68	
Verbal Aggression	1 (one)	154	14.22	2.93	0.567
	2 (two)	78	13.68	3.09	
	3 (three)	58	14.21	2.49	
	4 (four)	15	13.87	3.09	

In the study, no statistically significant difference was detected between the coping with stress scale and aggression level scale total scores and sub-dimension total scores (except for the problem solving and environmental support sub-dimensions) according to the students' classes ($p>0.005$, Table 8). As a result of the findings, the scores of 4th grade students were found to

be higher than the 1st grade students in the problem solving sub-dimension, while the scores of 4th grade students were found to be higher than the 2nd grade students in the environmental support sub-dimension total score.

Discussion and Conclusion

This study aims to examine the relationships between stress coping and aggression levels of sports science faculty students by taking some variables into consideration. As a result of the research findings, no significant difference was found between the participants' levels of coping with stress and aggression according to the variable of receiving criminal sanctions. This statement shows that the research results show that criminal sanctions do not have a significant effect on the participants' ability to cope with stress or their tendencies towards aggression. That is, facing criminal sanctions does not significantly affect the participants' methods of coping with stress or their tendencies towards aggression. This may suggest that researchers need to conduct further research on the potential of punitive sanctions to change behaviors related to stress management or aggression. However, these conclusions may be limited by the scope and method of the research, and different results may be obtained in different contexts. Therefore, it needs to be considered from a broader perspective and evaluated in accordance with the relevant literature. As a result of the literature review, no similar studies were found that addressed the criminal action variable.

As a result of the findings, when the effect of gender factor on sub-dimensions such as students' coping with stress, problem solving, logical analysis and aggression levels was examined, it was revealed that there was a difference in students' stress coping, problem solving and logical analysis skills depending on gender. According to the findings, it was determined that female participants were generally more successful than men in coping with stress. (Gündüz, 2019; Savcı & Aysan, 2014) found the relationship between coping with stress and gender variables to be higher in female participants than male participants, in line with the research findings. Contrary to existing research findings, Karabulut (2024) concluded in his study that male participants were able to cope with stress more functionally. However, (Duman, 2016; Doğru, 2018; Renk & Creasey, 2003; Tural, 1994; Binboğa, 2002) could not find a significant difference between the gender variable and the dimension of coping with stress.

The research also revealed that levels of aggression differ by gender. Although it was found that the anger levels of female participants were higher than male participants, male participants were found to be higher than female participants in terms of general aggression level and other sub-dimensions. This result may lead to the interpretation that male participants are more prone to aggression than females. (Yamak et al., 2019; Özgider & Akgün, 2021) obtained results parallel to the current research findings in their research.

When the age variable was examined in the study, it was determined that participants aged 26 and over were more effective in coping with stress than participants aged 18-21. This finding suggests that age may play an important role in the ability to cope with stress. It can be argued

that older participants were more effective at coping with stress due to factors such as maturity, experience and self-confidence. As individuals get older, their life experiences increase, which can improve their ability to cope with stress. Additionally, older participants may generally have better problem-solving and emotional regulation skills, which may provide an advantage when it comes to coping with stress. However, when the age variable and aggression levels were considered, it was determined that the general aggression levels of participants aged 18-21 were higher than participants aged 26 and over. This finding shows that the effect of age on aggressive tendencies is significant. It can be thought that participants in the younger age group may have a higher tendency to aggression due to factors such as lack of maturity, difficulty in emotional control and lack of life experience. Additionally, participants in the younger age group are often coping with the challenges of adolescence, which may lead to increased aggressive tendencies. Conducting research with different groups, (Taşğın & Çağlayan, 2011; Afyon & Metin, 2014; Çankaya & Çiftçi, 2019; Aşçı et al., 2015; Yazkan 2018; Özgider & Akgün, 2021) In their research findings where they examined the variables of aggression and age, they could not find a relationship between the two situations, contrary to existing research findings.

As a result of the research findings, no relationship was found between income and coping with stress. The most important reason for this result can be considered as cultural differences. Factors such as cultural differences, regional conditions, and research method may influence the relationship between income and stress because these factors can shape the stress coping strategies of individuals and communities. For example, coping with stress in one culture often relies on a social support network, whereas in another culture it may rely on individual resolution. Regional conditions are also important because the purchasing power of income and living standards may vary in different regions, which can affect the perception of stress. In the study, it was determined that students with high income levels had higher levels of aggression than students with low income. The reasons why high-income students have higher levels of aggression than low-income students may be diverse. This may be due to factors such as students with high incomes feeling under social status and pressure, their tendency to be more competitive, the influence of the modeling they receive from their families, social expectations and image pressure, inequality of opportunity and perception of injustice. These factors combined may lead higher-income students to tend to behave more aggressively. Erşan et al. (2009) in his research, he found that the aggression scores of high-income students were lower than those of students in other groups. He explained this situation as being related to the fact that students in this group can get what they want financially more easily than students in other groups. But, (Öztürk, 2019; Beşkat, 2016), did not find a relationship between income level and aggression levels in their research, similar to the results of the current research.

In the study, no relationship was found between students' ability to cope with stress according to the departments they study in. It was determined that only the positive evaluation scores of the recreation department students were higher than the coaching department students. The cause of this situation may depend on several factors. Firstly, due to the nature of the program in which recreation department students are educated, it is possible that it may include courses

that may emphasize positive thinking and perception of environmental support. These classes can teach students strategies to improve stress coping skills and maintain a positive outlook. Additionally, the recreation department can often provide an environment that encourages social interaction and includes group activities, which may increase students' perception of environmental support. Additionally, students in the recreation department can be considered to often participate in stress-reducing activities such as nature or outdoor activities, which may promote positive thinking and strengthen the perception of environmental support. When these factors come together, they can enable recreation department students to have a higher awareness and activities on these issues. (Çetin & Kuru, 2010; Özdemir, 2022; Karabulut, 2024) obtained results parallel to the existing research results in their research. When the relationship between the department and Aggression was examined in the study, it was determined that students studying in the coaching department received higher scores in physical aggression, anger and verbal aggression than students studying in the teaching department. In hostility, it was found that students studying in the coaching department received higher scores than students studying in the management department. Among the reasons why students in the coaching department have higher scores in the physical aggression, anger and verbal aggression subscales may be that they receive training in competitive sports environments and are exposed to more competition and pressure in these environments. These environments can encourage physical strength and aggressive competition, which can increase aggressive tendencies. On the other hand, since teaching students generally receive education in a collaborative and calm environment, their aggression levels may be lower. In the hostility sub-dimension, the fact that coaching department students received higher scores than management department students may reflect the fact that sports environments where leadership and competitive spirit are at the forefront tend to develop more feelings of hostility. Combining these factors, it can be concluded that the aggression and hostility levels of students in the coaching department are higher than those in other departments. As a result of the literature review, no research was found examining the relationship between the department variable of sports sciences faculty students and aggression.

In the research, the problem solving and environmental support scores of 4th grade students were found to be higher than those of 1st and 2nd grade students. There may be several possible reasons for this situation. Firstly, as students get older, their problem-solving skills and perception of social support generally improve. 4th grade students may have gained more experience and learning opportunities, which may increase their problem-solving skills and strengthen their perception of environmental support. Additionally, 4th grade is often a period in which social and academic skills are developed more intensively, which may contribute to students' increased environmental support and problem-solving skills. Finally, as students' grade levels rise, educational programs often become more complex and challenging, which may increase students' problem-solving skills and perception of environmental support. A combination of these factors may explain 4th grade students' higher problem solving and environmental support scores. Durmuş & Gerçe (2017); In their research, contrary to the existing data, they could not detect a relationship between the class the students studied and

their ability to cope with stress. As a result of the research findings, no relationship was found between the class variable and aggression. (Demir, 2020; Günay & Aygün, 2023) found in his research that, contrary to the current research results, the violence scores of second-grade students were higher than fourth-grade students. These findings indicate the need for further research to understand the impact of factors such as gender, age, income, department and class, as well as criminal sanctions, on stress coping and aggression.

Suggestions

As a result of the findings, a more in-depth examination can be made on the reasons for gender-based differences. Ethnographic studies can be conducted to examine the cultural and social norms behind gender-based differences. Field studies can be conducted to understand the effects on men's and women's stress coping strategies in a particular culture or society and how these strategies are shaped. Additionally, it may be recommended to develop measurement tools to more accurately measure gender-based stress coping differences. To better understand the relationship between age and coping with stress and aggression, the effect of age on coping with stress and aggression can be examined in more detail by conducting comparative analyzes between different age groups. In this way, subsequent researchers can better understand the differences that occur in certain age groups and determine the reasons for the differences. It is important to examine other individual factors (e.g. experience, personality traits, living conditions) as well as age in the research. Determining the effects of these factors on stress coping and aggression may provide a more comprehensive understanding. It is important to understand the social and cultural dynamics underlying age-related stress coping and aggression tendencies by evaluating research findings in social and cultural contexts. More research can be done to better understand how these factors shape the effects of age. These recommendations may provide guidance for better understanding the effects of age on stress coping and aggression and developing effective interventions in these areas. It is important to organize education and awareness programs for individuals with low income levels to teach them strategies to cope with stress and reduce their tendencies towards aggression. These programs can be designed to improve emotional regulation skills, increase problem-solving abilities, and teach alternative solutions. Increasing low-income individuals' access to family and community support may help them cope with stress and reduce tendencies toward aggression. Strengthening family communication, expanding social support networks and encouraging social solidarity can be effective strategies in this area. These findings may require reviewing the impact of public policies and social service programs on income inequality and psychosocial well-being. Making policies and social service programs aimed at reducing income inequality more effective can increase stress coping skills and reduce aggression tendencies. These suggestions may contribute to understanding the relationship between income level and coping with stress and aggression and to the development of effective interventions and policies in this area. It may be beneficial to adopt and implement courses that emphasize

positive thinking and perception of environmental support in other departments, such as the recreation department. It may be necessary to add courses to improve students' stress coping skills or revise existing courses. Environments that encourage social interaction and include group activities can be created. The fact that coaching department students received higher scores in the physical aggression, anger and verbal aggression subscales shows that competitive sports environments may increase aggressive tendencies. Therefore, it is important for students training in competitive sports environments to receive psychological support and develop skills to cope with aggressive tendencies. The fact that the hostility levels of the students of the coaching department are higher than those of other departments indicates that sports environments where leadership and competitive spirit are at the forefront may increase feelings of hostility. In this case, it is important to emphasize social skills such as empathy and collaboration along with leadership skills. The fact that recreation department students' perception of environmental support is higher than other departments emphasizes the importance of programs and activities to strengthen the perception of environmental support. Similar events can be organized in other departments to increase students' perception of environmental support. In order to understand and reduce stress coping strategies and aggression tendencies, the effects of factors such as income level, gender and age should be examined in depth and educational programs and social supports should be strengthened accordingly.

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Sport Education Technology: Development Trends

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Abstract

The main purpose of this study is to analyze the publications on sport education technology from a bibliometric perspective. Although sport education technology draws attention as a rapidly developing field in the intersection between education and sport sciences, there are deficiencies in the bibliometric analysis of research in this field. Therefore, this research is an original study that analyzes the publications in the field of sport education technology with bibliometric analysis method. With this bibliometric study, parameters such as the development, research areas, international collaborations, etc. of publications titled sports education technology in the Web of Science (WoS) database were examined comprehensively. Therefore, the research aims to provide important contributions to academic studies on sport education technology and emphasizes the need for a more in-depth examination of trends in this field for future studies. The results reveal that countries such as China, Russia and Turkey play an important role in sports education technology and that there are widespread collaborations between these countries. In addition, it was observed that most of the studies were published in English, and it was concluded that this situation provides a significant advantage in terms of international access.

Keywords: Bibliometrics, Sports Education Technology, Web of Science

Introduction

The concept of sport is defined as a kind of physical and intellectual movement that individuals perform of their own free will, with the reflection of dominant values and norms (Gökdağ et al., 2019). Sports are competition activities organized by branch, where physical and mental competition takes place within the framework of certain rules. Therefore, sport is an activity that enables individuals to reach a high level of performance; this process includes not only technical and tactical development, but also the development of physical, physiological, mental and psychological elements (Yılmaz, 2023a; Yılmaz, 2023b; Yılmaz and Daşkesen, 2024). Considering that human education starts with play, orientation to sports is very important in terms of leading a healthy life (Türkmen and Varol, 2015). Considering the social effects of the concept of sport, it is one of the biggest impact factors in the world in terms of health, culture and bringing people together. With the spread of modern sports, it has become a situation that has become a point of interest for people all over the World (Alaeddinoğlu, 2024). Especially with the development of technology, it has become one of the universal concepts of people in the World (Aydın and Aydın, 2024). All these situations lead to important innovations in sports sciences due to advances in technology (Yılmaz, 2022). Today, in order to achieve success and quality in the field of sports, both theoretical and practical sports education gains importance with the effective use of technologies (Bekar and Türkmen, 2023). With the introduction of smart devices into our lives, there have been significant changes in sports education (Aydın and Belli, 2022). Since health is considered to be the sine qua non condition of quality life, reducing the intensity of daily activity with technological developments, although it makes life easier, increases the number of inactive individuals in the long run and negatively affects health. Inactivity, i.e. sedentary life, is one of the most important problems for modern society, which realizes even its daily shopping from virtual markets on the computer (Bozkuş et al., 2013). Therefore, the effects of globalization on the business world today require vocational and technical training of manpower, which is the most important resource for organizations, businesses and societies (Özbek et al., 2021). Computer technology offers a different learning environment, introducing other types of learning and facilitating new methods. In this way, it increases the interest of students and athletes in acquiring skills and knowledge (Zhou, 2016). The modernization of computer technology in physical education and sport has enabled teachers to deliver better and more attractive lessons using digital technology. In this way, students' engagement increases and learning processes become more effective. Moreover, the integration of technology provides new opportunities for teachers to monitor and evaluate students' performance. This contributes to the development of athletes' abilities and a more efficient education (Koh et al., 2020; Cojocaru et al., 2022).

Sport education technology occupies an important place at the intersection of sport sciences and education. Research in this field covers topics such as the integration of technology in education, methods to improve sport performance, and the development of training materials. This study aims to examine publications on sport education technology from a bibliometric perspective.

Although sport education technology draws attention as a rapidly developing field in the intersection between education and sport sciences, there are deficiencies in the bibiometric analysis of research in this field. This research is thought to provide guidance for future research by analyzing existing publications and citations and providing important data to understand the development of the field. In addition, this study will contribute to increasing the visibility of publications on sport education technology, encouraging academic productivity and determining which topics attract more attention and which areas need more

research by providing important information for educational institutions and researchers to make strategic decisions. In addition, it is thought that it will enable more comprehensive and effective research in the field of sport education technology by encouraging collaborations between researchers from different disciplines.

This research is an original study that analyzes publications in the field of sport education technology with bibliometric analysis method. At the same time, it provides an understanding of the global and local dynamics of sport education technology by addressing various dimensions such as the content of publications, authors' countries and collaborations, which makes this study unique. At this point, it is thought that this study will be a valuable reference source for future research while making an important contribution to the sport education technology literature.

Material and Method

For the research, a total of 73 articles published in the Web of Science database under the title of sport education technology were examined by bibliometric analysis method through Sankey diagram, Bibliometrix-R package and VOSviewer programs. The concept of bibliometrics, which is accepted to have been used for the first time by Pritchard, is explained as the statistical analysis of data including publications such as books, journals, articles and theses accessed from various databases (Sayıner, 2023). Bibliometric studies contribute by providing authors with the most basic information about their field of study and help to provide insights into their perspective on the field (Karaca, 2024). Bibliometric analysis examines the evolution of scientific studies and the shaping processes of the literature, revealing the evolution of publications in a given research area over time, the contributions of researchers and countries, main themes and trends (Yılmaz and Dertli, 2024a). By providing a comprehensive visibility of scientific knowledge, this methodology contributes to understanding the evolution and future development directions of the research field (Yılmaz and Dertli, 2024b).

The following search text was used in the title (TI) field in the Web of Science database: (((TI=(Sport*and Technology*and Education*)) OR TI=(Sport Technology Education)) OR TI=(Sport Technology Education)) OR TI=(Sport* Technology* Education)). An advanced search with these keywords was used to identify publications covering the relevant topic. In the selection of publications, we focused only on studies with links to these terms in their titles and excluded studies that were not directly related to the topic. However, no restrictions were made in terms of factors such as year of publication, type of publication (article, journal, thesis, etc.). This study was limited to a search in the Web of Science database. Therefore, Scopus, Google Scholar and other databases are not included in this analysis. The software tools used in the analysis (Sankey diagram, Bibliometrix-R package and VOSviewer) are reliable and widely accepted verifiable tools for this type of analysis (Yılmaz, 2024). This software was effectively used to visualize the relationships between publications, authors, keywords and countries (Aria and Cuccurullo, 2017). All analyses were rigorously reviewed and based on verifiable data to ensure transparency and reproducibility of the study.

Criteria such as citation distribution, open access status, author countries and keyword analysis were analyzed. At this point, the questions sought to be answered in the study are as follows;

How does the citation report show the distribution?

How are citations and publications over time distributed?

How is the distribution of Web of Science index?

How are research areas distributed?

How is the distribution of Web of Science categories?

How is open access distributed?

What is the distribution of publication language?

How are corresponding author's countries distributed?

How is the citation of countries distributed?

How is the distribution of countries' collaboration world map?

How does co-occurrence author keywords show distribution?

How does the three-field plot show distribution?

How do titles according to trending topics show distribution?

How do abstracts according to trending topics show distribution?

How do keywords plus according to trending topics distribute?

How is the distribution of author's keywords according to trending topics?

How is the distribution of frequency of words over time in titles?

Findings

In this section, the findings of the studies on sport technology education are presented. In the advanced search section of the Web of Science database, as a result of a search of a total of 2,510 studies in the TS (title, abstract, keyword plus and author keywords) field, only 73 studies containing the term (Sport Technology Education) in the title were filtered. At this point, as in Aydoğan, (2024), Ertan, (2024), Karataş and Karataş, (2024), Gültekin and Korkmaz, (2024), the reason for focusing only on title (TI) data is that titles are the sections that provide the most direct reference to the topic and reflect the main trends in the literature most accurately. Since titles are the elements that most clearly express the subject of a study, focusing on this area provides a clearer picture of the main themes in the literature, the main trends and new developments in the research area. Therefore, the choice of title (TI) data makes it possible to comprehensively analyze the literature and more accurately reflect the evolution of a particular field. In this context, studies with the word “Sport Technology Education” in the title were selected using the Web of Science database. This selection process was meticulously carried out in order to increase the accuracy of the analysis and to ensure that the data obtained best reflects the important themes of the field. The selected keywords provide in-depth information about the key issues and trends of this research and more clearly illustrate the evolution of the literature in the field.

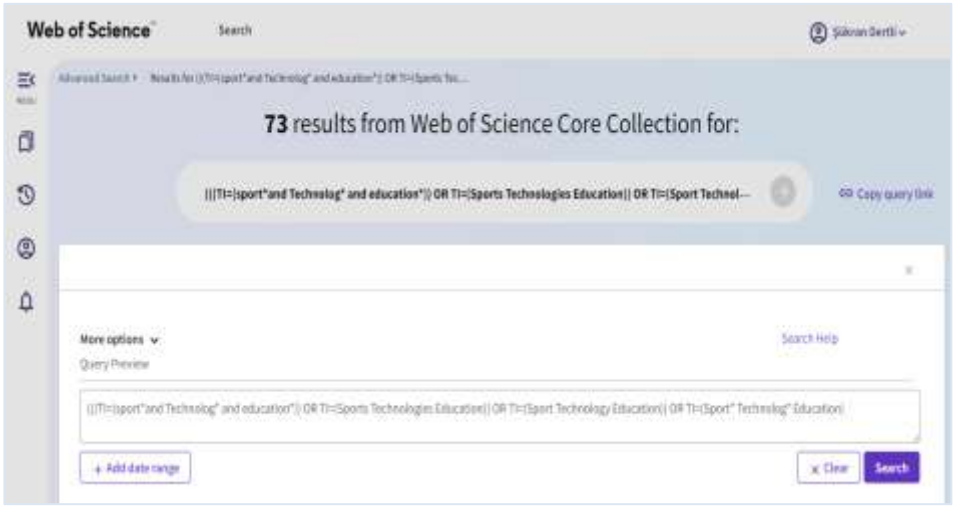

Figure 1. Citation report

In Figure 1, it is seen that data analysis was realized with 73 publications titled sport education technology.

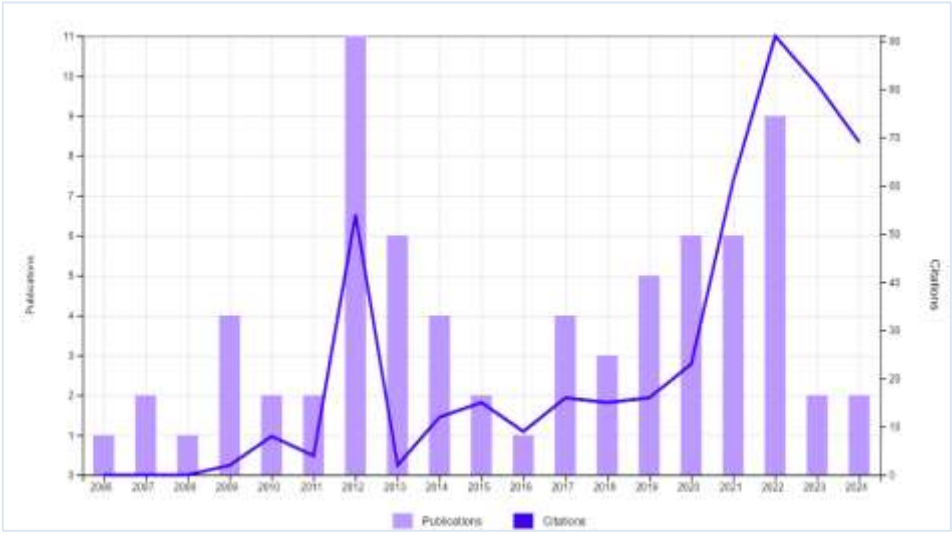

Figure 2. Distribution of citations and publications over time

Figure 2 shows that the publications titled sport education technology were prepared between 2006 and 2024. The findings obtained for these publications are as follows; 2006 (citation:0, publications:1), 2007 (citation:0, publications:2), 2008 (citation:0, publications:1), 2009 (citation:2, publications:4), 2010 (citation:8, publications:2), 2011 (citation:4, publications:2). 2012 (citation:54, publications:11), 2013 (citation:2, publications:6), 2014 (citation:12, publications:4), 2015 (citation:15, publications:2), 2016 (citation:9, publications:1), 2017 (citation:16, publications:4), 2018 (citation:15, publications:3). 2019 (citation:16, publications:5), 2020 (citation:23, publications:6), 2021 (citation:61, publications:6), 2022 (citation:91, publications:9), 2023 (citation:81, publications:2), 2024 (citation:69, publications:2).

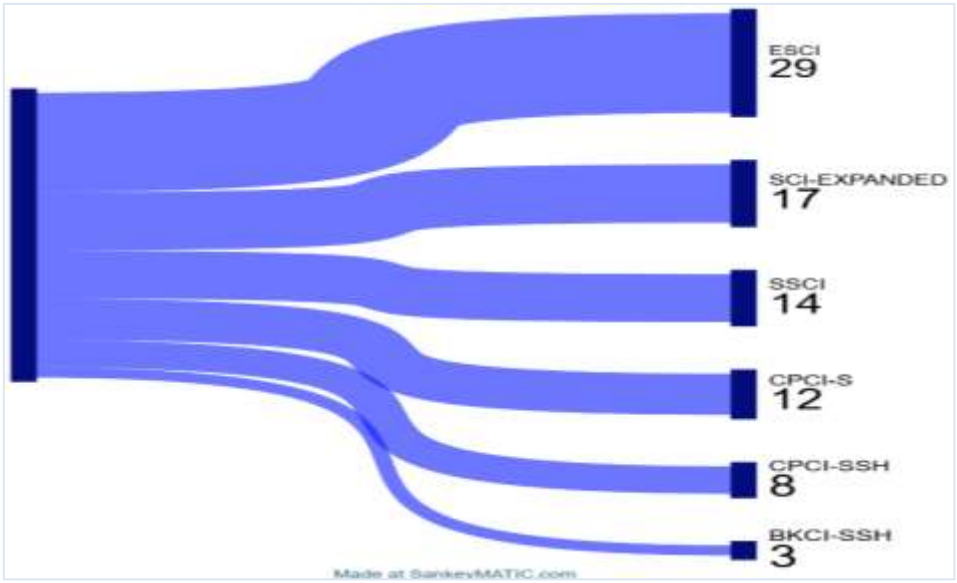

Figure 3. Distribution of Web of Science index

In Figure 3, it was found that the Web of Science indexes of the publications titled sport education technology were "ESCI (record count:29)", "SCI-EXPANDED (record count:17)", "SSCI (record count:14)", "CPCI-S (record count:12)", "CPCI-SSH (record count:8)", "BKCI-SSH (record count:3)".

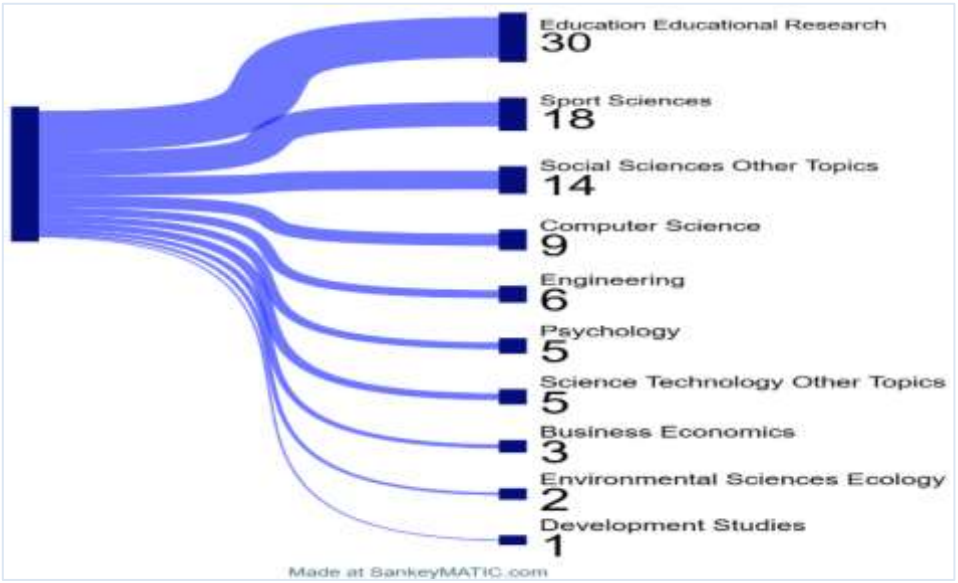

Figure 4. Distribution of research areas

In Figure 4, it is found that the research fields in the top 10 of the publications titled sport education technology are "education educational research (record count:30)", "sport sciences (record count:18)", "social sciences other topics (record count:14)", "computer science (record count:9)", "engineering (record count:6)", "psychology (record count:5)", "science technology other topics (record count:5)". "business economics (record count:5)", "environmental sciences ecology (record count:2)", "development studies (record count:1)".

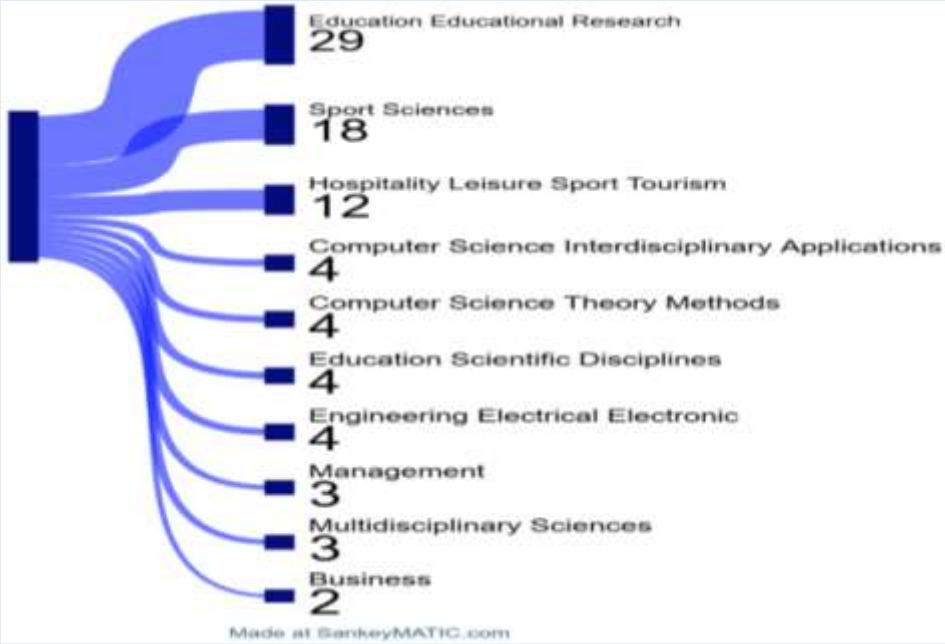

Figure 5. Distribution of Web of Science categories

Figure 5 shows that the top 10 Web of Science categories of publications titled sport education technology are "education educational research (record count:29)", "sport sciences (record count:18)", "hospitality leisure sport tourism (record count:12)", "computer science ınterdisciplinary applications (record count:4)", "computer science theory methods (record count:4)". "education scientific disciplines (record count:4)", engineering electrical electronic (record count:4)", "management (record count:3)", "multidisciplinary sciences (record count:3)", "business (record count:2)"

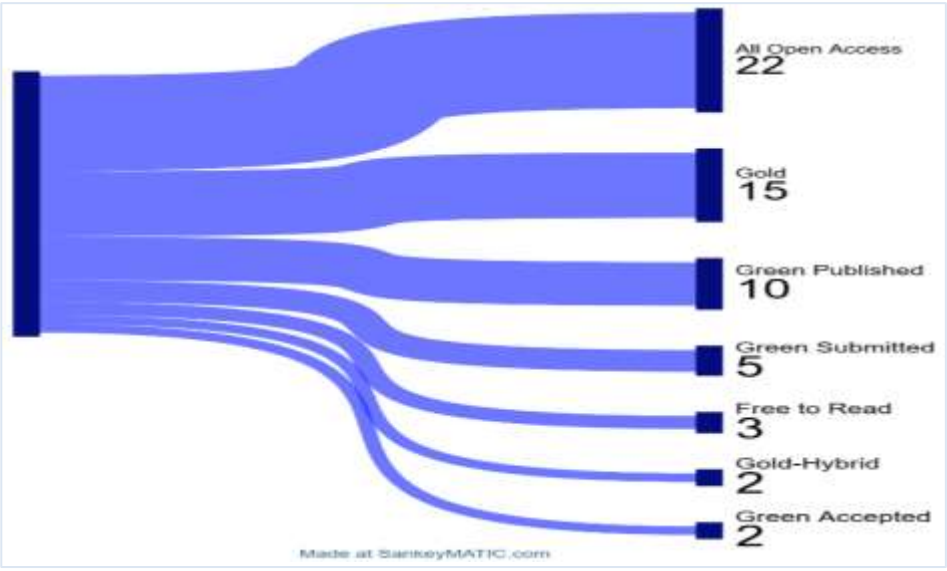

Figure 6. Distribution of open access

Figure 6 shows that the open access status of the publications titled sport education technology is "all open access (record count:22)", "gold (record count:15)", "green published (record count:10)", "green submitted (record count:5)", "free to read (record count:3)", "gold-hybrid (record count:2)", "green accepted (record count:22)".

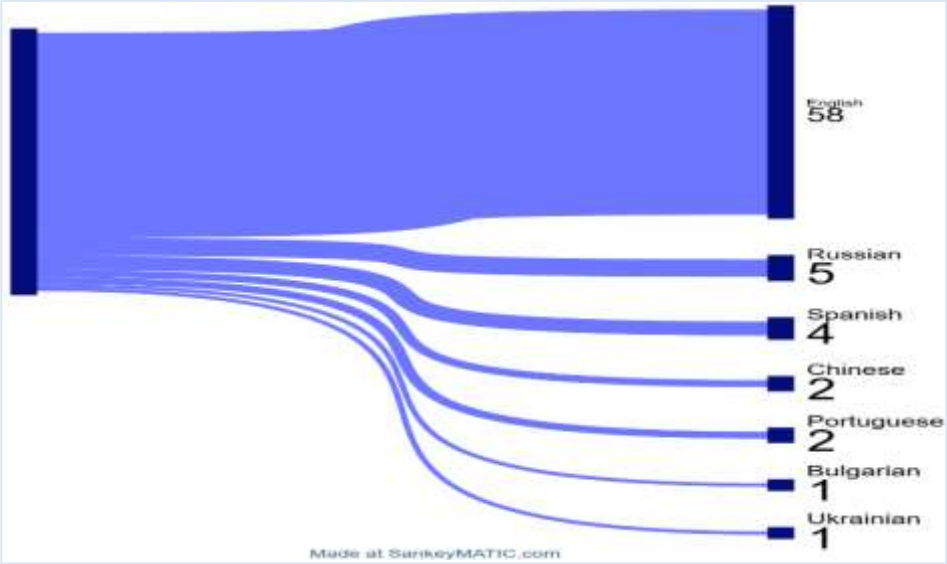

Figure 7. Distribution of languages

Figure 7 shows that the publication languages of the studies on sports education technology are “English (record count:58)”, “Russian (record count:5)”, “Spanish (record count:4)”, “Chinese (record count:2)”, “Portuguese (record count:2)”, “Bulgarian (record count:1)”, “Ukrainian (record count:1)”.

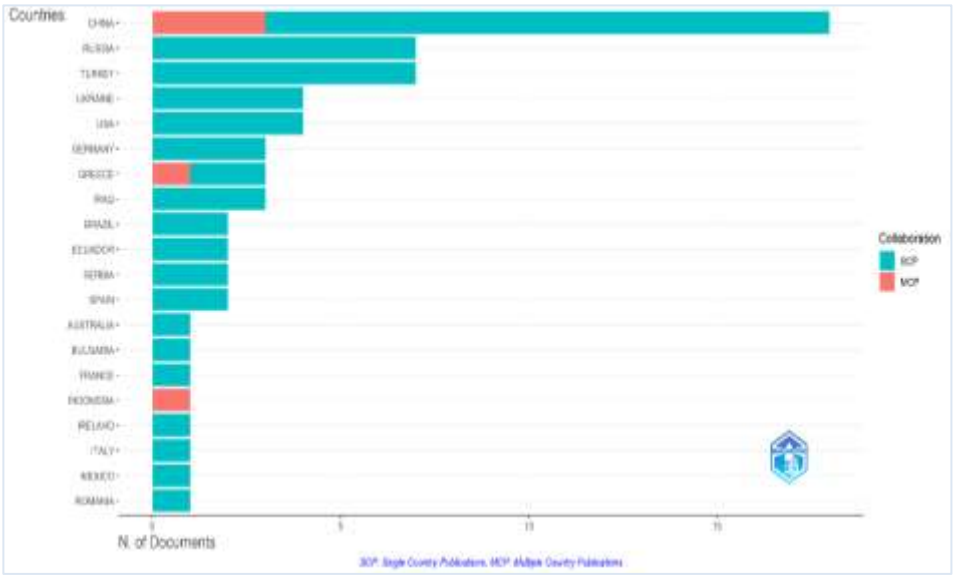

Figure 8. Distribution of corresponding author's countries

Figure 8 shows that the top 10 countries of the corresponding authors of the publications with the title of sport education technology are “China (articles:18, articles%:24.7, SCP:15, MCP:3, MCP%:16.7)”, “Russia (articles:7, articles%:9.6, SCP:7, MCP:0, MCP%:0)”, “Turkey (articles:7, articles%:9.6, SCP:7, MCP:0, MCP%:0)”. “Ukraine (articles:4, articles%:5.5, SCP:4, MCP:0, MCP%:0)”, “Usa (articles:4, articles%:5.5, SCP:4, MCP:0, MCP%:0)”, “Germany (articles:3, articles%:4.1, SCP:3, MCP:0, MCP%:0)”, “Greece (articles:3, articles%:4.1, SCP:2, MCP:1, MCP%:33.3)”. “Iraq (articles:3, articles%:4.1, SCP:3, MCP:0, MCP%:0)”, “Brazil (articles:2, articles%:2.7, SCP:2, MCP:0, MCP%:0)”, “Ecuador (articles:2, articles%:2.7, SCP:2, MCP:0, MCP%:0)”.

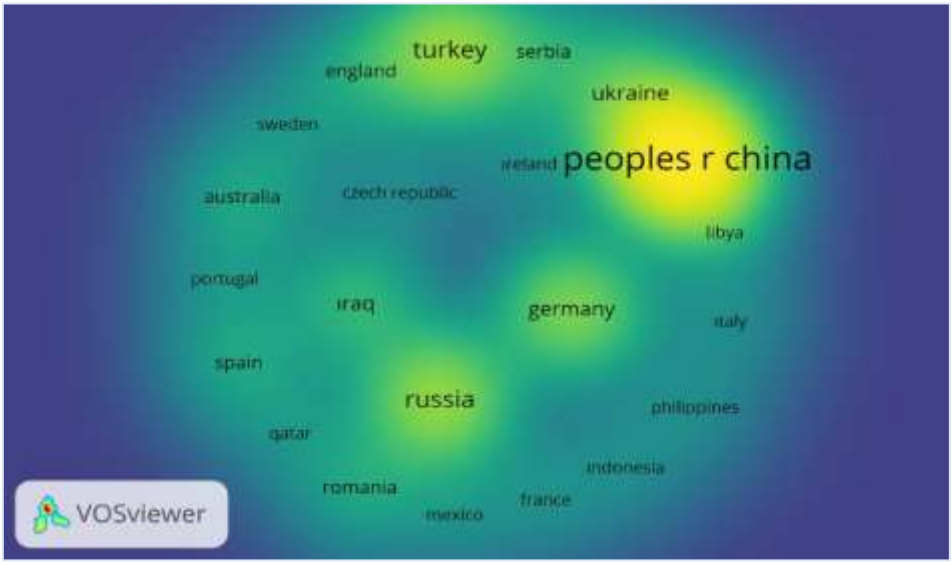

Figure 9. Distribution map of most cited countries

Figure 9 shows that the top 10 cited countries of the publications titled sport education technology are "Australia (citations:139)", "Indonesia (citations:138)", "Turkey (citations:78)", "Greece (citations:68)", "Peoples R China (citations:62)". "England (citations:36)", "Russia (citations:28)", "Phillipines (citations:24)", "Ukraine (citations:19)", "Czech Republic (citations:14)".

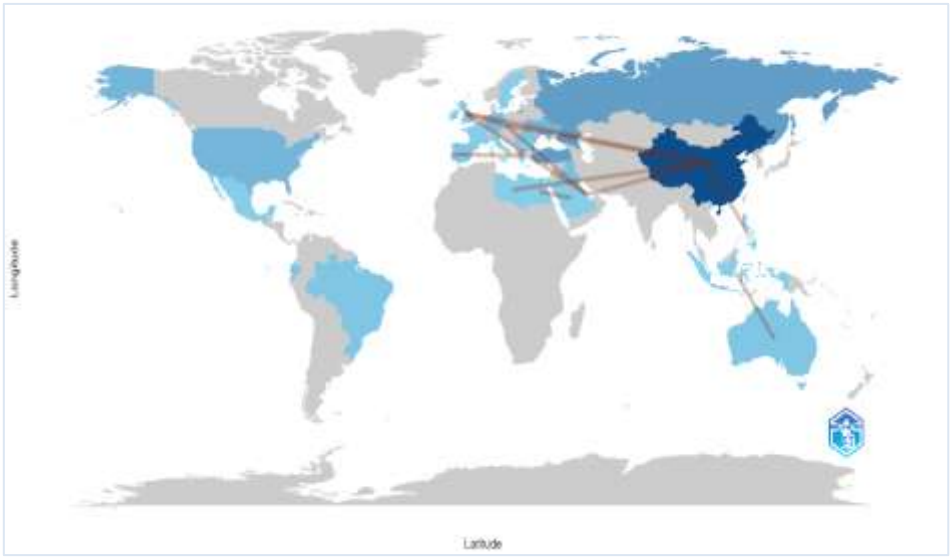

Figure 10. Distribution of countries' collaboration world map

Figure 10 shows that the publications with the title of sport education technology are "China and Czech Republic (frequency:1)", "China and Libya (frequency:1)", "China and Philippines (frequency:1)", "China and Qatar (frequency:1)". "China and United Kingdom (frequency:1)", "Czech Republic and Qatar (frequency:1)", "Egypt and Saudi Arabia (frequency: 1)", "Greece and Portugal (frequency: 1)". "Indonesia and Australia (frequency:1)", "United Kingdom and Czech Republic (frequency:1)", "United Kingdom and Qatar (frequency:1)".

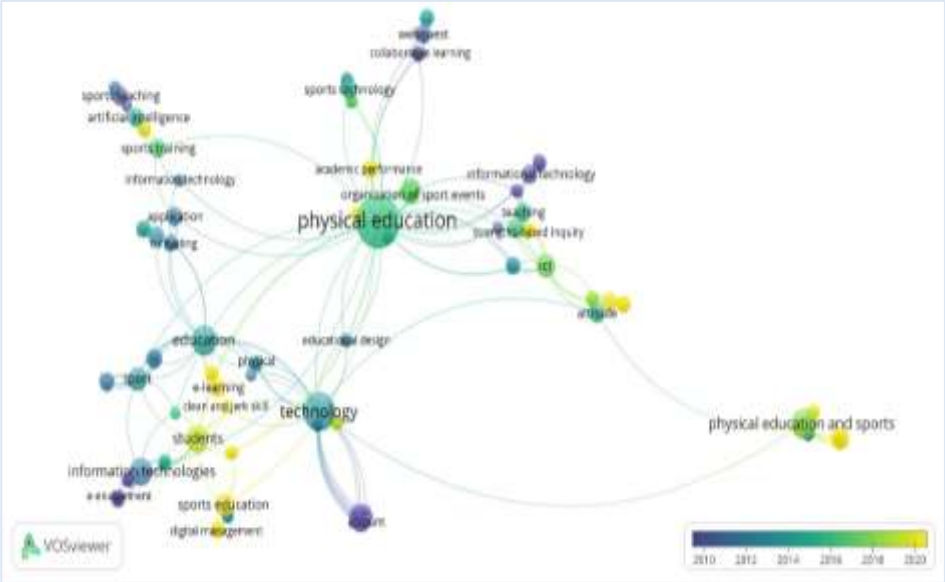

Figure 11. Distribution of co-occurence author keywords

In Figure 11, the co-author keywords in the top 10 of 154 items, 17 clusters, 438 links and 451 total link strength publications titled sport education technology are as follows: “Physical education (occurences: 15, total link strength: 50)”, “technology (occurences: 8, total link strength: 30)”, “education (occurences: 5, total link strength: 21)”. “physical education and sports (occurences: 5, total link strength: 16)”, “information technologies (occurences: 4, total link strength: 15)”, “students (occurences: 4, total link strength: 15)”. “sport (occurences: 3, total link strength: 15)”, “ıct (occurences: 3, total link strength: 15)”, “sports education (occurences: 3, total link strength: 11)”, “motivation (occurences: 2, total link strength: 10)”.

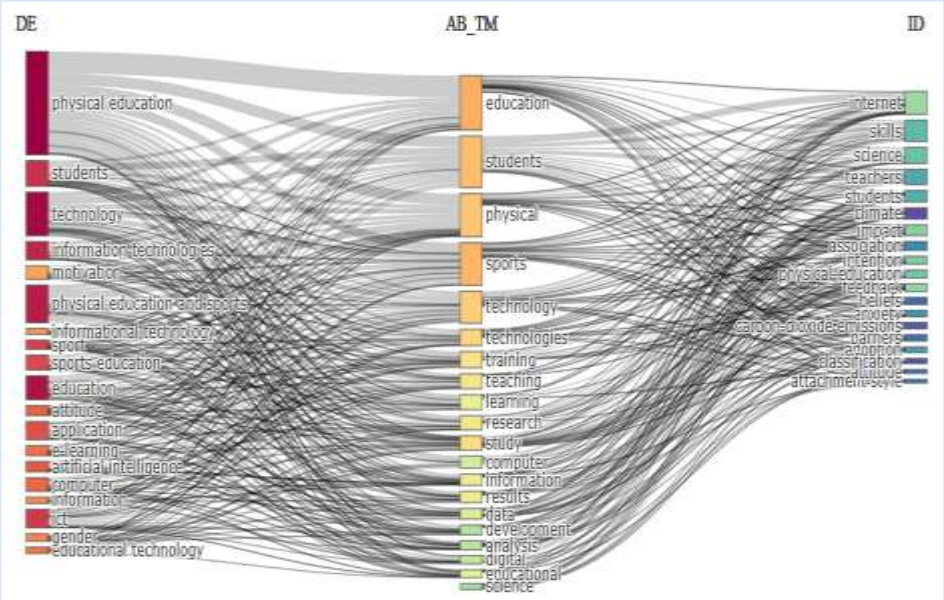

Figure 12. Distribution of three-field plot

In the three-field plot distribution created with abstract, keywords and keywords plus in Figure 12, it was found that sports education and technology are integrated with each other.

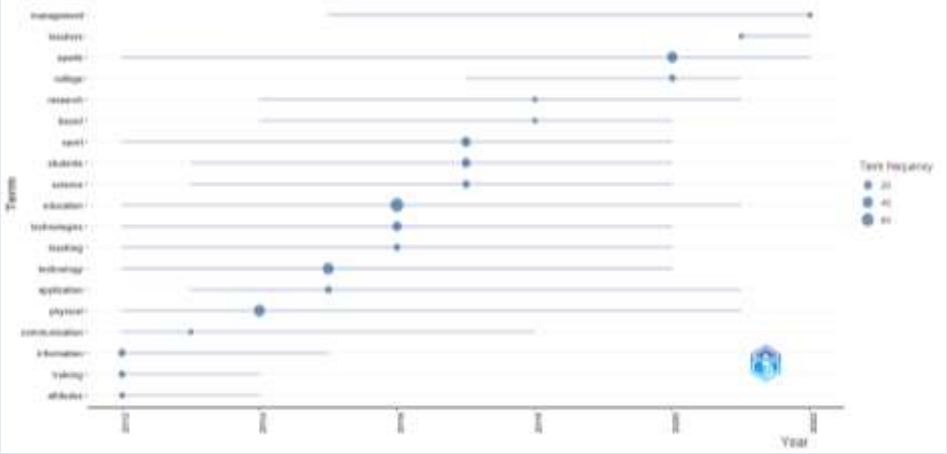

Figure 13. Distribution of titles according to trending topics

Figure 13 shows that the trending topics of the titles in the top 10 of the publications titled sport education technology are "education (frequency:76, year(Q1):2012, year(median):2016, year(Q3):2021)", "physical (frequency:46, year(Q1):2012, year(median):2014, year(Q3):2021)", "technology (frequency:43, year(Q1):2012, year(median):2015, year (Q3):2020)". "sports (frequency:40, year(Q1):2012, year(median):2020, year(Q3):2022)", "sport (frequency:27, year(Q1):2012, year(median):2017, year(Q3):2020)",

"Technologies (frequency:26, year(Q1):2012, year(median):2016, year(Q3):2022)", "students (frequency:24, year(Q1):2013, year(median):2017, year(Q3):2020)". "information (frequency:12, year(Q1):2012, year(median):2012, year(Q3):2015)", "science (frequency:11, year(Q1):2013, year(median):2017, year(Q3):2020)", "application (frequency:9, year(Q1):2013, year(median):2015, year(Q3):2021)".

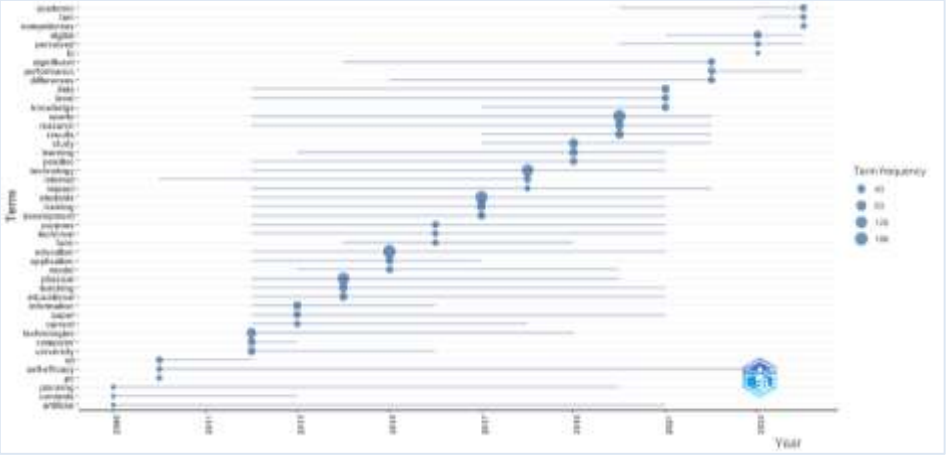

Figure 14. Distribution of abstracts according to trending topics

Figure 14 shows that the trending topics of the abstracts in the top 10 of the publications titled sport education technology are "education (frequency:162, year(Q1):2012, year(median):2015, year(Q3):2021)", "sports (frequency:146, year(Q1):2012, year(median):2020, year(Q3):2022)", "students (frequency:131, year(Q1):2012, year(median):2017, year(Q3):2021)".

"Physical (frequency:127, year(Q1):2012, year(median):2014, year(Q3):2020)", "technology (frequency:117, year(Q1):2012, year(median):2018, year(Q3):2021)", "technologies (frequency:60, year(Q1):2012, year(median):2012, year(Q3):2019)", "study (frequency:55,

year(Q1):2017, year(median):2019, year(Q3):2022)". "training (frequency:50, year(Q1):2012, year(median):2017, year(Q3):2021)".

"Teaching (frequency:44, year(Q1):2012, year(median):2014, year(Q3):2021)","research (frequency:43, year(Q1):2012, year(median):2020, year(Q3):2022)".

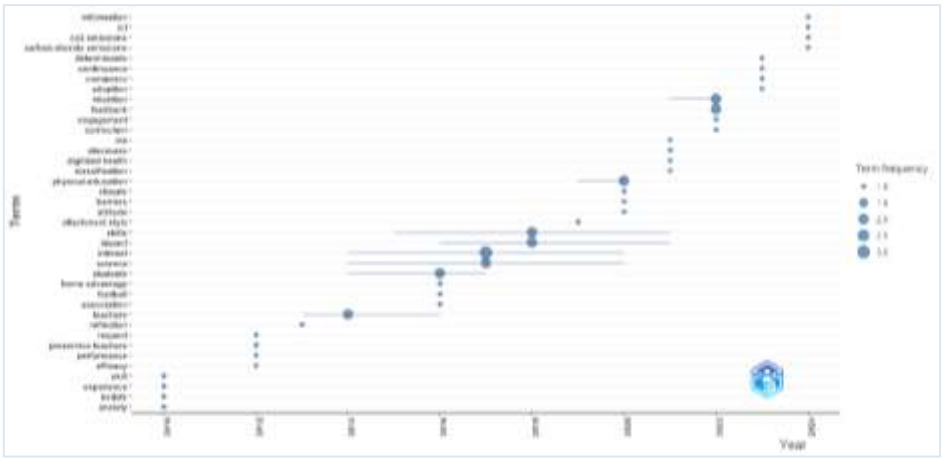

Figure 15. Distribution of keywords plus according to trending topics

Figure 15 shows that the Keywords plus trending topics in the top 10 of the publications titled sports education technology are "internet (frequency:3, year(Q1):2014, year(median):2017, year(Q3):2020)", "teachers (frequency:2, year(Q1):2013, year(median):2014, year(Q3):2016)","students (frequency:2, year(Q1):2014, year(median):2016, year(Q3):2017)", "science(frequency:2, year(Q1):2014, year(median):2017, year(Q3):2020)"."impact (frequency:2, year(Q1):2016, year(median):2018, year(Q3):2021)",

"skills (frequency:2, year(Q1):2015, year(median):2018, year(Q3):2021)", "physical-education (frequency:2, year(Q1):2019, year(median):2020, year(Q3):2020)","feedback (frequency:2, year(Q1):2022, year(median):2022, year(Q3):2022)". "intention(frequency:2, year(Q1):2021, year(median):2022, year(Q3):2022)", "anxiety (frequency:1, year(Q1):2010, year(median):2010, year(Q3):2010)".

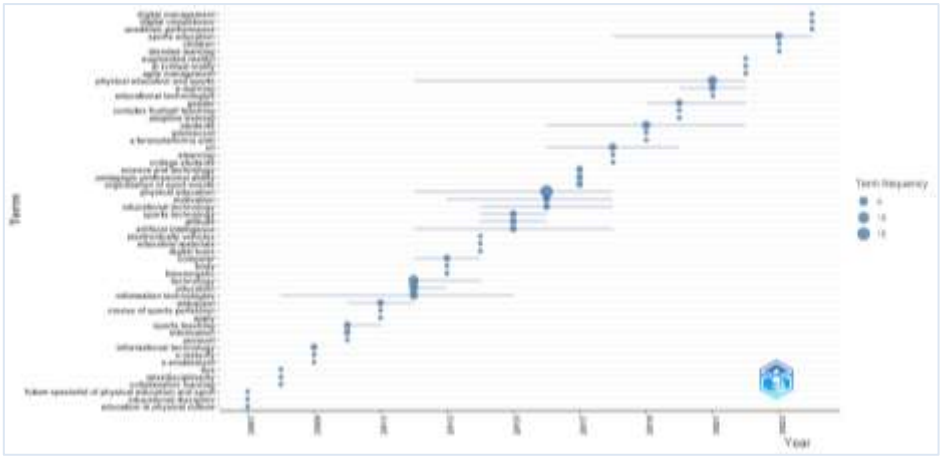

Figure 16. Distribution of author's keywords according to trending topics

Figure 16 shows that the author's keywords in the top 10 of the publications with the title "physical education (frequency:15, year(Q1):2012, year(median):2016, year(Q3):2018)", "technology (frequency:8, year(Q1):2012, year(median):2012, year(Q3):2014)", "education

(frequency:5, year(Q1):2012, year(median):2012, year(Q3):2013)", "physical education and sports (frequency:5, year(Q1):2012, year(median):2021, year(Q3):2022)",

"Information technologies (frequency:14, year(Q1):2008, year(median):2012, year(Q3):2015)", "students (frequency:4, year(Q1):2016, year(median):2019, year(Q3):2022)", "ict (frequency:4, year(Q1):2016, year(median):2018, year(Q3):2020)". "sports education (frequency:3, year(Q1):2018, year(median):2023, year(Q3):2024)", "informational technology (frequency:2, year(Q1):2009, year(median):2009, year(Q3):2009)", "information (frequency:2, year(Q1):2010, year(median):2010, year(Q3):2010)".

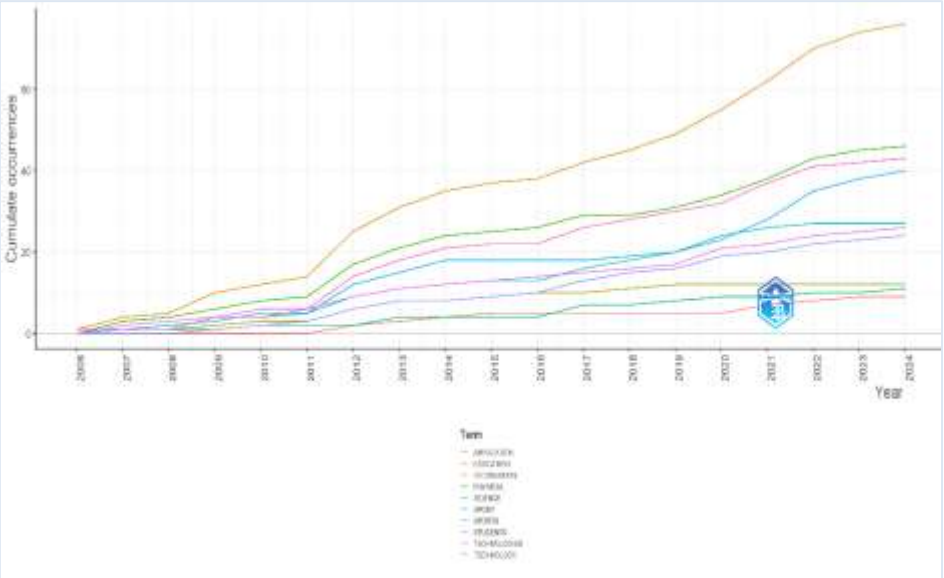

Figure 17. Frequency of words over time in titles

Figure 17 shows that the word frequency of the publications titled sport education technology increased after 2009.

Discussion and Conclusion

In this study, academic trends in the field of sport education technology are analyzed and gaps in the literature are revealed. There are some significant gaps in the literature on how technology can be used effectively in teaching processes and how pedagogical models can adapt to this technology integration. Sospedra Harding et al. (2020) emphasized that technology integration in physical education teaching should develop in line with pedagogical models. The study revealed that teachers and students need more training and development in the integration of digital tools and technologies into physical education lessons. The researchers stated that technology integration in education contributes to important issues such as combating physical inactivity and developing physical education skills. In this context, it is emphasized that supporting pedagogical approaches and teaching methodologies with digital tools is critical. However, more research on the alignment of technology integration in education with pedagogical models is needed and in-depth analyses of how technology use contributes to different aspects of education (learning, teaching, student engagement) are lacking. There are some important areas in the literature that could fill these gaps. More quantitative and qualitative studies are needed on teachers' attitudes towards digital tools and how these tools can be integrated into teaching methodologies. In addition, the number of studies evaluating the effectiveness of technology-supported learning processes should be increased. It can be stated that technology integration in education should be

emphasized more on its integration with pedagogical approaches and teaching methodologies by going beyond just an instrumental dimension. It is suggested that multidisciplinary research should be encouraged in how these literature gaps can be filled in future studies. Including more studies from different fields such as educational technologies, sport sciences and instructional sciences will increase the body of knowledge in this field and reveal more effective ways of technology integration in education. In particular, it is important to examine teachers' experiences in interacting with digital tools and analyze how pedagogical models align with these experiences. In conclusion, it can be stated that there is a need for more in-depth analysis on the relationship of technology integration with pedagogical models in studies conducted in the field of sport education technology, and these gaps should be filled in future research. Expanding the research in this field can enable both teachers and students to get more efficiency from the educational processes and contribute to the use of technology in education to become more effective.

The findings of this study provide important clues about academic developments in the field of sport education technology and basic knowledge in the literature. The data obtained draws attention to the current situation in this field, as well as certain directions for further research. Below, the results of the study and recommendations based on this information are presented.

The data analysis of 73 publications on sport education technology shows that academic interest in this field is increasing. When the distribution of publications between 2006 and 2024 is analyzed, a significant increase is observed as of 2012. This shows that after 2012, there is an increased interest in academic studies in this field. Especially the high number of citations of the publications made in 2021 and 2022 reveals that the importance of sports education technology is increasing. In the study conducted by Sarıipek and Hacıcaferoğlu (2024) on the concepts of physical education, sports education and disability, it was determined that most of the researches produced belonged to the year 2022 and the most citations belonged to the year 2024. It is seen that the majority of the publications are included in the “ESCI” index, followed by “SCI-EXPANDED” and “SSCI” indexes. This situation indicates that studies in the field of sport education technology have started to be recognized on the international platform. Yılmaz (2024) compared the effects of artificial ıntelligence and metaverse technologies in the field of Sports and Recreation, and found that the studies produced were mostly included in SCI-EXPANDED, SSCI and ESCI indexes. The findings obtained are in parallel with the findings obtained from this study.

It is seen that fields such as education and educational research, sports sciences, social sciences, computer sciences are intensively included in Web of Science categories. Therefore, it was concluded that educational research forms the basis of studies on sport education technology. This situation emphasizes the close relationship of sport education technology with both education and sport sciences. In all of these, it reveals that sports education technology is integrated with education. These findings are in line with the findings of Baytur and Ulaş’s (2022) study in the field of sports education.

Open access publications play an important role in increasing access to academic knowledge. Therefore, the high rate of open access publications increases the accessibility of information in this field and contributes to the dissemination of research. The fact that the majority of the publications are in English facilitates international access, while publications in languages such as Russian and Spanish show the interest in certain regions. The fact that China is the country that produces the most articles among the countries of the authors shows that academic studies in this field are concentrated in Asia. It is noteworthy that Turkey also has a significant share. The fact that Australia and Indonesia are among the most cited countries

reveals that these countries host important studies in sport education technology. Collaborations between countries are especially concentrated between China and other countries; this situation reveals that international cooperation and information sharing is increasing. This may be related to the national policies and investment priorities of these countries. China is thought to have invested heavily in sports and educational technologies in recent years. Similarly in Turkey, the growing interest in the development of physical education and sports technology may be supported by local policies and government-sponsored projects. It can also be argued that the cultural emphasis on the positive effects of sport on public health in these countries has increased interest in sport education technologies. China's emphasis on international collaborations may also have been instrumental in increasing the number of publications in this field by establishing strong links with the global academic community. In conclusion, this intensive production of publications in the field of sport education technology may be a reflection not only of national policies and investments, but also of cultural factors and international collaborations.

The co-occurrence of keywords clearly reveals the main themes and relationships of the studies on sport education technology. The use of keywords such as "physical education", "technology", "education" with high frequencies clearly reveals the themes that the studies focused on. In the three-field distribution created with "abstract", "keywords" and "keywords plus", the existence of the integration of sport education and technology is seen. Therefore, the three-field distribution reveals that the integration of sport education and technology is increasing. In all these cases, it is thought that it will form an important basis for future research. Topics such as education, physical education and technology constitute the main themes of the studies in this field. In this respect, the frequent occurrence of the words "education" and "sports" in the titles and abstracts of publications reveals that these fields are gaining more and more importance and research is concentrated in this direction.

Similarly, in the distribution of key topics, it is seen that key concepts such as "education" and "sports" have a high frequency. This reflects the increasing importance of technology in the field of sport education and how educational methodologies are shaped in this context. In particular, the frequency of "physical" and "technology" emphasizes the integration of technological innovations in sport education. Moreover, the presence of concepts such as "training" and "teaching" reveals how critical the technological tools used in teaching processes are for educators. The inclusion of concepts such as "internet" in the keyword trends indicates the role of digitalization in sport education. It is understood that the studies show a trend in how they adopt online educational applications and interactive platforms. Furthermore, the frequency of the words "teachers" and "students" provides important clues on how these studies influence the interaction between educators and students. The author's keywords likewise reveal the concentration of specific topics. The prominence of words such as "physical education" and "technology" indicate the main focal points in this field. In particular, the concept of "information technologies" reflects the prevalence of studies investigating the role of technology in education. The frequency of keywords over time shows an increase, especially after 2009. This indicates the development trends of sport education technology and the expansion of the research field. The trend words analyzed show that education and sport are at the forefront. These trends provide important guidance for future research.

Development trends in the field of sport education technology significantly influence educational approaches and research topics. It was concluded that "data analytics", "performance monitoring", "gamified learning", "multidisciplinary approaches", "student-centered education", "digitalization and online education" are the main development trends in

this field. These development trends in sport education technology show that the field is evolving dynamically. Educators and researchers should take these trends into account and update their educational methods and content to provide more effective and engaging learning experiences. In the future, it is expected that these trends will deepen further and major transformations will occur in the field of sport education with the integration of new technologies. Overall, this bibliometric study on sport education technology clearly reveals the dynamics and changing trends of the field. As the role of technology in education is increasing, it is expected that research on this subject will also diversify. Educators and researchers aiming to develop and implement more effective training methods using this data will increase the impact of technology in sport education. In the future, a more multidisciplinary approach to this field may contribute to the evolution of sport education technology. This bibliometric study reveals the current situation in the field of sport education technology. However, in order to further deepen and develop research in this field, the following suggestions can be made: Longer-term and comprehensive analyses of studies on sport education technology should be conducted. In this way, the evolution of trends over time can be better understood. Sport education technology is influenced by various disciplines. More interdisciplinary studies in fields such as education, sport science, engineering and psychology should be encouraged. In addition to quantitative data, an emphasis on qualitative research can provide more in-depth information about the applications and impacts of sport education technology.

Previous studies in the field of sport education technology have generally focused on technology integration and pedagogical models. However, there are limited studies in the literature on how technology integration can be more effectively combined with pedagogical methods. Although most of the existing studies address the applicability of sport education technologies and their integration into teaching processes, there are still gaps in how teachers and students can use these technologies more efficiently. To address these gaps, more quantitative and qualitative research on the integration of teaching methods and pedagogical models with technology is needed. Future studies provide an important opportunity to expand the application areas of educational technologies and explore pedagogical innovations in the field of sport education in more depth. Furthermore, increasing multidisciplinary research reflecting the evolving trends of sport education technology will help to fill the gaps in the field. In this study, sport education, development area, academic advances are analyzed and the stages in the literature are revealed. This research is an original study that investigates publications in the field of sport education technology by bibliometric analysis method. As a result of the related literature review, there is no study that examines the bibliometric analysis of publications titled sports education technology in WoS, which reveals the originality of this study. It also provides an understanding of the global and local dynamics of sport education technology by addressing various dimensions such as the content of publications, authors' countries and collaborations. In this case, it is thought to be a valuable reference source by making a significant contribution to the sport education technology literature.

Qualitative studies on user experiences, teaching methods and technology integration should be included. Research examining the impact of sport education technology on education systems and sport policies should be conducted. This can strengthen the link between academic knowledge and practical applications. Inter-country collaborations can contribute to the exchange of knowledge and experience in the field of sport education technology. It is important to develop international projects and establish joint research networks. Given the rapidly changing nature of technology, proactive research should be conducted to identify future trends in sport education technology. The impact of innovative technologies such as

artificial intelligence, virtual reality and distance learning should be explored. Since this study conducted a bibliometric analysis of the publications titled sport education technology in WoS, a broader literature analysis can be made by examining the keywords in Ts (subject, abstract, keywords) in the future. These recommendations can contribute to the progress of research in the field of sport education technology in a more systematic and effective way. It is thought that future studies will help this field to better explore its potential and expand its application areas. Future studies could use quantitative methods such as network analysis or qualitative research methods such as case studies. Network analysis can be a useful approach to study collaborations and interactions between different countries. Case studies can be used to gain an in-depth understanding of the impacts of sport education technology in the context of specific schools, educational institutions or sport organizations. Furthermore, examining the potential impact of new technological developments, innovations such as artificial intelligence (AI) and virtual reality (VR), Metaverse technology on sport education can help us understand how research topics and teaching practices in this field will be shaped. These technologies can both increase interactivity in education and transform teaching methods. However, in terms of theoretical frameworks, the use of models such as social learning theory or technology acceptance model can be useful to study the integration of sport education technology into teaching processes. These theories can provide a basis for understanding the impact of technology on teaching methods. In conclusion, it is considered that future research should focus on a set of new methodological approaches and theoretical frameworks that will allow it to better explore new trends in the field of sport education technology, taking into account the rapidly changing nature of technology. This will contribute to advancing the field in a more systematic way and will be an important step to better explore the potential of sport education technology.

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The Role of Emotional Intelligence in Athletes' Psychological Resilience: An Examination of Gender and Sport Type

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Abstract

The aim of this study is to examine the effect of emotional intelligence (EI) on psychological resilience (PR) and how this relationship varies in terms of gender and sport type. The research involved 354 student-athletes aged between 17 and 27, who are actively participating in sports clubs at various universities. Among the participants, 151 are female and 203 are male, with an average age of 21.31 years (SD = 2.71). Data were collected using the "Personal Information Form," the "Emotional Intelligence Scale," and the "Child and Youth Psychological Resilience Scale." Path analysis revealed that EI has a positive and significant effect on PR. Additionally, it was found that male athletes have higher levels of PR compared to female athletes, and team athletes exhibit higher PR than individual athletes. The interaction between gender and EI was also found to be significant, with this effect being more pronounced in female athletes. These findings suggest that EI is an important factor in enhancing athletes' PR, and that this effect may vary according to gender and sport type.

Keywords: Emotional Intelligence, Psychological Resilience, Gender Differences, Sport Type

Introduction

Nowadays, cognitive factors in the context of sports hold significant importance (Ubago-Jiménez et al., 2019). In the competitive realm of sports, the ability to regulate emotions (Dağ & Sarı, 2019) can influence athletic performance (Ubago-Jiménez et al., 2019). Goleman (1995) defines EI as the capacity to control one's own emotions, understand the emotions of others, and translate these emotions and thoughts into actions. The concept of EI is crucial for both amateur and professional athletes (Erbektaş et al., 2017), as athletes experience considerably higher levels of anxiety and stress during competitions, with emotional intensity far surpassing that of everyday life. Moreover, athletes frequently encounter psychological pressures during competitions—such as spectator expectations, adverse influences, and the impact of opponents—which necessitate that they manage their own emotions and comprehend those of others in order to achieve success (Yanar, 2017; Güler & Erhan, 2022). The primary objective of this study is to examine whether gender and sport type have moderating effects on the relationship between EI and PR.

Connor et al. (2003) and Dencla et al. (2020) defined PR as the ability to effectively adapt to significant challenges or to cope with stress. PR is a critical construct that not only enhances athletic performance and fosters valuable life skills (Mcmanama et al., 2021) but is also essential for building endurance—namely, for confronting challenges and demonstrating positive adaptation—which is crucial for athletes to achieve high levels of performance (Collins & Macnamara, 2012). When young athletes are able to adapt positively to the stressors inherent in their sport, they demonstrate an improved ability to respond to setbacks, obstacles, and failures (Galli & Gonzalez, 2014), transform challenges into opportunities for personal growth (Day & Wadey, 2017), and attain both athletic success (Remes et al., 2016) and psychological well-being (Nezhad & Besharat, 2010). In particular, increasing PR in young athletes is of paramount importance, as such efforts contribute not only to their athletic achievements (Fletcher & Sarkar, 2012) but also to their overall personal development. Consequently, this study is regarded as significant because it focuses on young athletes and aims to elucidate the relationship between EI and PR in this population. Furthermore, by examining the moderating effects of gender and sport type on the relationship between EI and PR, this research is expected to make a valuable contribution to the literature.

Athletes' mental resilience is positively and strongly associated with both EI and PR (Nicholls et al., 2009). It has been reported that, in both male and female athletes, increases in EI are accompanied by increases in mental resilience (Tavrah et al., 2016). In particular, female athletes have been found to exhibit higher levels of EI compared to male athletes; this enhanced EI is associated with a superior ability to evaluate emotions, regulate affect, and overall higher emotional competence (Yıldız et al., 2021; Austin et al., 2005; Yeniad, 2019). In individual athletes, EI has been shown to positively influence mental resilience (Orhan & Karagözoğlu, 2021), an effect that is believed to stem from the fact that individual athletes assume full responsibility for themselves, compete in isolation, and must confront challenges alone (Salar et al., 2012; Bahadır & Adiloğulları, 2020). Moreover, it has been suggested that an improvement in skiers' mental skill capacities is accompanied by an increase in EI (Azimkhani, 2014), and that combat sport athletes exhibit higher levels of PR compared to

team sport athletes (Reche-Garcia et al., 2020). In the context of sports, EI has been found to affect performance and psychological skills both directly and indirectly (Dağ & Sarı, 2019); athletes with high EI tend to demonstrate their performance more effectively (Petrides & Furnham, 2000), and according to Cowden (2016), EI contributes positively to athletes' mental resilience.

It is hypothesized that in this study, EI will have a positive effect on PR, and that this relationship will be moderated by gender and sport type. The research model is illustrated in Figure 1.

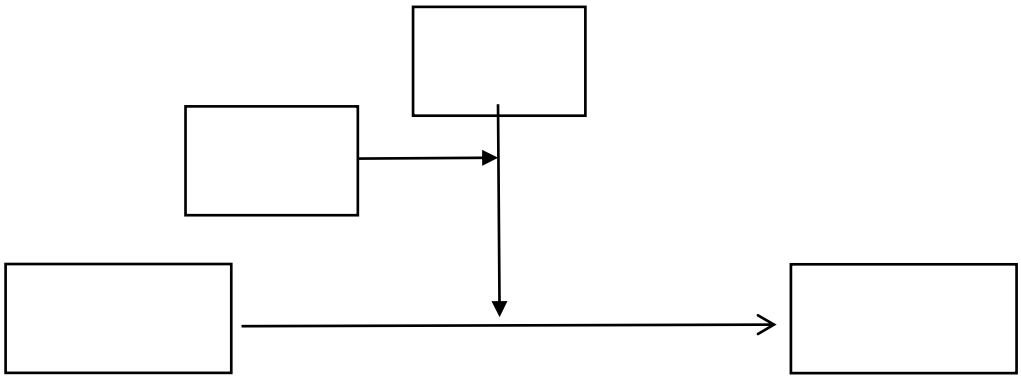

Figure 1. Research Model

Material and Method

Study Group and Procedure

This study was conducted with 354 student-athletes aged between 17 and 27 who were actively involved in university sports clubs. Participants were included in the study on a voluntary basis. Among the participants, 151 (42.7%) were female, and 203 (57.3%) were male, with a mean age of 21.31 (SD = 2.71). Prior to the commencement of the study, ethical approval was obtained from the relevant university's ethics committee, and the data collection process was carried out online via Google Forms. All participants were informed about the study, and their voluntary participation was explicitly stated in written form. Data collection was facilitated through communication with team coaches from various universities. Demographic information of the participants is presented in Table 1. This study was approved by the Ethics Committee of Batman University with the decision dated 31/10/2024 and numbered 08/19.

In the study, the sample size was determined using the R software, and a power analysis was conducted with the pwr package. With a 99% confidence level ($\alpha = 0.01$), 95% power ($1-\beta$), a medium effect size ($f^2 = 0.10$), and 3 independent variables ($u = 3$), the calculation indicated that at least N = 232 participants were required. Based on this recommendation, the ideal number of participants for the study was determined to be 354.

Table 1. Frequency and Percentage Distributions of Participants' Personal Information

		N	%
Gender	Female	151	42.7
	Male	203	57.3
Sport Type	Individual sports	133	37.6
	Team sports	221	62.4
Sporting Experience	1-2 years	75	21.2
	3-4 years	124	35
	5-6 years	89	25.2
	7 years or more	64	18.1
Total		354	100

Data Collection Tools

The data for the study were collected using the "Personal Information Form," the "Emotional Intelligence Scale," and the "Child and Adolescent Psychological Resilience Scale."

Emotional Intelligence Scale

To assess the EI levels of the participants, the Emotional Intelligence Scale developed by Lee & Kwak, (2012) and adapted into Turkish by Kayıhan & Arslan, (2016) was used. The scale consists of 20 items and 3 factors (Emotional Understanding, Emotional Facilitation, Emotional Regulation). A five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) was used for each of the 20 items. The reliability coefficients for the internal consistency of the scale were calculated as follows: Emotional Understanding = 0.79, Emotional Facilitation = 0.73, and Emotional Regulation = 0.85.

Child and Adolescent Psychological Resilience Scale

To measure the PR of the participants, the 12-item Child and Adolescent Psychological Resilience Scale developed by (Liebenberg et al., 2013) and adapted into Turkish by (Arslan, 2015) was used. The scale follows a five-point Likert format, ranging from "Completely Describes Me (5)" to "Does Not Describe Me at All (1)." Higher scores indicate a higher level of resilience. The reliability coefficient for the internal consistency of the scale was calculated as 0.89.

Data Analysis

After the data were transferred to a computer environment, the necessary assumptions for the analyses were examined. To check whether the data met the univariate normality assumption, the skewness and kurtosis values were calculated. The reference range for skewness and kurtosis values was set to ±2.00 for all data in the study (George & Mallery, 2019). To determine the significance of the variables in the study, standardized factor values (Standardized β) and their corresponding z-values were used. The bootstrap technique was applied to confirm whether the relationships between variables were statistically significant (Preacher & Selig, 2012).In this study, 5,000 resampling iterations were performed, and the analysis was calculated with a 95% confidence interval (MacKinnon et al., 2004).

For the statistical analysis of the data obtained for the study, SPSS and R software packages were used. Additionally, for the multiple regression analysis conducted in R, the "lavaan," "semPlot," and "pwr" packages were employed.

Findings

The correlations for the variables and additional descriptive statistics are provided in Table 1. It was determined that all relationships between the variables in the current study were statistically significant and that the skewness and kurtosis values fell within the recommended reference values, thus meeting the univariate normality assumption (see Table 1).

Table 1. Correlation Matrix and Descriptive Statistics

	Mean	**Sd.**	**1**	**2**	**3**	**4**
1.Gender	--	--	--			
2.Sport Type	--	--	-0.9	--		
3.Psychological Resilience	3.81	0.80	0.352**	-0.214**	--	
4.Emotional Intelligence	3.55	0.68	0.283**	-0.350**	.431**	--
Skewness	--	--	--	--	-.929	-.874
Kurtosis	--	--	--	--	.244	.952

Note: *N* = 354; *Sd.*= Standard deviation; **p< .01, *p<.05.

To determine the causal relationship between EI and PR among student-athletes, a path analysis was conducted using the "lavaan" package. The results of the analysis are presented in Table 2.

Table 2. Path Analysis Results

					%95 CI	
Variables	**B**	**Sd.**	**CR(z)**	**p**	**LL**	**UL**
Direct Effects						
EI → PR	0.255**	0.063	4.022	<.001	0.131	0.379
G → PR	0.220**	0.047	4.658	<.001	0.127	0.312
ST → PR	-0.250**	0.042	-5.916	<.001	-0.333	-0.167
Interaction Effects						
ST × G → PR	0.024	0.043	0.559	.576	-0.061	0.109
ST × EI → PR	0.053	0.059	0.902	.367	-0.062	0.169
G × EI → PR	-0.152*	0.060	-2.527	.012	-0.270	-0.034
ST × G × EI → PR	-0.099	0.058	-1.712	.087	-0.212	0.014

Note: N = 354; *p < .05, **p < .01, β: Standardized effect. EI = Emotional Intelligence, PR = Psychological Resilience, G = Gender, ST = Sport Type. Gender is coded as 0 = Female, 1 = Male. Sport Type is coded as 0 = Individual Sport, 1 = Team Sport.

Upon reviewing Table 2, a positive and statistically significant relationship was found between EI and PR (b = 0.255, p < .001), indicating that individuals with higher EI exhibited higher levels of PR. The main effect of gender on PR was found to be significant (b = 0.220, p

< .001), with male athletes demonstrating higher levels of PR compared to their female counterparts. However, the interaction between sport type and gender did not have a significant effect on PR (b = 0.024, p = .576). Similarly, the interaction between sport type and EI did not significantly impact PR (b = 0.053, p = .367). In contrast, the interaction between gender and EI was found to be statistically significant (b = -0.152, p = .012), suggesting that the influence of EI on PR differed by gender, with the effect being stronger for females than for males (Figure 1). When examining the three-way interaction, it was determined that the interaction between sport type, gender, and EI did not significantly affect PR (b = -0.099, p = .087).

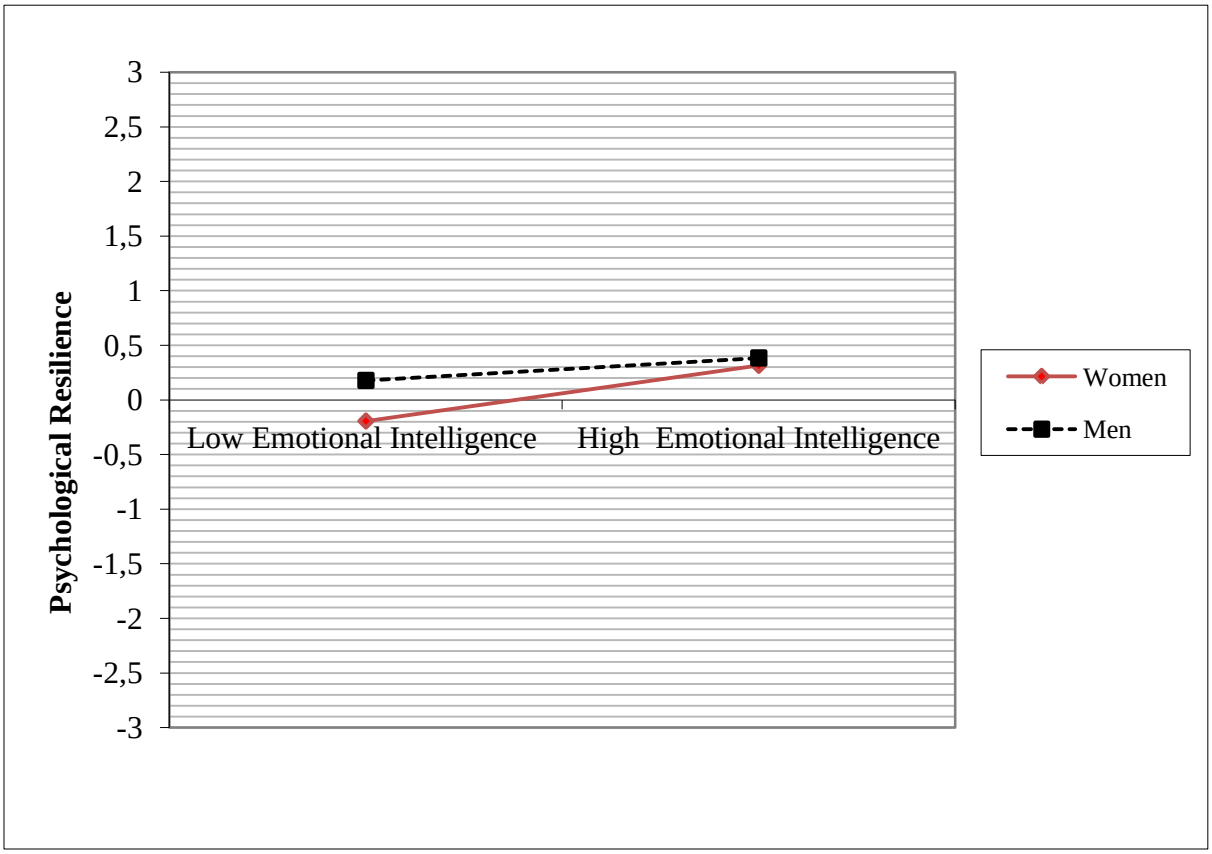

Figure 1. Visualizing the Gendered Effects of EI on PR

Additionally, a negative and statistically significant relationship was found between sport type and PR (b = -0.250, p < .001), indicating that team athletes have lower levels of PR compared to individual athletes. The overall explanatory power of the model was calculated to be R^2 = 0.350, meaning that the independent variables accounted for 35% of the variance in PR.

Discussion and Conclusion

This study examines the impact of emotional intelligence, gender, and sport type on PR in student-athletes. The findings particularly highlight the determining role of EI on PR. The positive effect of EI on PR is consistent with previous studies and suggests that EI enhances individuals' ability to cope with stress (Akbari & Khormaiee, 2015; Kökçam et al., 2022). Young athletes with high EI are better able to recognize their own emotions, which allows

them to identify negative emotional states such as stress and anxiety early and develop strategies to cope with them (Abualruz et al., 2024) . Additionally, athletes with high EI not only understand, manage, and use their own emotions but also those of others, helping them cope with stress, maintain high motivation, and build positive relationships with teammates (Humphrey, 2013; Kökçam et al., 2022). Good cohesion within a team may lead to the enhancement of athletes' PR.

A significant effect of gender on PR was found, with male athletes demonstrating higher levels of PR compared to female athletes. This finding is consistent with meta-analytic studies in the sport psychology literature (Gök & Yılmaz Koğar, 2021). The greater competitive experience of male athletes, their upbringing in social norms that encourage risk-taking, and the differences in their stress coping strategies may explain this result (Smyth & Sweetman, 2015). However, some studies suggest that female athletes can also demonstrate high PR by effectively utilizing EI and social support mechanisms (Hoar et al., 2010).

The negative effect of sport type on PR suggests that individual athletes may be more psychologically vulnerable. This result can be attributed to the nature of individual sports, where athletes may feel isolated in both success and failure, social support mechanisms tend to be more limited compared to team sports, and they are forced to cope with stress factors alone (Andersen et al., 2018). The literature indicates that individual athletes experience more difficulties in stress management compared to team athletes, and this can negatively impact their PR (Darongkamas et al., 2011).

On the other hand, team athletes may benefit from greater group support and collective coping strategies, which can help mitigate the effects of stress (Johnston et al., 2021). However, individual athletes' development of greater self-discipline and their ability to demonstrate resilience based on intrinsic motivation can, in some cases, provide an advantage in terms of PR (León-Guereño et al., 2020).

Another important finding of the study is that the interaction effect between gender and EI on PR is significant and negative. This suggests that EI plays a more decisive role in enhancing PR for female athletes. When female athletes develop their emotional intelligence, they can more effectively utilize their coping skills to manage stress (Enns et al., 2018; Ogińska-Bulik, 2005) thereby increasing their PR. The lower impact of EI for male athletes may indicate that they rely on different mechanisms to cope with stress (e.g., problem-focused coping strategies or individual coping methods instead of social support) (Gök & Yılmaz Koğar, 2021; Graves et al., 2021). This finding suggests that emotional intelligence-based interventions may be particularly effective in enhancing the PR of female athletes.

However, the lack of significant interactions between sport type, gender, and EI suggests that these variables should be evaluated independently. It appears that neither sport type (team or individual), gender, nor EI interacts to create an effect on PR. This finding may indicate that individual differences (such as personality traits, experiences, and support systems) could be more decisive in the development of PR (Hirano, 2020).

Recommendations and Limitations

This study demonstrates that emotional intelligence, gender, and sport type are critical factors in enhancing PR in student athletes. It has been found that athletes with higher EI exhibit greater PR. This finding emphasizes the need to incorporate psychological training programs that develop emotional awareness, self-regulation, and interpersonal skills for athletes. The higher PR of male athletes compared to female athletes suggests that gender is an important variable in sport psychology. This indicates the need to develop specialized programs aimed at strengthening coping mechanisms for female athletes. The lower PR of individual athletes shows that more support should be provided in their stress management and resilience-building processes. Coaches and sport psychologists can offer mental training, emotion regulation exercises, and stress management programs to enhance athletes' EI (Houghton et al., 2011; Thomas & Zolkoski, 2020). Stronger social support mechanisms and training programs to increase PR can be developed for female athletes (Fiorilli et al., 2019). Cognitive-behavioral therapy (CBT) and meditation-based techniques could be recommended to help individual athletes improve their stress-coping skills (Lau et al., 2017). Since the study uses a cross-sectional design, causal relationships cannot be definitively determined. Future research should investigate the relationships between emotional intelligence, PR, and gender using longitudinal designs. The impact of cultural factors on PR should be explored further. Comparing studies conducted in different countries could provide a broader perspective on the effects of gender and EI (Raghavan & Sandanapitchai, 2024).

This study revealed that the effect of EI on PR is more pronounced in female athletes compared to male athletes. Additionally, it was observed that team sports provide more support for athletes' PR compared to individual sports, and male athletes have higher levels of PR than female athletes. These findings highlight the important role that gender and sports type play in understanding and supporting athletes' psychological endurance. Future research can further explore the effects of these factors on PR, enabling the development of more effective strategies for enhancing psychological well-being in the context of gender and sports type.

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Investigation Of The Effects Of Lower Extremity Massage Performed Before Oraining On Flexibility In Volleyball Players

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Abstract

Investigation of the Effects of Lower Extremity Massage Performed Before Training on Flexibility in Volleyball Players.This study aimed to investigate the effects of lower extremity massage performed before training on flexibility in volleyball players. The participants were 12 athletes from the Gümüşsu Gümüşhanespor volleyball team, divided into two groups: an experimental group (6 athletes) receiving massage and a control group (6 athletes) without massage. Pre-test and post-test flexibility measurements were taken using a Digital Flexion Meter device over a 4-week period. Statistical analysis was conducted using SPSS, with significance set at $p<0.05$.The results showed that the experimental group had higher flexibility post-test scores compared to the control group. In the 3rd and 4th flexibility measurements, significant differences were found between the two groups. Within the experimental group, flexibility improved significantly from pre-test to post-test, as shown by the Wilcoxon Signed-Rank Test and Dependent Samples t-test results.Overall, the study concluded that lower extremity massage before training significantly improves flexibility in volleyball players. The post-test flexibility scores of the experimental group were higher than their pre-test scores, and their flexibility was superior to the control group's results. These findings are valuable for coaches, athletes, and sports scientists, contributing to performance criteria in volleyball.

Keywords: Volleyball, Massage, Flexibility, Lower Extremity

Introduction

Volleyball is a sport in which aerobic and anaerobic energy systems are used together, requiring the use of both aerobic and anaerobic systems as needed during the match (Thissen-Milder & Mayhew,1991). Additionally, several motor skills are used in connection with these energy systems. To mention the general structure and rules of volleyball, volleyball is a game played by two teams of six players each on a court 9 meters wide and 18 meters long, with a net in the middle of the court. The primary objective in volleyball is to score points by making the ball touch the ground on the opponent's side of the court. The secondary objective is to win the set, and ultimately, the match (Çelenk, 2013).

Massage, deriving its meaning from the Greek "massein" and the Hebrew "mashesh," is generally interpreted as touching, stroking, and kneading. Massage is a science that provides physical and psychological relaxation by stimulating muscles with mechanical movements (Gürkan, Dalbudak, Bakır, Bakır, Dinç, 2018). Sports massage is a sub-discipline of general massage theories, specifically targeting the muscular structure of athletes to facilitate warm-up, prevent cooling, and accelerate recovery after matches and training sessions. Sports massage combines traditional massage techniques with knowledge of human anatomy and muscle structure to enhance athlete performance, facilitate warming up, accelerate recovery after matches and training, and prevent cooling (Gürkan et al., 2018).

In addition to the general definition of massage, massage manipulations are also important. These include Stroking, Kneading, Friction, Percussion, and Vibration manipulations. Stroking, also known as Effleurage, is the foundation of massage manipulations. It is known as the preparation application of massage and is applied as both the first and last technique of massage. Its purpose is to prepare and warm up the target muscle tissue and muscle groups. Kneading, also known as Petrissage, is squeezing in circular or S-shaped movements by taking the target muscle tissue into the palm. Friction manipulation is the oldest massage technique that increases blood flow in the skin and warms tissues superficially by increasing tissue heat. Friction manipulation is applied to heal fibrous tissue, commonly known as knots, and edema formed forms under the skin. Percussion, also known as Tapotement, is the technique of hitting or beating, called tapping and hammering in our language. Percussion manipulation is performed with appropriate intensity on target muscle tissue with the palm, outer side of the little finger, and different regions of the hand. Vibration manipulation is the last of the classic massage techniques and is called the vibration technique. It involves tremor movements that occur when the hand touches the body. When the vibration technique is performed with sufficient hardness and duration, it creates some reflex physiological effects (Yüksel, 2007).

Flexibility refers to the ability of joints and joint groups connected to these joints to operate at the widest possible angle during a movement. In other words, it is the capacity of the joints and joint groups required to move at the most appropriate angle during the performance of a movement (Bisanz & Gerisch,1993). In the classification of flexibility, two headings come to

the fore. The first is "Flexibility According to Force Use," and the second is "Flexibility According to Application Form" (Ölmez, 2023).

"Flexibility According to Force Use" is divided into two parts: "Active Flexibility" and "Passive Flexibility." Active Flexibility involves the efforts and efforts of the athlete himself to perform movements and exercises. For example, an athlete reaching reaches his toes without any external support. Passive Flexibility involves the athlete performing movements and exercises with the help of a partner or a tool. For example, a partner supporting supports the athlete's toes while reaching them (Ölmez, 2023).

"Flexibility According to Application Form" is also divided into two parts: Dynamic Flexibility and Static Flexibility. Dynamic Flexibility involves performing loading movements with a specific rhythm. Small rhythmic loading movements are made at the end of flexibility. For example, the athlete continuously reaches his toes in a rhythmic manner rhymatically reaches his toes and adjusts his body position, repeating these movements in series. Static Flexibility maintains joint openness for a certain period. The basic principle of flexibility exercises performed by the athlete is stability. For example, the athlete reaches his toes and holds the ankle for a while. In this case, the stability of the ankle joint is ensured. The flexibility of the lower extremities, which are the support system in human life and sports branches, plays a critical role in success and health. For this reason, exercises should be done for the flexibility of the lower extremities. For the flexibility of the lower extremities, exercises to be performed with the legs and ankles should be known. These exercises should be performed with equipment such as cones, bars, ropes, and stairs. An individual should stretch the lower extremities up to a certain period to reduce tension and warm them up. To use just to maintain balance, the massage should be used for the feet as well (Ölmez, 2023).

Material and method

Digital Flexion Meter elasticity measuring device

Fotoğraf 1. Digital Flexion Meter elasticity measuring device

The Measurement Chart

The 'Measurement Chart,' created by the researcher, was designed to gather information on the physical characteristics of athletes and their family structures within the scope of the research subject. It includes age, height, weight, age of starting sports, and measurement results.

Photograph

Measurements with participants were meticulously recorded. During measurements, participants were informed with their consent, and this process was documented with photographic records. Images created by the researcher and participants during flexibility measurement and massage application added visual richness to the study.

Research Group

The population of the study consists of all volleyball players, and the sample group (research group) consists of the players of the Gümüşsu Gümüşhanespor Volleyball A Team, which competes in the Turkish Volleyball 1st League. The research group consists of 12 athletes. The researchers voluntarily participated in the study. The athlete group was divided into two groups: an experimental group (6 athletes) and a control group (6 athletes), and both groups were maintained until the end of the process. The experimental group received a 5-minute general massage to the lower extremities (legs) after the pre-test before warm-up, and post-test measurements were taken after the massage. The control group did not receive any massage, and only pre-test and post-test measurements were taken.

Validity and Reliability of Data Collection Tool

Various studies demonstrate the reliability of the 'Digital Flexion Meter' device in flexibility measurement.

In this study, athletes' flexibility measurements were conducted using the 'Digital Flexion Meter' device with the Standard Reach Test method. This test protocol has high validity and reliability in assessing flexibility in the back and leg regions (Holtvd., 1999).

Studies have yielded results regarding the use of the 'Digital Flexion Meter' device (Holt, Pelham, Burke, 1999; Perret, Poiraudeau, Fermanian, Colau, Benhamou, Revel, 2001).

Data Collection Process

The data collection process consisted of a single stage spanning 4 weeks. Initial measurements were taken from athletes before warm-up, followed by a five-minute massage on the lower extremities for a group of six participants without warming up, and then second measurements were taken. The control group underwent pre-tests on each measurement day without any massage and was kept active (engaged in specific games such as volleyball with a ball) without cooling down, followed by final test measurements along with the experimental group's final tests. The process was planned for 4 weeks with measurements taken once a week. The measurement days were as follows: 31.01.2023, 07.02.2023, 14.02.2023, 21.02.2023. The total measurement period was planned over 4 weeks with measurements taken once a week.

Data Analysis

In this study, the effects of lower extremity massage before training on flexibility in volleyball players were investigated, and necessary parameters were measured. The obtained data were analyzed using the SPSS for Windows 22.0 software package.

In the first step, the experimental and control groups were evaluated as independent groups, and it was aimed to determine whether there were differences in pre-test and post-test flexibility scores between the experimental and control groups (independent groups). Therefore, to select the test, it was evaluated whether the variables exhibited normal distribution using the Kolmogorov-Smirnov and Shapiro-Wilk tests. According to the test results, it was observed that pre-test and post-test flexibility scores exhibited normal distribution in the experimental and control groups. Independent Samples t-test was applied for comparison of independent groups.

In the second step, pre-test and post-test flexibility scores were evaluated as dependent groups, and it was examined whether the difference between pre-test and post-test flexibility scores exhibited normal distribution, which is one of the assumptions of dependent group tests, using the Kolmogorov-Smirnov and Shapiro-Wilk tests. According to the test results, it was observed that 1st flexibility scores did not exhibit normal distribution in the experimental group. Therefore, the Wilcoxon Signed Rank Test was used to compare pre-test and post-test scores. 1st, 2nd, 3rd, and 4th flexibility pre-test and post-test scores exhibited normal distribution in the control group. Therefore, the Dependent Samples t-test was used to compare pre-test and post-test scores.

In all current tests, the error rate was set at $\alpha=0.05$, and differences between comparisons were considered statistically significant when $p<0.05$. Ms-Excel 2010 and IBM SPSS Statistics 22.0 software were preferred for statistical analysis and calculations.

Table 4. Normality Test for Pre-Test and Post-Test Scores of Flexibility in the Control and Experimental Groups (1st, 2nd, 3rd, and 4th Tests)

			Kolmogorov-Smirnov			Shapiro-Wilk		
Group	**Test**		**Statistic**	**sd**	**p**	**Statistic**	**sd**	**P**
Control	**Pre-test**	1. Flexibility	0,277	6	0,168	0,832	6	0,112
		2. Flexibility	0,217	6	0,200	0,868	6	0,218
		3. Flexibility	0,226	6	0,200	0,877	6	0,255
		4. Flexibility	0,279	6	0,160	0,807	6	0,068
	Post-test	1. Flexibility	0,246	6	0,200	0,844	6	0,142
		2. Flexibility	0,195	6	0,200	0,903	6	0,392

		3. Flexibility	0,232	6	0,200	0,856	6	0,175
		4. Flexibility	0,257	6	0,200	0,810	6	0,073
Experiment	**Pre-test**	1. Flexibility	0,200	6	0,200	0,939	6	0,651
		2. Flexibility	0,216	6	0,200	0,930	6	0,580
		3. Flexibility	0,240	6	0,200	0,870	6	0,227
		4. Flexibility	0,254	6	0,200	0,787	6	0,045
	Post-test	1. Flexibility	0,149	6	0,200	0,990	6	0,989
		2. Flexibility	0,255	6	0,200	0,913	6	0,453
		3. Flexibility	0,259	6	0,200	0,882	6	0,279
		4. Flexibility	0,288	6	0,131	0,807	6	0,068

In Table 4, it was examined whether the variables exhibit normal distribution, and it was determined that the pre-test and post-test scores of the control group showed a normal distribution ($p > 0.05$).

Similarly, it was found that the pre-test and post-test scores of the experimental group also exhibited normal distribution ($p > 0.05$).

Table 7. Normality Testing of the Differences Between Pre-Test and Post-Test Scores for Flexibility in Control and Experimental Groups for 1st, 2nd, 3rd, and 4th Measurements.

		Kolmogorov-Smirnov			**Shapiro-Wilk**		
Group		**Statistic**	**df**	**p**	**Statistic**	**df**	**P**
Control	1. Flexibility Pre-test-Post-test	0,147	6	0,200	0,984	6	0,971
	2. Flexibility Pre-test-Post-test	0,311	6	0,071	0,830	6	0,108
	3. Flexibility Pre-test-Post-test	0,252	6	0,200	0,916	6	0,480
	4. Flexibility Pre-test-Post-test	0,193	6	0,200	0,957	6	0,794
Experiment	1. Flexibility Pre-test-Post-test	0,438	6	0,001	0,568	6	<0,0001
	2. Flexibility Pre-test-Post-test	0,187	6	0,200	0,939	6	0,647
	3. Flexibility Pre-test-Post-test	0,231	6	0,200	0,902	6	0,387
	4. Flexibility Pre-test-Post-test	0,281	6	0,150	0,863	6	0,201

In Table 7, the normality of the variables was examined. It was found that the control group's pre-test and post-test scores for flexibility in the 1st, 2nd, 3rd, and 4th measurements displayed normal distribution ($p > 0.05$).

However, the experimental group's 1st measurement pre-test and post-test scores did not show normal distribution ($p < 0.05$). For the 2nd, 3rd, and 4th measurements, the experimental group's pre-test and post-test scores demonstrated normal distribution ($p > 0.05$).

Findings

Table 1. Descriptive Statistics of Participants' Demographic Characteristics

	Control		Experiment	
	Min. / Max.	**Avr.±SS**	**Min. / Max.**	**Avr.±SS**
Age	17,0 / 36,0	25,17±6,55	22,0 / 39,0	29,50±6,41
Age of starting sports	6,0 / 18,0	11,33±4,63	10,0 / 17,0	13,00±2,45
Height (cm)	179,0 / 197,0	191,00±6,48	184,0 / 202,0	193,67±6,35
Weight (kg)	78,0 / 90,0	83,17±5,15	80,0 / 103,0	88,67±8,73
BKİ (wg / hg^2)	20,51 / 27,15	22,88±2,36	20,8 / 30,4	23,76±3,48

In Table 1, the average age of the control group is 25.17±6.55 years, while the average age of the experimental group is 29.50±6.41 years.

The average age for starting sports in the control group is 11.33±4.63 years, and in the experimental group, it is 13.00±2.45 years.

The average height of the control group is 191.00±6.48 cm, and the average height of the experimental group is 193.67±6.35 cm.

The average weight of the control group is 83.17±5.15 kg, while the average weight of the experimental group is 88.67±8.73 kg.

The average BMI of the control group is 22.88±2.36 kg/m², and the average BMI of the experimental group is 23.76±3.48 kg/m².

Table 2. Frequency and Percentage Values of Participants' BMI and Massage Application

		Control	Experiment
BKİ	**Normal**	5 (%83,3)	5 (%83,3)
	Owerweight	1 (%16,7)	-
	Obesity class1	-	1 (%16,7)
	Total	6 (%100)	6 (%100)
Massage Aplication	**5 minutes**	-	6 (%100)

In Table 2, it is observed that in the control group, 83.3% of participants are in the normal weight category and 16.7% are overweight, while in the experimental group, 83.3% are in the normal weight category and 16.7% are classified as grade 1 obese.

In the experimental group, all participants received a massage application for 5 minutes (100%), while no massage application was performed in the control group.

Table 3. Descriptive Statistics of Pre-Test and Post-Test Scores for Flexibility in the Control and Experimental Groups (1st, 2nd, 3rd, and 4th Tests)

		Control		Experiment	
		Min./ Max.	**Avr.±SS**	**Min. / Max.**	**Avr.±SS**
Pre-test	1. Flexibility (cm)	-7,9 / 5,4	0,03±6,00	-5,4 / 20,6	4,90±9,56
	2. Flexibility (cm)	-5,6 / 6,6	1,53±5,34	-5,4 / 20,8	5,70±8,68
	3. Flexibility (cm)	-6,4 / 6,2	0,62±5,30	1,5 / 18,4	7,08±6,38
	4. Flexibility (cm)	-4,6 / 5,7	1,47±4,74	2,3 / 18,6	6,87±6,13
Post-test	1. Flexibility (cm)	-7,7 / 5,2	0,05±5,68	-4,1 / 22,9	9,02±9,44
	2. Flexibility (cm)	-4,7 / 7,2	1,78±4,95	-0,5 / 24,3	9,13±8,61
	3. Flexibility (cm)	-5,6 / 6,0	0,98±5,04	3,3 / 19,9	9,10±6,39
	4. Flexibility (cm)	-4,0 / 6,1	1,75±4,67	3,8 / 22,8	9,62±6,90

In Table 3, the average score for the 1st flexibility pre-test in the control group is 0.03±6.00 cm, while in the experimental group it is 4.9±9.56 cm.

For the 2nd flexibility pre-test, the average score in the control group is 1.53±5.34 cm, and in the experimental group, it is 5.7±8.68 cm.

The average score for the 3rd flexibility pre-test in the control group is 0.62±5.30 cm, while in the experimental group it is 7.08±6.38 cm.

For the 4th flexibility pre-test, the average score in the control group is 1.47±4.74 cm, and in the experimental group, it is 6.87±6.13 cm.

Overall, it was found that the participants in the experimental group had higher levels of flexibility in the 1st, 2nd, 3rd, and 4th tests during the pre-test.

In the post-test, the average score for the 1st flexibility test in the control group is 0.05±5.68 cm, while in the experimental group it is 9.02±9.44 cm.

For the 2nd flexibility post-test, the average score in the control group is 1.78±4.95 cm, and in the experimental group, it is 9.13±8.61 cm.

The average score for the 3rd flexibility post-test in the control group is 0.98±5.04 cm, while in the experimental group it is 9.10±6.39 cm.

For the 4th flexibility post-test, the average score in the control group is 1.75±4.67 cm, and in the experimental group, it is 9.62±6.90 cm.

Overall, it was found that the participants in the experimental group had higher levels of flexibility in the 1st, 2nd, 3rd, and 4th tests during the post-test.

Table 5. Comparison of Pre-Test and Post-Test Scores for Flexibility by Group (1st, 2nd, 3rd, and 4th Tests)

		Control (n=6)	Experiment (n=6)	Group Comparison
		Avr.±SS	Avr.±SS	
Pre-test	1. Flexibility (cm)	0,03±6,00	4,90±9,56	t=1,056; p=0,316
	2. Flexibility (cm)	1,53±5,34	5,70±8,68	t=1,002; p=0,340
	3. Flexibility (cm)	0,62±5,30	7,08±6,38	t=1,909; p=0,085
	4. Flexibility (cm)	1,47±4,74	6,87±6,13	t=1,707; p=0,119
Post-test	1. Flexibility (cm)	0,05±5,68	9,02±9,44	t=1,994; p=0,074
	2. Flexibility (cm)	1,78±4,95	9,13±8,61	t=1,813; p=0,100
	3. Flexibility (cm)	0,98±5,04	9,10±6,39	t=2,442; p=0,035
	4. Flexibility (cm)	1,75±4,67	9,62±6,90	t=2,314; p=0,043

In Table 5, an Independent Samples t-test was conducted to determine whether there were differences in pre-test and post-test flexibility levels between the groups. The results showed no significant differences in the 1st, 2nd, 3rd, and 4th flexibility pre-test levels between the experimental and control groups ($p > 0.05$).

It was found that the differences in the 1st and 2nd flexibility post-test levels between the experimental and control group scores were not significant ($p > 0.05$).

However, the differences in the 3rd and 4th flexibility post-test levels between the experimental and control group scores were significant ($p < 0.05$). In light of these findings, it can be stated with 95% confidence that the 3rd and 4th flexibility post-test scores of the experimental group are higher than those of the control group.

Table 6. Descriptive Statistics of the Differences Between Pre-Test and Post-Test Scores for Flexibility in Control and Experimental Groups for 1st, 2nd, 3rd, and 4th Measurements.

	Control		Experiment	
	Min./ Max.	Avr.±SS	Min. / Max.	Avr.±SS
1. Flexibility Pre-test-Post-test (cm)	-0,9 / 0,8	-0,02±0,58	-18,0 / -0,6	-4,12±6,82
2. Flexibility Pre-test-Post-test (cm)	-0,9 / 0,7	-0,25±0,67	-4,9 / -1,4	-3,43±1,31
3. Flexibility Pre-test-Post-test (cm)	-0,8 / 0,2	-0,37±0,33	-3,0 / -1,2	-2,02±0,73

4. Flexibility Pre-test-Post-test (cm)	-0,6 / 0,1	-0,28±0,25	-4,2 / -1,2	-2,75±1,20

In Table 6, the mean difference between pre-test and post-test scores for flexibility is -0.02±0.58 cm for the control group and -4.12±6.82 cm for the experimental group in the 1st measurement.

For the 2nd measurement, the mean difference is -0.25±0.67 cm for the control group and -3.43±1.31 cm for the experimental group.

In the 3rd measurement, the mean difference is -0.37±0.33 cm for the control group and -2.02±0.73 cm for the experimental group.

Finally, in the 4th measurement, the mean difference is -0.28±0.25 cm for the control group and -2.75±1.20 cm for the experimental group.

Table 8. Comparison of Pre-Test and Post-Test Scores for Flexibility in Control and Experimental Groups for the 1st Measurement.

	Pre-test	**Post-test**	**Difference**	**Group Comparison**
	Medyan (IQR)	**Medyan (IQR)**	**Medyan (IQR)**	
Control	2,00 (11,95)	2,05 (11,40)	0,00 (0,88)	Z=0,105; p=0,916
Experiment	3,55 (16,93)	8,55 (15,00)	1,30 (5,17)	Z=2,207; p=0,027

In Table 8, the Wilcoxon Signed-Rank Test was applied to determine the difference between pre-test and post-test flexibility levels in the control group. The results showed that there was no statistically significant difference between the 1st pre-test and post-test scores ($p > 0.05$).

In the experimental group, the Wilcoxon Signed-Rank Test was also used to assess the difference between pre-test and post-test flexibility levels, and it was found that the difference between the 1st pre-test and post-test scores was statistically significant ($p < 0.05$). These results indicate with 95% confidence that the massage application was effective for the 1st flexibility level among the participants in the experimental group.

Table 9. Comparison of Pre-Test and Post-Test Scores for Flexibility in the Control Group for 2nd, 3rd, and 4th Measurements.

Control	**Pre-test**	**Post-test**	**Difference**	**Group Comparison**
	Avr.±SS	**Avr.±SS**	**Avr.±SS**	

2. Flexibility	1,53±5,34	1,78±4,95	0,25±0,67	t=0,908; p=0,406
3. Flexibility	0,62±5,30	0,98±5,04	0,36±0,33	t=2,750; p=0,040
4. Flexibility	1,47±4,74	1,75±4,67	0,28±0,25	t=2,795; p=0,038

In Table 9, a Dependent Samples t-test was applied to determine the differences between pre-test and post-test flexibility levels for the 2nd, 3rd, and 4th measurements in the control group. It was found that the difference between the pre-test and post-test scores for the 2nd flexibility was not statistically significant ($p > 0.05$).

For the 3rd and 4th flexibility measurements, a Dependent Samples t-test was conducted, and it was determined that the difference between the pre-test and post-test scores was statistically significant ($p < 0.05$). Additionally, it was observed that the post-test scores for the 3rd and 4th flexibility were higher than the pre-test scores. These results suggest that the training and competitions conducted throughout the season had a positive impact on flexibility development.

Table 10. Comparison of Pre-Test and Post-Test Scores for Flexibility in the Experimental Group for 2nd, 3rd, and 4th Measurements.

Experiment	Pre-test	Post-test	Difference	Group Comparison
	Ort.±SS	Ort.±SS	Ort.±SS	
2. Flexibility	5,70±8,68	9,13±8,61	3,43±1,31	t=6,415; p=0,001
3. Flexibility	7,08±6,38	9,10±6,39	2,02±0,73	t=6,813; p=0,001
4. Flexibility	6,87±6,13	9,62±6,90	2,75±1,20	t=5,600; p=0,003

In Table 10, a Dependent Samples t-test was applied to determine whether there were differences between pre-test and post-test flexibility levels for the 2nd, 3rd, and 4th measurements in the experimental group. The results showed that the differences between the pre-test and post-test scores for the 2nd, 3rd, and 4th flexibility measurements were statistically significant ($p < 0.05$). It was also observed that the post-test scores for the 2nd, 3rd, and 4th flexibility were higher than the pre-test scores. This finding indicates with 95% confidence that the massage application was effective.

Discussion

As a result of the literature review, a limited number of studies have been found that investigate the effects of lower extremity massage applied to volleyball players on flexibility parameters. Based on this, our study is planned to examine the effects of massage on flexibility in volleyball players.

In this section, the findings obtained will be compared with the results of various studies in the existing literature. Subheadings include demographic characteristics and the results of statistical comparisons of flexibility measurement outcomes.

higher. This is likely due to the Gümüşsu Gümüşhanespor volleyball team athletes having a higher starting age, greater experience, and older average age within the player group.

Statistical Comparison of Flexibility Measurement Results

In this section, we will compare and evaluate the flexibility measurement results obtained from our research, focusing on both inter-group (between control and experimental groups) and intra-group (within the experimental or control group) comparisons.

Table 3 shows that, in the pre-test, participants in the experimental group had higher flexibility levels (1st, 2nd, 3rd, and 4th) compared to the control group. The mean score for the 1st flexibility level in the control group was 0.05±5.68 cm, while in the experimental group, it was 9.02±9.44 cm. In the post-tests, the flexibility levels of the experimental group participants remained higher for levels 1, 2, 3, and 4. These results indicate that the flexibility parameter showed positive and significant improvement in the experimental group compared to the control group, likely due to the independent variable identified, which is the massage application.

Table 5 presents the results of an Independent Samples t-test conducted to determine whether there were significant differences in flexibility levels (pre-test and post-test) between groups. The results indicated that there were no significant differences in the scores for levels 1, 2, 3, and 4 in the pre-test ($p>0.05$). Additionally, no significant differences were found for levels 1 and 2 in the post-test ($p>0.05$). However, significant differences were found for levels 3 and 4 in the post-test ($p<0.05$), suggesting that the experimental group's scores for these levels were higher than those of the control group. Therefore, the significant difference in scores for levels 3 and 4 indicates that the massage application positively affected flexibility.

In summary, while the massage did not lead to significant changes in the 1st and 2nd flexibility measurements, it proved to be more effective during the subsequent 3rd and 4th measurements when combined with previous applications.

Table 8 shows that the Wilcoxon Signed-Rank Test was applied to determine whether there is a difference between the pre-test and post-test flexibility levels in the control group, and it was found that the difference between the pre-test and post-test scores of the first flexibility test was not statistically significant ($p>0.05$). In the experimental group, the Wilcoxon Signed-Rank Test was applied to determine whether there is a difference between the pre-test and post-test flexibility levels of the first flexibility test, and it was found that the difference between the pre-test and post-test scores was statistically significant ($p<0.05$). The higher post-test scores compared to the pre-test scores in the experimental group suggest that the massage application was effective. According to the data obtained from Table 8, it was

determined that the massage applied after the first flexibility pre-test in the experimental group was effective based on the post-test data.

In Table 10, the paired t-test was applied to determine whether there is a difference between the pre-test and post-test flexibility levels in the experimental group for the second, third, and fourth flexibility tests, and it was found that the differences between the pre-test and post-test scores were statistically significant ($p<0.05$). The higher post-test scores compared to the pre-test scores in the experimental group for the second, third, and fourth flexibility tests suggest that the massage application was effective.

Koçak et al. (2005) conducted a study investigating the effect of massage on flexibility in 16-18-year-old football players, and according to the results obtained, they concluded that combining training with massage would be more effective than training alone. The findings from our study parallel the results of Koçak et al. (2005).

In another study, the values obtained from the sit-and-reach test with massage application were compared with the values obtained from the treatment without massage. After treatment without massage, no changes were observed in some subjects, while significant improvements in sitting and reaching abilities were observed in subjects after treatment with massage application (Crosman, Chateauvert, Weisberg, 1984). The findings from our study are in parallel with the study conducted by Crosman, Chateauvert, and Weisberg (1984).

In a study conducted on 10 patients with chronic active and passive movement disorders in the knee joint, it was reported that massage performed with friction manipulation applied three times a week provided improvements in the range of motion in the knee joint (Fehan, 1990). The findings from our study are in parallel with the study conducted by Fehan (1990).

In another study conducted on 20 female students from Ondokuz Mayıs University Yaşar Doğu Faculty of Sports Sciences, the participants' pre-tests were taken, followed by a 30-minute leg and back massage, after which their post-tests were taken. According to the results obtained, the flexibility data measured after the massage were higher than those measured before the massage. It was concluded that massage improves flexibility, meaning it has positive effects on the range of motion of the joints (Atan, 2020). The findings from our study are in parallel with those of Atan (2020).

In a study conducted by Abanoz, Beyleroğlu, Şahin, and Çelik (2018), the effects of local sports massage applied before warm-up on various performance values in football players were examined. According to the results of this study, it was stated that local sports massage performed before training or competition had a negative effect on vertical jumping but positive effects on flexibility. The findings of our study show similarities in a compatible way with the study by Abanoz et al. (2018).

In another study, well-trained female volleyball players were divided into control, 30-second foam roller, and 60-second foam roller exercise groups. The results of the research indicated that both foam roller exercises (30 seconds and 60 seconds) had positive and significant

effects on hip flexibility values (Ali, 2019). The findings from our study are in parallel with those of Ali (2019).

In the study by Işık et al. (2017), the effects of different modalities on the flexibility of the hamstring muscle group were investigated. In this study, one group was subjected to stretching exercises only, another group was subjected to both stretching and massage, and the last group was subjected to heat application and stretching exercises together. The massage was applied by a trained physiotherapist for an average of 9-12 minutes. According to the results obtained, it was stated that the massage caused small changes in static stretching performance and that these changes were not significant. The findings from our study do not parallel those of Işık et al. (2017). It is thought that the lack of parallelism between the two studies is due to the difference in the study groups. In our study, professional-level volleyball players constituted the research group, whereas in the study by Işık et al. (2017), the research group consisted of individuals with short hamstring muscles.

According to the findings obtained from our study, it was found that massage applications have significant and positive effects on flexibility, i.e., joint range of motion. When the findings of our study are compared with the studies examined in the literature, it is found that there are studies both parallel and not parallel to our study. In all the studies that parallel our study, it was concluded that massage has positive effects on flexibility, as in our study. In the study that did not parallel our study, it is thought that the lack of parallelism between the two studies is due to the difference in the study groups.

Results

As a result, when comparing our research with studies in the literature, it was concluded that the average age of the research group in our study (35 years) is higher than the research groups in the studies in the literature. During the evaluation and interpretation of the flexibility results, studies both parallel and not parallel to our study in the literature were encountered. It is believed that the studies that show parallelism with our research are similar due to factors such as the massage application, the athletes' ages, training levels, and the stages of their careers. The studies that do not show parallelism with our research are thought to differ due to the different research groups in the two studies.

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