

Determining the Anticipation Times of Athletes Participating and Non-Participating in Volleyball, Handball, and Basketball School Sports at Secondary Schools

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ABSTRACT

The aim of this study is to find out the anticipation times of fifth-to eighth-grade students who participate and those who do not participate in school sports in volleyball, handball, and basketball in secondary schools, and also to determine whether the anticipation time varies according to gender, different speeds and sports experience of students participating in school sports. A total of 267 athletes (150 girls and 117 boys) participated in volleyball, handball, and basketball from the 5th to 8th grades of secondary schools, and a total of 214 athletes (90 girls and 124 boys) who did not participate in school sports in these branches were studied. The “Basin Anticipation Timer” device measured the anticipation time. As a result of the analysis, it was found that female students participating in school sports have better anticipation time than that of male students. The anticipation times of students participating in school sports were determined at speeds of 5 m/s and 8 m/s with average constant, absolute, and variable errors of (0.018, 0.044, 0.059) and (0.017, 0.041, 0.055), respectively. Even though the 8 m/s error results seem better than the 5 m/s results, no statistically significant difference was found between them.

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1. INTRODUCTION

Coincidence anticipation time (CAT) is the ability to predict when an object image will arrive at a designated target in time and space. Anticipation time (AT) is often used to test hand-eye coordination and estimate visual accuracy. Each correct anticipation affects the performance of the athlete and the performance result, takes sports and scientific studies one step further, and contributes to the fact that success is not a chance (Williams *et al.*, 2000).

Poulton (1957) said there are two different forms of anticipation: effector anticipation and receptor anticipation. Effector anticipation refers to the individual's ability to determine how long it will take a person to move their limbs. In contrast, receptor anticipation is the ability to decide how long an external event will take (McMorris, 2004).

According to Lobjois *et al.* (2006), anticipation consists of two parts. One is stated as perceptual detection, “identifying the object moving in space,” while the other one is

stated as perceptual-motor perception, “giving an appropriate coordinated reaction to the approaching object” (p. 75). In sports environments, when the environment is unpredictable and inconsistent, the capacity to predict the upcoming object, such as a ball, is seen as a fundamental concept. These environments can be defined as environments where open skills are applied. In addition, it is stated that the demonstration of anticipation time ability occurs in cases where the control of the movement skill is determined by the environment and not by the athlete. Receiving or controlling the incoming ball in football or tennis can be given as examples. Therefore, anticipation appears to be one of the most important factors in applying explicit skills in environments requiring quick reactions (Williams *et al.*, 2002). In sports environments, it is used to detect talent in athletes or to identify athletes with special abilities by testing perception time, hand-eye coordination, and visual consistency (Ripoll & Latiri, 1997).

In ball sports, estimating the speed and direction of any approaching object (ball) is extremely important. In the

same way, in basketball, volleyball, and handball, which all are team sports played with the ball, the event of intercepting the ball before the last point it should meet by anticipating in which direction and at what speed the ball will go out of hand while the opponent players pass among themselves, is how long it takes to anticipate. It is an indication that it is necessary (McMorris, 2004). In these team sports, which are played with the ball and are one of the indispensable branches of school sports, anticipation timing occupies a very important place.

Determining the anticipation time (AT) of students who participate and do not participate in team sports at the secondary school level, examining the differences between them, and determining the status of the AT is important for perceptual features affecting success, especially in the field of physical education, and determining their future performances in in-school and out-of-school sports activities.

Team sports qualify as open skills. Open skills aim to accurately predict the location and time at which a moving object, such as a ball, will arrive. Meanwhile, the speed of the moving object and the distance between the athletes are also important. Although volleyball, basketball, and handball branches are each played with a ball, we do not know the ATs of the players competing in these sports due to differences such as the size of the ball, field dimensions, and number of players. This study intended to obtain the information mentioned above.

This study aims to examine the differences in the AT of fifth-, sixth-, seventh-, and eighth-grade students who participate in school sports in volleyball, handball, and basketball branches and do not participate in school sports according to gender, experience, whether they do sports or not, and speed.

2. METHOD

2.1. Participants

A total of 267 students, 150 girls, and 117 boys, participated in school sports in the branches of volleyball, handball, and basketball in the fifth to eighth grades of public secondary schools in the central district of the city of Bolu in Turkey. At the same time, a total of 214 athletes, 90 girls and 124 boys, who did not participate in school sports, participated in this study.

2.2. Data Collection Devices

To measure the anticipation time (AT), a “Bassin Anticipation Timer (BAT)” (Lafayette Instrument Company, Model 50575) device was used, as shown in Fig. 1. This device consists of 3 parts and 49 small lamps. The first lamp is a yellow warning lamp. The remaining 48 lamps are red light motion simulation lights. There are two handpieces and a BAT control panel connected to the device. At the beginning of the device, there is a handpiece connected to the device, which is used to give an external warning. At the end of the device, there is another device connected to the device (at the predetermined target point or closest to the target point) to stop the external warning. As soon as the warning is given, the lamps on the device turn on and move forward. The first lamp turns yellow, and the other



Fig. 1. Bassin anticipation timer (BAT) device.

lamps turn red. The participant tries to stop the signal at the target point. Scores are measured in milliseconds and tabulated for error calculations.

2.3. Data Collection

In the central district of the city of Bolu, secondary schools with active, licensed male and female athletes in volleyball, handball, and basketball branches of school sports were researched, and the necessary data were collected. Data on students who do not do sports were also taken from students in the same schools.

The BAT device was placed on the tables in the gyms or multi-purpose halls of the schools. Students were divided into 10 groups for measurement. Each measurement took approximately 3–4 minutes.

Each candidate takes a standing position so that he or she can see the BAT device. There are two hand-held devices connected to the BAT apparatus, which has 48 lamps on it, one at the start and the other at the end. A stimulus is sent to the device with the apparatus at the starting point, but it is done so that the student does not see the moment of pressing the apparatus, and the lamps on the device are in motion and continue until the end. By showing the previously determined target point, it was said that he could stop the light at any time by pressing the apparatus in his hand in the nearest place to the target. After pressing the button, the value on the BAT control panel is recorded on the form.

The BAT device has features that can be adjusted for different speeds, and measurements were made at two speeds (5 m/s and 8 m/s). Each student was given 5 attempts before measurements. After the trials, 20 real measurements were taken for two different speeds, and the students were informed that the data was recorded on the student information forms. For all groups, first 5 m/s and then 8 m/s speed measurements were taken, and the data was written on the form. During the trial measurements, students were given feedback about their performance.

2.4. Data Analysis

In the analysis of the data, t-test, descriptive statistical techniques (Frequency, Percentage, Average, Standard deviation) were used for those who participated and did not participate in school sports according to two different speeds and gender, and those who participated in school

sports according to experience. The significance level was accepted as 0.05 in the study. The average constant, absolute, and variable error values were calculated separately.

2.4.1. Constant Error (CE)

Constant error is the value that indicates whether the athlete's AT performance is before or after the target point. If the score is negative, the detection time is considered to be before the target point, and if the score is positive, it is considered to react after the target point. It gives information about the direction of the error.

2.4.2. Absolute Error (AE)

Absolute error reflects the athlete's average sensing time. It does not provide information about whether the performance occurred before or after the target point; it only refers to the magnitude and amount of the error.

2.4.3. Variable Error (VE)

Variable error measures consistency in the athlete's performance. It shows how far the performance is from the average constant error (Schmidt & Lee, 2014).

3. RESULTS

According to Table I, it may be concluded that there is a significant difference in CE in favor of female students participating in school sports, but there is no difference in AE and VE at both 5 m/s and 8 m/s. According to these results, it may be said that female students tend to apply more determined pressure to reach the target point than male students.

Looking at the results of students who do not participate in school sports, it can be said that there is a significant difference in favor of male students in AE, but there is no difference in CE and VE for both 5 m/s and 8 m/s. The AE of male students is smaller than that of female students.

As indicated in Table II, when the performances of the students participating in school sports at the 5 m/s and 8 m/s speeds are compared, no significant differences were found in CE, AE, and VEs.

When the anticipation time of students who do not participate in school sports is examined at the 5 m/s and 8 m/s speeds, it is seen that there is no significant difference in CE, but there is a difference in AE and VE in favor of male students. Again, when the data is examined, it is seen that as speed increases, the magnitude of the error decreases, and the consistency of the error increases.

As shown in Table III, when the ATs of students participating in school sports at different speeds were examined according to their sporting experience in years, it was determined that students with 1–2 years of experience and students with 3–4 years of experience showed different performance in CE. Accordingly, students who have been participating in school sports for 1–2 years have achieved better ATs at both 5 m/s and 8 m/s speeds than students who have been participating in school sports for 3–4 years. These students' ATs did not show any difference in either AE or VE.

TABLE I: COMPARISON OF THE CAT OF STUDENTS BY PARTICIPATION IN SCHOOL SPORTS AND GENDER

	Speed (m/s)	Error	Gender	$\bar{X}$	t	p
Participants in school sports	5	CE	F	0.015	-2.130	0.034*
			M	0.023		
		AE	F	0.045	0.890	0.374
			M	0.042		
			F	0.062		
	8	CE	M	0.055	1.276	0.203
			F	0.015		
		AE	M	0.020	-1.986	0.048*
			F	0.041		
			M	0.040		
Non-participants in school sports	5	CE	F	0.054	-0.468	0.640
			M	0.056		
		AE	F	0.015	1.939	0.054
			M	0.006		
			F	0.053		
	8	CE	M	0.042	2.448	0.015*
			F	0.069		
		AE	M	0.063	0.870	0.385
			F	0.011		
			M	0.006		
		CE	F	0.045	2.163	0.032*
			M	0.039		
		AE	F	0.063	1.637	0.103
			M	0.053		
			F	0.053		

Note: * $p < 0.05$. F: female, M: male, CE: constant error, AE: absolute error, VE: variable error.

TABLE II: COMPARISON OF THE CAT OF STUDENTS BY PARTICIPATION IN SCHOOL SPORTS AND SPEED

	Error	Speed (m/s)	$\bar{X}$	t	p
Participants in school sports	CE	5	0.018	0.641	0.522
		8	0.017		
	AE	5	0.044	1.930	0.055
		8	0.041		
	VE	5	0.059	1.268	0.206
		8	0.055		
Non-participants in school sports	CE	5	0.010	0.660	0.510
		8	0.009		
	AE	5	0.047	2.718	0.007*
		8	0.041		
	VE	5	0.065	2.076	0.039*
		8	0.057		

Note: * $p < 0.05$.

4. DISCUSSION

The purpose of the study was to examine the ATs of fifth-, sixth-, seventh-, and eighth-grade students who participate in school sports in volleyball, handball, and basketball branches in secondary schools and those who do not participate in school sports, and to determine whether the AT varies according to gender, different speeds, and sports experience of students participating in school sports.

Studies on AT have yielded different results when looking at the gender factor. While Aktağ *et al.* (2015), Akbulut (2014), Alaei (2015), Dede (2010) or Millslagle (2004) could not find a significant difference in ATs between

TABLE III: COMPARISON OF CAT OF STUDENTS PARTICIPATING IN SCHOOL SPORTS ACCORDING TO EXPERIENCE

	Speed (m/s)	Error	Experience (year)	$\bar{X}$	t	p
Participants in school sports	5	CE	1-2	0.015	-2.789	0.006*
			3-4	0.026		
		AE	1-2	0.044	0.762	0.447
			3-4	0.042		
		VE	1-2	0.060	0.368	0.713
			3-4	0.057		
	8	CE	1-2	0.013	-4.086	0.000*
			3-4	0.026		
		AE	1-2	0.041	0.115	0.908
			3-4	0.040		
		VE	1-2	0.055	0.499	0.618
			3-4	0.053		

Note: * $p < 0.05$.

men and women, Ak and Koçak (2010) found that men made fewer mistakes than women and Sanders (2011) has concluded that men had better ATs than women and this was due to the difficulty of the skill. They found that men have an advantage in easy skills, and as the skill becomes more difficult, the difference between male and female athletes decreases. Also, Aslan et al. (2022) found that male players had better anticipation times than female players who participated in team sports. However, in this study, we noticed that female students participating in school sports have better ATs than male students. However, the situation turned against female students who did not participate in school sports. The secondary school period is the period of adolescence for female students, and studies have shown that the perception time develops rapidly until adolescence. Participation in sports activities favors female students who enter puberty before boys. At the same time, it does not contribute to the perception time of female students who do not participate in sports activities (Solorio & Stevens, 1997).

When we look at the ATs of students participating in school sports at 5 m/s and 8 m/s speeds, it was seen that CE = 0.018, AE = 0.044, and VE = 0.059, means for 5 m/s speed are worse than CE = 0.017, AE = 0.041 and VE = 0.055 of 8 m/s speed. However, these results do not show a statistically significant difference.

Akpınar et al. (2012) investigated the ATs of athletes in different racquet sports at different speeds. They determined that the table tennis athletes had better ATs as the speed increased. In his study, Alaei (2015) found that 5 m/s AT means were better than 1 m/s AT means. Fernandes et al. (2005) measured the ATs of sedanters and young swimmers at different speeds and found no significant differences between their groups.

When the 5 m/s and 8 m/s ATs of students who did not participate in school sports were examined, no significant difference was detected in CE. However, significant differences were noticed in AEs and VEs. While students' AE = 0.047 and VE = 0.065 at 5 m/s, AE = 0.041 and VE = 0.057 at 8 m/s. This shows that the 8 m/s students' perception performance tended to push closer to the target point in the magnitude of the error, and a significant difference was observed in the consistency of the error.

While measurements were taken for two groups, the first 5 m/s measurements were taken, and then 8 m/s measurements were taken immediately. It is thought that students make 8 m/s AT measurements more consistently and with fewer errors because they get used to the device and the environment. As a result, they make the measurements more concentrated.

In addition, this study sought an answer to whether the anticipation time of students participating in school sports differs according to their sports experiences. According to the results, a significant difference in constant error was obtained between those who have been doing sports for 1-2 years and those who have been doing sports for 3-4 years, both at 5 m/s and 8 m/s speed. Interestingly, students who have been doing sports for 1-2 years have better anticipation times. No significant difference was detected in variable and absolute errors among students.

In their study, Aktağ et al. (2015) examined the ATs of university students according to their sports experiences and did not reach any significant findings. Saygı et al. (2016) found that experienced football players showed better ATs at lower speeds. On the other hand, Kim et al. (2013) and Mori et al. (2002) found in their studies that experienced athletes had better ATs than less experienced athletes. When we look at those who have participated in school sports for 1-2 years, It has been observed that since they have just started sports and therefore are more determined and willing, they train themselves and repeat more frequently to learn basic techniques at the beginner level, they increase the frequency of training in periods close to competition periods in school sports, and they also do special training to improve their motor skills. Therefore, we think these may cause big differences, such as in quality.

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