

## The Effects of Cognitive Learning and Imagination Training on the Balances of the 14-16 Years Old Handball Players

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Received: April 9, 2018

Accepted: May 18, 2018

Online Published: December 4, 2018

doi:10.11114/jets.v7i1.3834

URL: <https://doi.org/10.11114/jets.v7i1.3834>

### Abstract

The purpose of this research is to examine the effects of imagination and cognitive learning exercises, which are applied to increase the success of elite handball players, on their balance skills.

The research group consists of a total of 36 voluntary male athletes, 18 of which are the control group and 18 of them are the experimental group, aged between 14 and 16, with at least 5 years of sports experience, who have been playing handball in Kayseri Youth Sports Club. For the study group, 8-day, 30-minute cognitive training and imagination study program was applied as two sets per day. No exercise was applied to the control group. Static and dynamic balance tests were applied to all of the participants (study and control group at the beginning and end of the study. According to the results of the analysis performed at the end of the study, a significant difference was found between the post-test results of all balance parameters of the experimental and control groups ( $p < 0.05$ ). When the pre-test and post-test results of the control group were compared, there was a significant difference between the scores of Static, Level8, Level4 and Oscillation CE ( $p < 0.05$ ) and there was no significant difference between Level2 and Oscillation OE ( $p > 0.05$ ). When the pre-test and post-test results of the experimental group were compared, a significant difference was found between all equilibrium parameters ( $p < 0.05$ ).

As the result, it was found that cognitive imagination programs have positive effects on learning the balance skills in handball players under the light of the obtained findings.

**Keywords:** handball, imagination, cognitive learning, balance

### 1. Introduction and Purpose

Handball is a circuitous sport aiming at responding the opponent's offence with the best defence, trying to prevent the opponent from scoring, and scoring on the offence; and it contains numerous movements. The technical-tactical, conditional-mental and psychological properties, as a whole, constitute the basis of the performance in handball. The balance skill that forms the basis of performance and is at the centre of conditional skills is known to have a significant role in the successful display of many sports skills, in changing direction, standing, starting, holding, moving an object and protecting the position of the body. According to Meinel and Schnabel, balance is defined as keeping the whole body stable and protecting the status of the body during and after a movement (Altay, 2001). The individual's ability to protect the balance can be defined as a decisive factor in the development of other motor systems (Erkmen, 2007). Balance control is a complex motor skill that involves the integration of sensory inputs as well as the planning and execution of flexible types of motion. There are two types of balance: static and dynamic balance. The ability to provide the balance of the body in a specific place or position is called static balance (Hazar & Tasmektepligil, 2008). The dynamic balance is the result of neutralizing the external forces acting on the body by the muscles and soft tissues around the joints (Nichols et al., 1995).

In handball, technical-tactical, conditional-mental and psychological properties all constitute the basis of the performance. Everyone in sporting activities faces both physical and mental loads. To minimize the impact of these loads, training is carried out against the factors that cause these loads. However, during training, weight is often given to fitness exercises, and technical and tactical training (İkizler, 1997). Mental training is among the things that an athlete must learn and practice in his/her annual training program (Karagözoğlu, 2005).

Imagination is an experience similar to the sensory ones such as seeing, feeling and hearing, but generally occurring in the absence of an external stimulus. For example, a handball player can imagine the voice of a handball, touching it, and even though the audience and friends' screams that do not actually exist. These experiences are, in general, the products of our memory. These experiences can be remembered internally in a clear way and can be built on old external events (Konter, 2006).

The sporting world has always focused on the highest performance concept. For this reason, the athlete who aims to achieve high performance must be prepared for the competition psychologically as well as physiologically. This preparation phase of imagination training and cognitive-based learning techniques are very important contributors to the high performance of an athlete.

According to cognitive theorists, learning is defined as the individual's perception of an external stimulus, comparison of previous knowledge, the creation of new knowledge, and memorization and remembering of obtained information (Erdem, 1998). One of the most important theories in the cognitive approach is that the individual takes the knowledge and processes it according to his or her own self (Özden, 2004). Knowledge passes through four processes. These are sensory recording, short-term memory, long-term memory and control processes. In sensory memory, the surrounding stimuli are taken by sensory organs and transmitted to the short-term memory, in other words, to the working memory. With brief repetitions, the information is sent to the long-term memory to be coded and stored. When this information is needed, the information is called up from the long-term memory and processed in short-term memory (Ataman, 2004).

The purpose of this research is to demonstrate the effects of cognitive-based learning and imagination skills on learning and on the ability of balance, which is a techno-motoric feature for sportsmen, in athletes.

## **2. Material and Method**

A total of 36 male volunteers between the ages of 14 and 16, handball licensed for at least 5 years, 18 of which were experimental and 18 were control groups participated in the study. The groups were defined in a randomized way. Athletes have been selected from persons who have not experienced any limb anomaly within the last 6 months (this was determined by asking the athletes themselves on the information form).

### **Study Protocol (Method)**

The study was carried out in Erciyes University School of Physical Education and Sports laboratories. This study was conducted in two stages (pre-test and post-test). First, the age, height (m), weight (kg) and body mass indexes (BMI: kg / m<sup>2</sup>) of the volunteers were taken 1 day before starting the training. Afterwards, the athletes' static balance, Dynamic Level8, Dynamic Level4, Dynamic Level2, Oscillation Index eye-open (OE) and Oscillation Index eye-closed (CE) balance values were measured through pre-tests. The same day, athletes were given information about the study. Then, imagination and cognitive learning and balance training were applied only to the experimental group, with no other applications, including 8 days, 40 minutes, 2 periods per day.

At the end of the eighth day, as test results, static equilibrium, Dynamic Level8, Dynamic Level4, Dynamic Level2, Oscillation Index OE and Oscillation Index CE balance tests were performed on the experimental and control groups.

### **Data Collection Tools:**

#### **Height, Weight and BMI Measurements:**

The heights of the athletes were measured by the height measurement scale (0.1 cm accuracy), with bare feet or socks, and the body weights were measured with a scale (0.1 kg accuracy) while the athletes were wearing shorts. Body mass indexes were determined by dividing the body weights by the square of the heights (Zorba & Ziyagil, 1995; Tamer, 2000).

#### **Balance Device and Balance Measurements:**

In this study, Biodex Balance System (Biodex, Inc., Shirley, New York) was used for static and dynamic balance measurements.

The Biodex balance device consists of a mobile platform that allows the participant to stand still and move forward, backward and sideways. The platform has a mobility rating of 0-12. 12 is the most stable, 0 is the most mobile platform (Figure 1). In this study, Level8, Level4 and Level2 grades are used for dynamic measurements. Participants were taken to the tests after they had warmed up and stretched for 5 minutes with their sports clothes. The static balance test was performed with the eyes open and the eyes closed, respectively, in the double leg standing position. The dynamic balance test was applied at the double leg standing position. After the subjects had been exercised on the balance platform for about 2-3 minutes, the tests were started and a rest was given for about 1 minute between the test series. During static tests, subjects were requested not to get any support using their arms. With this position, it was planned that the chances of the person to misjudge the test by touching the support rail and the effect of the arms on the balance to be decreased. During the test, the subjects were informed that the upper body movements had to be lowered to the minimum and that only the legs had to be



### 3. Data Analysis

The data obtained after the study were evaluated in the SPSS 20 program. First, descriptive statistics are presented. The number of participants in the study group is below 50 subjects. For this reason, whether the data shows a normal distribution was determined by examining the Shapiro-Wilk test, the histogram, Q-Q, P-P graphs with skewness and kurtosis values. Paired Samples T-test was used for intra-group measurements and Independent Samples T-test was used for inter-group measurements since the data showed normal distribution. Significance level was accepted as  $p < 0.05$ .

### 4. Findings

Table 1. Descriptive Statistics of Participants

		Pre-test				Post-test			
		N	Min	Max	$\bar{x} \pm SS$	N	Min	Max	$\bar{x} \pm SS$
Control Group	Static	18	.60	2.20	1.17±45	18	.49	2.12	1.11±47
	Level8	18	1.01	2.60	1.75±36	18	.92	2.42	1.64±37
	Level4	18	1.40	2.43	1.95±38	18	1.33	2.40	1.83±37
	Level2	18	1.89	3.45	2.82±48	18	1.67	3.72	2.75±61
	Oscillation OE	18	.74	1.13	1.06±11	18	.75	1.21	.98±13
	Oscillation CE	18	1.12	2.66	1.69±36	18	.99	2.63	1.60±27
Experimental Group	Static	18	.3	2.0	0.98±50	18	.2	1.7	0.73±40
	Level8	18	.8	2.4	1.54±44	18	.9	1.9	1.27±28
	Level4	18	1.1	2.4	1.73±42	18	.8	2.1	1.41±40
	Level2	18	1.1	3.8	2.44±94	18	.7	3.5	2.12±95
	Oscillation OE	18	.62	1.40	0.92±20	18	.42	1.00	0.69±18
	Oscillation CE	18	.89	2.66	1.46±44	18	.45	1.92	1.17±32

In Table 1, when the descriptive pretest-posttest statistics of the volunteers were examined, the Control Group pre-test results were  $1.17 \pm 0.45$  for Static,  $1.75 \pm .36$  for Level8,  $1.95 \pm .38$  for Level4,  $2.82 \pm .48$  for Level2,  $1.06 \pm .11$  for Oscillation OE, and  $1.69 \pm .36$  for Oscillation CE, while Control Group post-test results were  $1.11 \pm 0.47$  for Static,  $1.64 \pm .37$  for Level8,  $1.83 \pm .37$  for Level4,  $2.75 \pm .61$  for Level2,  $.98 \pm 13$  for Oscillation OE and  $1.60 \pm 27$  for Oscillation CE, in 18 athletes participated. When we examined the descriptive pre-test and post-test statistic of the test group volunteers, the Experimental Group pre-test results were  $0.98 \pm .50$  for Static,  $1.54 \pm .44$  for Level8,  $1.73 \pm .42$  for Level4,  $2.44 \pm .94$  for Level2,  $0.92 \pm 0.20$  for Oscillation OE, and  $1.46 \pm 44$  for Oscillation CE, while Control Group post-test results were  $0.73 \pm 40$  for Static,  $1.27 \pm 28$  for Level8,  $1.41 \pm 40$  for Level4,  $2.12 \pm 95$  for Level2,  $0.69 \pm 18$  for Oscillation OE and  $1.17 \pm 32$  for Oscillation CE, in 18 athletes participated.

Table 2. Control and Experimental Group Pre-Test Comparison

	Group	N	$\bar{x} \pm SS$	t	p
Static	Control	18	1.17±45	1.119	.239
	Experimental	18	0.98±50		
Level8	Control	18	1.75±36	1.575	.125
	Experimental	18	1.54±44		
Level4	Control	18	1.95±38	1.595	.120
	Experimental	18	1.73±42		
Level2	Control	18	2.82±48	1.517	.142
	Experimental	18	2.44±94		
Oscillation OE	Control	18	1.06±11	1.676	.103
	Experimental	18	0.92±20		
Oscillation CE	Control	18	1.69±36	1.767	.086
	Experimental	18	1.46±44		

In Table 2, no significant difference was found between Static, Level8, Level4, Level2, Oscillation OE, and Oscillation CE scores when Control and Experiment Group pre-test results were compared ( $p > 0.05$ ).

Table 3. Control and Experimental Group Post-Test Comparison

Balance	Group	N	$\bar{x} \pm SS$	t	p
Static	Control	18	1.11±47	2.541	.016*
	Experimental	18	0.73±40		
Level8	Control	18	1.64±37	3.420	.002**
	Experimental	18	1.27±28		
Level4	Control	18	1.83±37	3.273	.002**
	Experimental	18	1.41±40		
Level2	Control	18	2.75±61	-4.806	.000**
	Experimental	18	2.12±95		
Oscillation OE	Control	18	0.98±13	5.707	.000**
	Experimental	18	0.69±18		
Oscillation CE	Control	18	1.60±27	3.701	.001**
	Experimental	18	1.17±32		

In Table 3, a significant difference was found between Static, Level8, Level4, Level2, Oscillation OE, and Oscillation CE scores when Control and Experimental Group post-test results were compared ( $p < 0.05$ ).

Table 4 Control Group Pretest-Posttest Comparison

Balance	Group	N	$\bar{x} \pm SS$	Correlation	t	p
Static	Pre-test	18	1.17 $\pm$ 45	.987	3.555	.002*
	Post-test	18	1.11 $\pm$ 47	.000		
Level8	Pre-test	18	1.75 $\pm$ 36	.987	7.755	.000**
	Post-test	18	1.64 $\pm$ 37	.000		
Level4	Pre-test	18	1.95 $\pm$ 38	.972	5.466	.000**
	Post-test	18	1.83 $\pm$ 37	.000		
Level2	Pre-test	18	2.82 $\pm$ 48	.910	1.137	.272
	Post-test	18	2.75 $\pm$ 61	.000		
Oscillation OE	Pre-test	18	1.06 $\pm$ 11	.689	1.137	.279
	Post-test	18	0.98 $\pm$ 13	.000		
Oscillation CE	Pre-test	18	1.69 $\pm$ 36	.982	5.991	.000**
	Post-test	18	1.60 $\pm$ 27	.000		

In Table 4, no significant difference was found between Level 2 and Oscillation OE scores ( $p > 0.05$ ), while a significant difference was found between Static, Level8, Level4 and Oscillation CE scores ( $p < 0.05$ ) when Control Group pretest-posttest results were compared

Table 5. Experimental Group Pretest-Posttest Comparison

Balance	Group	N	$X \pm SS$	Correlation	t	p
Static	Pre-test	18	0.98 $\pm$ 50	.974	7.291	.000**
	Post-test	18	0.73 $\pm$ 40	.000		
Level8	Pre-test	18	1.54 $\pm$ 44	.832	4.429	.000**
	Post-test	18	1.27 $\pm$ 28	.004		
Level4	Pre-test	18	1.73 $\pm$ 42	.968	12.894	.000**
	Post-test	18	1.41 $\pm$ 40	.000		
Level2	Pre-test	18	2.44 $\pm$ 94	.992	11.800	.000**
	Post-test	18	2.12 $\pm$ 95	.000		
Oscillation OE	Pre-test	18	0.92 $\pm$ 20	.746	7.101	.000**
	Post-test	18	0.69 $\pm$ 18	.000		
Oscillation CE	Pre-test	18	1.46 $\pm$ 44	.904	5.937	.000**
	Post-test	18	1.17 $\pm$ 32	.000		

$p < 0.005$ \*,  $p < 0.001$ \*\*

In Table 5, a significant difference was found between Static, Level8, Level4, Level2, Oscillation OE, and Oscillation CE scores when Control and Experimental Group pretest-posttest results were compared ( $p < 0.05$ ).

## 5. Discussion and Results

Mental training is used extensively in studying the sports skills. With the imagination in the positive direction, the skills can be improved, and these skills can be demonstrated more successfully and strongly by correcting their weaknesses. Mental training is a psychological skill and has an important power to improve the performance of the athlete (Konter, 1999, Altıntaş & Akalan, 2008). Cognitive learning, in this sense, supports imagination (mental). The processes of receiving, understanding and analyzing the information begin to be revived in their minds and are reflected in the outward direction in time as well. In fact, the change in behaviour in cognitive learning, which is fully occurring in the mind, is also reflected in the outside appearance.

In our study, no statistically significant difference was found between the static and dynamic balance pre-test results of the experimental and control groups ( $P > 0.05$ ). This shows that the study group was homogeneously distributed.

When we examined the static and dynamic balance post-test data of the experimental and control groups, a significant difference was found in all parameters ( $P < 0.05$ ). This difference is thought to be related to imagination and cognitive balance studies in the experimental group for 8 days. Mental training is a psychological skill and has an important power to improve the performance of the athlete (Konter, 1999). Furthermore, it is known that mental training and cognitive-based teaching methods, which are among the learning-accelerating practices, increase the learning of the athletes' skills (May, 1986; Mahoney, & Sunin, 1986).

In his work, Sosovec examined the effects of visual imagination on the penalty shootout in the football and divided the subjects into mental, physical, and mental and physical training groups. It was determined that, for both of the physical and mental training groups, the rates of the shots on target was higher than the other two groups (Sosovec, 2004).

A statistically significant difference was found between Static, Level8, Level4 and Oscillation CE scores when we

examined the pretest and posttest balance values of the control group ( $p < 0.05$ ). However, although there was an improvement in Level 2 and Oscillation OE scores, no significant difference was found ( $p > 0.05$ ). However, when we examined the pretest and posttest balance values of the experimental group, a significant difference was found between Static, Level8, Level4, Level2, Oscillation OE, and Oscillation CE scores ( $p < 0.05$ ).

Today, sports performance is defined as the physiological, biomechanical and psychological efficiency that the athlete has shown during the activity. Achieving optimal and superior performance depends on the development of both the psychological and physiological capacities of the athlete and the appropriate acceleration of the athlete's performance to a certain level (Konter, 2003)

Parrish and Murphy (23) examined the effect of positive and negative imagination on motor performance. In their study, they divided 30 university students into 3 groups as positively imagining, negatively imagining and not imagining. Participants were asked to throw golf balls into the hole. As the result, it has been determined that the group that develops the most is the group that positively imagines, then the group that never imagines, and finally, the group that imagines negatively. Botwina and Krawczynski (2003) studied the effect of mental training on penalty shoot-outs in their study. In their study, both the mental and physical training group were more accurate than the other two groups (Botwina, & Krawczynski, 2003). For example, in another recent study, video-assisted mental training has been shown to have a positive effect on shooting skills on the football. According to the findings of the research, mental training practice combined with physical training is more effective than only physical or mental training practice (Özdal et al., 2013). Martin and Hall (1995) reported in their research that the athletes making imaginative studies set higher goals and more realistic expectations than others (Martin & Hall, 1995). As it can be seen, imagination, especially in sports, training or pre-competition, which requires a more complex and systematic presentation of motor skills, ensures that the motor skills are reinforced more positively.

As the result, the determination of the cognitive learning levels of the athletes and the development of the imagination levels as well as the physical training are necessary both for motivating themselves and for increasing their success levels. When the findings of the study are evaluated in general, it is seen that there is a significant relationship between cognitive imagination and balance skills.

## 6. Suggestions

1. Athletes should perform physical training and cognitive training and imagination exercises.
2. In basic skill teaching, the cognitive training should be emphasized so that the student/athlete can recognize himself/herself.
3. In the sport branch to be taught, the cognitive process must be initiated before physical practice and this process should be supported by imagination exercises.
4. According to the results obtained, cognitive training process and imagination training process should be applied in all sports branches with physical training.

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