



## The Relationship between Cognitive Styles, Attention and Performance of Shooting Skill

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### Keywords

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### Abstract

**Background:** One of the most important factors in the performance of motor skills is the psychological properties of individuals. In this regard, the relationship between individuals' cognitive styles and attention levels has not been investigated.

**Objective:** The aim of the present study was to investigate the relationship between cognitive styles, attention and performance of shooting skill.

**Methods:** In this research, 150 athletes were selected through purposeful sampling. Group Embedded Forms Test (GEFT) attention test according to black and red table and air gun shooting test were used for data collection. Data analysis was handled by Pearson's correlation coefficient.

**Results:** Results showed that correlation between independent and neutral cognitive styles and shooting performance is more than field-dependent cognitive styles. Results also showed participants with higher attention in presence of a disruptive stimulant showed a better performance in shooting skill.

**Conclusions:** Based on results achieved, it may be stated that measures may be taken to improve performance of shooting skill among athletes by using cognitive styles, improving attention, and considering their personal features and training methods.

### Introduction

Predicting the success of a promising athlete to a top performer has been dream of every recruiter in sports personality traits are quite prominent in the important outcomes of life such as sports and exercise fields (Shrivastava, VenuGopal, and Singh, 2010). In this regard, one of the important personality traits of individuals is cognitive styles. Cognitive styles are regular mental habits or behaviors addressing problem-solving, data processing, or mind maps and are based on individuals' primary or basic abilities (Blazhenkova & Kozhevnikov, 2010; Thomson, Watt and Liukkonen, 2015). In fact, these styles are

perpetual potential abilities different from person to person. They might impact learning, and especially individuals' performances (Robotham, 1995; Thomson et al., 2015). Cognitive styles are a level of environmental conditions affecting individuals' understanding and decision-making. Based on this approach, individuals are divided into Field-dependent and independent groups (Stemberg and Grigorenko, 1997; Liu, 2006). Field-dependent individuals consider outside environment as their judgment reference and are not readily able to separate stimulants from the field, and therefore their cognition is easily affected by environmental changes. Such individuals have

lower independent performance in decisions and behaviors, and their efficiency in using physical information is low (Liu and Chepyator-Thomson, 2009). Field-dependent individuals generally recognize the information (Ghotbi, Hamari, Saemi, and Zarghami, 2011). Field-independent individuals can process information free from surrounding influence, while performance of field-dependent individuals is affected by the environment stimulants (Rogers, 1995; Zhao, Shi, You, and Zong, 2017).

Regarding numerous stimulants an individual always encounters, life without selective attention would be definitely difficult. Sport is not an exception to the rule. In fact, few factors may be found being more important in better performance of sport activities than the ability of focusing on proper indicators (Liu and Chepyator-Thomson, 2008). Attention is an individual's overall capacity to process the information (Magill, 2004). Attention includes learning consciousness along with individuals' preparedness to receive sensory information and maintain consciousness. In other words, attention is a process guiding our awareness to make information accessible to the senses. Attention is of great importance in sport. To know what has been under attention is a basic skill for desirable performance and function. When athletes are desirably aware of correct indicators they want to pay attention to, and become potentially aware of distraction instances, they would be able to predict the events and consequently, they would quickly react to them (Schmidt and Lee, 2011).

Sport researchers and trainers are aware of important impact of attention in performing motor skills; that is, precision and quality of motions highly depend on performers' attention to performance of motor skills. This fact has been approved by completed studies (Beilock, Bertenthal, McCoy, and Carr, 2004; Ghotbi et al., 2011). In a sport context, numerous studies have been conducted on cognitive styles and motor performance. Ghotbi et al. (2011) have examined precision in indoor and outdoor spaces with cognitive styles approach. Results showed that field-independent participants had better performance under both outdoor and indoor conditions compared to field-dependent ones. Liu and Chepyator-Thomson (2008) have examined relation between field dependency and independency, participation in sports and level of physical activity among school students. Results showed significantly higher levels of physical activity and more participation in organized sports among field-independent students compared to field-dependent students. Liu and Chepyator-Thomson (2009) examined field independency and dependency in physical activities among high school students. Results showed that field-dependent students had much lower level of physical activity and participation in organized sports compared to field-independent students.

Yan (2010) examined the effect of cognitive styles on students' selective reaction time and precision. Results showed that field-dependent students' selective reaction time was slower and less precise compared to field-independent and

neutral students, while field-independent and neutral individuals acted significantly faster and more precise than field-dependent ones. Ghotbi et al. (2011) examined personal differences in occupational memory and motor performance through cognitive styles approach. Results showed that field-independent participants had better performance in the task of throwing darts, numerical and spatial memory compared to field-dependent and neutral participants. Zarghami, Saemi, and Fathi, (2012) examined the effect of concentration point on performance of discus skill. Results of this study showed that performance of external focus group was higher than inner focus and non-focus conditions. Thomson, Watt and Liukkonen (2015) investigated the effect of cognitive style and teaching style on the motor skill performance of 11 and 12-year-old physical education students. The results showed that student performance in a throwing and catching task was affected by cognitive style and teaching style within the field independent sample. However, the children categorized as field dependent did not demonstrate any significant changes in the performance tasks. Mazzocante et al. (2019) investigated the relationship of sports practice with motor performance, selective attention, cognitive flexibility and processing speed in children aged 7 to 10 years. The result revealed a positive relationship between children practicing sports and the ability of cognitive flexibility and attention compared to non-practicing children.

Since shooting is among those fields of sport where psychological skills play more part in

athletes' success compared to other sports, therefore considering psychological skills effective on these athletes seems necessary. Regarding the importance of cognitive styles and attention and skill performance in learning and training, and also with respect to the results obtained from previous studies and existing challenges, this has made researchers interested in examining relationship of cognitive styles and attention (with or without disruptive stimulants) with performance of air gun shooting skill.

## Method

### Participants

The statistical population of this study included all air gun shooting athletes in Zanjan Province counting up to 300 athletes among them 169 were selected based on the Morgan sample size table. In this study, those individuals with qualities effective in learning how to shoot such as weak eyesight or other physical issues were excluded and those subjects with at least one-year experience of participation in shooting competitions were selected. Therefore, 150 athletes selected for the study through purposeful sampling method.

### Measures

- a. Group Embedded Forms Test: Witkin et al.'s (1971) Group Embedded Forms Test (EFT) was used to measure field dependence and independence. This test is consisted of three parts: first part includes 7 figures provided for practicing. Second and third parts include 9 figures each, and 5 minutes time is allocated for answering

each part. Test score is obtained from second and third parts. Participants should find simple figures of the last page of the test from a set of other figures within 12 minutes time and color or mark them. Every correct answer is scored 1 point and the higher the score of participants, the more field-independent they are. Scores between 0 to 6 indicate field-dependency, 7 to 11 indicates neutrality, and 12 to 18 shows field independency. Stability coefficient of this test was calculated by Witkin et al. (1971) to be 0.82 for men and 0.79 for women. Mousavi (1998) has calculated convergence coefficient of this test by Cronbach's alpha to be 0.87.

- b. Attention test based on black and red table: this scale includes a 7x7 table which has black and red-colored squares. In every red square of this table numbers 1 to 25 are indicated next to an alphabetic letter, and in every black square numbers 1 to 25 are indicated next to alphabetic letters. The test is conducted in two steps. In step one under a normal condition [without disruptive stimulants], participants should sort numbers and letters from red squares of the table from 1 to 25 respectively and then they should sort numbers and letters from black squares of the table from 24 to 1 respectively. In second step, disrupting stimulants and hearing and vision disturbing such as noises are added to the environment to distract the participants and

they should repeat the test under this condition. Test time is 5 minutes for each stage and participants rest for 5 minutes between every stage. Test validity and reliability are 84% and 86% according to black and red table respectively. This shows high score of validity and stability of the test. A proper place with armchairs was provided for the first step without disruptive stimulant and then the test was conducted. But this atmosphere would not be appropriate for the second step and it was conducted in a place with disruptive hearing and visual stimulants (Bahrami, Minasiyan and Chalungariyan, 2010).

- c. Experimental task: the task accomplished in this study was shooting in standing position. To do so for right-handed individuals, right leg steps back so that the tip-toe makes a 45-degree angle with the forward leg, and legs are spread as wide as a little bit more than the length of the shoulders. In this position, the forward knee bends, and the backward knee is held out well serving as a column. Body weight falls forward, butt stock of the weapon is placed in the shoulder circle, the handgrip of the weapon is held correctly and the target is aimed. In this position, the hand which holds the body of the weapon (as a stand) should be vertical to the ground and the hand which holds the handgrip should make a 45-degree angle with the body as much as possible, whereby the proportion of body

weight is 60 to 40; that is 60% of body weight should fall on the forward leg and 40% of it should fall on the backward one. Scores were assigned on the basis of the accuracy of shots in terms of the closeness to the centre. A score of 10 was considered for bullets hitting the center, 9 for bullets hitting the next circle and so on.

### Procedures

In this research, which was conducted as a filed study, the statistical population of shooters in Zanzan was first determined by inquiring from the Department of Sports and Youth. Then 150 of them were selected based on purposeful sampling. Afterwards, participants were divided into 3 groups (50 field-independent, 50 field-dependent, and 50 neutral) based on scores obtained in group embedded figures test. Then attention test with and without stimulant was conducted on the participants. After becoming familiar with the study, each participant performed 3 range shots and the trainer informed them about the score and how to perform range shots. Then they performed shooting (10 bullets) as their shooting performance score (Kashani, Nik Ravan, and Azari, 2016).

### Statistical Methods

To analyze the data, Pearson's correlation coefficient test was used. All hypotheses of the study were analyzed at significance level of .05. The data obtained were analyzed by SPSS software version 21.

### Results

With regards to normality of the data, Pearson's correlation coefficient test was used in order to examine relationship between field-independent, field-dependent, and neutral cognitive styles with performance of air gun shooting skill. The results showed that there is a significant relationship between cognitive field-independent style ( $r = 0.72$ ,  $p = .001$ ), field-dependent style ( $r = 0.54$ ,  $p = .001$ ), neutral cognitive style ( $r = 0.68$ ,  $p = .001$ ), and performance of air gun shooting skill. These results show a significance positive relationship between field independent and dependent cognitive styles and performance of air gun shooting skill, but coefficient degree of correlation between independent and neutral cognitive styles and shooting performance is higher than field-dependent cognitive styles.

Examining the relationship between attention and performance of air gun shooting skill showed that there is a significant relationship between attention with disruptive stimulant ( $r = 0.70$ ,  $p = .001$ ), attention without disruptive stimulant ( $r = 0.48$ ,  $p = .001$ ), and performance of air gun shooting skill. According to these results, a positive and significant relationship between attention with and without disruptive stimulant and performance was determined. That is, participants who had more attention in presence of disruptive stimulants, showed better performance in shooting skill.

Table 1. Characteristics of athletes.

Characteristic	Mean	Standard Deviation
Age (years)	23.82	2.33
Height (cm)	175.4	9.1
Weight (kg)	68.9	9.3
Age started playing shooting (years)	3.5	2.6

### Discussion

The present study aims at examining relationship of cognitive styles and attention (with or without disruptive impellent) with performance of air gun shooting skill. Results related to examining relationship between field-independent cognitive styles and performance of air gun shooting skill from Pearson's correlation coefficient test indicated a positive and significant relationship between field-independent cognitive styles and performance of air gun shooting skill. In other words, players who have less dependence to the field show better skill performance. Results are in line with studies made by Liu and Chepyator-Thomson (2009), Yan (2010), Ghotbi et al. (2011), Thomson et al. (2015) and Mazzocante et al. (2019). Namvar, Ghotbi, Bahrami, and Islamju, (2011) have studied precision in shooting with Kalashnikov rifle in sitting, laying, and standing positions based on cognitive styles. Results showed significant differences between three groups of laying, sitting, and standing positions. Findings of this study showed that field-independent participants of all three positions have better performance than their competitors. In this regard, Kane (1972) argued that field-independent feature

can be an advantage for participants and athletes in sports skills like throwing darts, shooting and more. Analyzing these results, one may state that field-independent cognitive styles play an important role and it is significant. Therefore, this variant should be continuously evaluated and enhanced among athletes in order to relatively empower and increase their performance and skill. Also, the relationship between field-dependent and neutral cognitive styles with performance of shooting skill was examined and the results showed a positive and significant relationship between neutral and field-dependent cognitive styles with performance of shooting skill. In this regard, Guillot & Collet (2004) analyzed the relationship between field dependence-independence and complex motor skills. Results showed significantly higher scores were obtained by athletes in acrobatic sports, indicating that they tended to be predominately more field-independent whereas the lower scores were obtained by tennis and table-tennis players. So, analyzing these results one may state that field-dependent cognitive styles should be addressed more and more and athletes' desirable skill performance should be enhanced through better training and learning and enhancement of

these styles among them. Regarding increasing importance and more applied and desirable role of field-independent athletes compared to field-dependent ones, necessary measures should be taken in order to create proportion and balance between these two variants, so that athletes gain desirable and proportionate performance in both field-independent and dependent areas, and their performance skill level in shooting would be increase, and they would take more principal and important steps for success. In this regard, Yan (2010) stated field-independent participants of different tasks performed better than the field-dependent participants. So individual differences must be considered in designing appropriate training programs and training should be dedicated based on cognitive styles of athletes and kind of exercise.

Examining the relationship between attention and performance of shooting skill showed a positive and significant relationship between attention (with and without disruptive stimulant) and performance. That is, those participants with more attention along with a disruptive stimulant, showed better performance in their shooting skill. These results are in line with the studies of Hejazi, Aslankhani, Farokhi, and Shojaei, (2011), and Zarghami et al. (2012). According to the result, one may state that if athletes could concentrate their attention when necessary, and minimize those factors causing distraction while performing their skill during exercises and competitions, their performance would increase and they would gain success in their sport. These skills can be taught and the

responsibility is upon trainers. Trainers can be effective in learning the skill and performance through providing education on how to allocate attention capacity to the learner and practicing in presence of a disruptive stimulant. It may be said that those individuals with greater attention capacity would have better performance.

### Conclusion

Finally, it can be said that the results of this study have explained the discrepancy in findings of previous studies in relation with the effect of cognitive styles and attention on performance, and they indicate that cognitive styles and desirable attention would lead to improvement in individuals' performance. Therefore, trainers should consider these two important features in selecting and also in training athletes, because according to the results of this study, the two said factors play a principal role in improvement of athletes' performance. Regarding the results of this study, it is recommended to identify individuals' cognitive styles as a natural feature that affects performance in order to become familiar with them, and their attention capacity should be considered in order to improve their performance. It is also recommended to conduct a study on field-independent, neutral and dependent cognitive styles and learning of other skills.

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**Conflict of interest**

The authors declare no conflict of interest.

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