

The effect of anxiety on reaction time of Physical Education students of Tabriz University, Iran

El efecto de la ansiedad en el tiempo de reacción de los estudiantes de Educación Física de la Universidad de Tabriz, Irán

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Abstract: The objective of the present study is to investigate the effect of anxiety and reaction time in students of the University of Tabriz. 24 female and 24 male physical education students of Tabriz University responded to the Spielberger Scale Questionnaire and the Reaction Time Test to determine the level of anxiety. Sampling was conducted randomly from physical education students of Tabriz University with the age 22 ± 3 . After ensuring that the data were normal, through the variance analysis, two in-group factors of anxiety and reaction time were analyzed for each of the variables individually. The results indicated that there was a negative relationship between state anxiety and choice reaction time of hands ($r = 0.112$, $p = 0.398$) and between trait anxiety and simple reaction time of feet ($r = 0.209$, $p = 0.154$). In addition, there was a positive relationship between state anxiety and simple reaction time of feet ($p = 0.0625$, $r = -0.072$) and between trait anxiety and choice reaction time of hands ($p = 0.874$, $r = -0.024$). The results of this study support the Inverted U hypothesis.

Key Words: Choice reaction time, simple reaction time, state anxiety, trait anxiety.

Resumen: El objetivo del presente estudio es investigar el efecto de la ansiedad y el tiempo de reacción en estudiantes de la Universidad de Tabriz.

Participaron 48 estudiantes (24 mujeres y 24 hombres) de Educación Física de la Universidad de Tabriz. Los estudiantes fueron evaluados mediante el cuestionario de escala de Spielberger y la prueba del tiempo de reacción para determinar el nivel de ansiedad. El muestreo se realizó de manera aleatoria en estudiantes de Educación Física de la Universidad de Tabriz, con una edad de 22 ± 3 años. Después de comprobar la normalidad de los datos, a través del análisis de varianza, se analizaron dos factores (ansiedad y tiempo de reacción) en cada grupo para cada una de las variables individualmente. Los resultados indicaron que hubo una relación negativa entre la ansiedad-estado y el tiempo de reacción de las manos ($r = 0.112$, $p = 0.398$) y entre la ansiedad-rasgo y el tiempo de reacción simple de los pies ($r = 0.209$, $p = 0.154$). Además, hubo una relación positiva entre la ansiedad-estado y el tiempo de reacción simple de los pies ($p = 0.0625$, $r = -0.072$) y entre la ansiedad-rasgo y el tiempo de reacción de las manos ($p = 0.874$, $r = -0.024$). Los resultados de este estudio respaldan la hipótesis de la U invertida.

Palabras clave: tiempo de reacción de elección, tiempo de reacción simple, ansiedad-estado, ansiedad-rasgo.

Introduction

Nowadays, due to less attention to sports psychology, athletes may suffer frequent failures that cause irreparable damage to them and the sports community. Therefore, attention to sports psychology and variables related to the performance of athletes can have beneficial results (Rook et al, 2018). There are important components in sports psychology that are related to athletes' performance. Among these variables are role ambiguity, role conflict, and competitive anxiety. Success or failure in the sports fields depends on many factors: the athlete's goals, his personality traits, how he interacts with other athletes, motivations, the coach's knowledge of the athlete, and many other psychological and social factors such as sports anxiety, are all factors that can affect the quality of performance and its results. Among the psychological factors, one of the variables that is related to the sports performance and can surely be effective in normal life, is anxiety

(Keshavarz, Mehrabi, & Soltanizadeh., 2009). Therefore, researchers are seeking to identify effective factors related to the optimal performance of athletes. The main objective of the present study is to investigate the effect of anxiety on the simple reaction time of physical education students of Tabriz University. The relationship between anxiety and reaction of the human body and its impact on daily activities, especially exercise, and the importance of controlling anxiety can be named as secondary objectives of the present study as to increase athletes' performance in achieving sports success. Anxiety is defined as a person's reaction to a stressful situation. It occurs when a person doubts his ability to cope with stressful situations (Kias, & Raudsepp, 2005). Spielberger divided the anxiety into two categories of state and trait anxiety. State anxiety is unstable and varies depending on the situation, and is the result of a person's perception of the threatening current situation and often comes with the activation of the autonomic nervous system (Osvo, & Brad, 1993). Trait anxiety is a stable and partly acquired behavioral tendency that is often defined as a person's characteristics

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(Anshel, 2016). Both dimensions of anxiety that is, the stable dimension (trait) and the amount of anxiety are associated with the demands and environmental conditions (state) (Righi, Mecacci, & Viggiano, 2009). Individuals with different trait anxiety respond differently to state anxiety, that is, their function changes under the influence of state anxiety in a variety of ways. Anxiety can improve the information processing of stimulus-response tasks, but not the complex skills that require strategic processing (Ziaee, & Amiri, 2016).

Various theories have been presented regarding anxiety and its impact on performance: one-dimensional theories such as Inverted U and Drive Theory, and multi-dimensional theories such as Cups Catastrophe Theory and Zones of optimal functioning theory. Although most of the support of the multiple theories is concerned with the relationship of anxiety with performance, (Jarvis, 2001) the Drive Theory is related to arousal and function. Hall was the designer of this theory, based on which, the performance is affected by three main factors: complexity of skill, habit learned, and arousal. The Drive Theory predicts that the best performance occurs in very important competitions and the performance improves as the arousal increases (Jarvis, 2001). $\text{Performance} = \text{Habit} \times \text{Motivation}$.

Another hypothesis in this connection is the Inverted U hypothesis, which was presented by Yerkes and Dodson. They believed that for each task, there was a level of arousal, and the best performance occurs at that level. The arousal more or less than the desirable level leads to its fall-down. (Jarvis, 2001)

In the fall-down model, Fuzzy and Hardy stated that when athletes get cognitive anxiety, a brief increase occurs in their arousal and leads them to the desired level, resulting in a sudden drop in their performance. In the model of optimal functioning zones, Hanin stated that each athlete would prefer a level of anxiety, at which point he would have a good performance, otherwise his level of performance would be worse. The level of anxiety that the athlete prefers is called his optimal functional zone (Jarvis, 2001), but such patterns are more descriptive and little effort has been made to identify the underlying mechanisms of anxiety's facilitating or weakening effects (3.2). One of the theories regarding the effect of anxiety on performance is the Eysenck and Calvo (1992) processing efficiency theory (Bagherzadeh, Shahbazi, Tahmasebi, & Borujeni, 2007). According to this theory, the effect of anxiety on performance is evaluated by the effect that anxiety places on working memory. The working memory is a section which deals with the active processing and temporary storage of information during the task. In the working memory, the information obtained from the environment is compared with the information stored in the long-term memory, and then the desired decision is selected, organized and ready for implementation. According to Bedley (1996), the system

has three subcategories of phonological information, Visual-spatial, and operating components; the central system is the place of planning and decision making. The operating system and subsequently the available space of the working memory is reduced (Tejari, 2000). According to this theory, the decision-making system is able to prevent the negative effect of anxiety on performance by compensating for the reduction in available space by obtaining additional processing resources. Nevertheless, if an individual is successful in trying to increase the working memory capacity, while not affecting his effectiveness or functioning, his performance is reduced due to more effort. This extra effort is not always happening and other factors contribute to this theory. Eysenck argues that this extra effort only occurs when one feels that he has a significant chance of success. Apart from individual features, task characteristics also affect the generalizability of this theory. According to Eysenck, when the assignment becomes more complicated and the processing requirement increases, it adds up to the amount of occupancy of the working memory space, which, due to more cognitive load, negatively affects both aspects of the efficiency and effectiveness of the assignment (Bagherzadeh, Shahbazi, Tahmasebi, & Borujeni, 2007). Considering the studies conducted in this area, the objective of this study is to investigate the effect of anxiety on reaction time.

Methodology

Participants

The subjects of the present study were 48 female and male physical education students of the University of Tabriz. Twenty-four of the subjects were female and 24 were male who were all prepared already. Moreover, the inclusion criteria for the subjects were at least 3 terms of regular activity in practical courses, and all subjects voluntarily participated in the research. All subjects were 22 ± 3 years old. The present research is descriptive conducted as a field study.

Procedures and Instruments

The reaction time as well as the vision and hearing stimulation were measured with the YB-1000 reaction time measuring device in the motor behavior laboratory of the Faculty of Physical Education of Tabriz University. This device has two visual and auditory channels, with which all three types of reaction time (simple, selective, and differential) can be measured. The reaction time test included 5 selective visual attempts for hands and 5 attempts for feet at intervals of 2-8 seconds, and the mean for each subject was reported individually as the final record. All subjects were placed in a comfortable position standing in front of the device and

the buttons were conveniently placed in their hands. At the time of the selective reaction, as the lights were on (red, blue, yellow), they pressed the related button. In calculating the simple reaction time of the feet, the subjects were placed in stand-by situation on a special plate and by hearing a 100 Hz sound had to jump out of the plate.

The Spiel Berger State-Trait Anxiety Inventory (STAI) was used to measure the trait and state anxiety. Anxiety is defined by Spiel Berger as a transitory emotional state, which refers to the relatively stable individual differences in preparedness for anxiety. This means that tendency of people to respond to threatening situations is different (Spiel Berger, 1983). The first form of the STAI-X questionnaire was presented in 1970 by Spiel Berger et al. (Obeidi Zadegan, & Moradi, 2009). In the scale of anxiety state, the main purpose of measuring anxiety is from low to high intensity. The low scores represent a feeling of calm, mean scores reflect moderate levels of stress and anxiety, and high scores, reflecting an intense fear, are close to panic and horror.

The Spiel Berger State-Trait Anxiety Inventory consists of 40 questions. The first 20 questions evaluate the state of anxiety (state anxiety) and 20 second questions assess anxiety trait (trait anxiety). The anxiety state (obvious anxiety) scale consists of 20 sentences that assess the individuals' emotions at "this moment and response time". The anxiety trait (hidden anxiety) scale also includes 20 sentences that measure general and common feelings of the individuals and allow the respondents to rank their feelings with a score of 1 for no anxiety and a score of 4 for high anxiety. A total score of between 20 and 80 is recorded for each person. The reliability of this tool is reported 0.86 for students. In recent years, this scale has been used as a common test for assessing anxiety inside and outside the country (Obeidi Zadegan, & Moradi, 2009).

After satisfying the subjects and the introduction and explanation of the researchers, the anxiety questionnaire was first filled in with an appendage of individual characteristics and then the reaction time test was performed.

Statistical Analysis

In the present study, descriptive statistics were applied to describe the data. Kolmogorov-Smirnov K-S test was used to examine the normality of the data and Pearson correlation test was used to examine the relationship between the variables,

Excel 2016, and SPSS version 16 were also applied for the analysis of the data.

Results

In the results of the descriptive statistics, the scores in general variables such as age, height, and weight were approximately the same and the subjects were in the range of 22 ± 3 years old. To verify the normality or abnormality of the data, the normal distribution test (Kolmogorov-Smirnov K-S) was used and the results indicated the normality of the scores in all stages and in all variables.

Table 1. Kolmogorov-Smirnov test for the distribution of variables.

Variable	State anxiety	Trait anxiety	Hands reaction	Feet reaction
K-S	P=0.594	P=0.193	P=0.840	P=0.148

The results of one-way ANOVA test indicated that there was no significant difference between trait and state anxiety, which is displayed in Table 2.

Table 2. Students' mean anxiety.

Scale	Amount	Number	Students' percentage
State anxiety	No or minimum (20-30)	5	10.41
	Mild (42-31)	25	52.08
	Average (53-43)	9	18.75
	Severe (54 and more)	9	18.75
Trait anxiety	No or minimum (20-34)	9	18.75
	Mild (35-45)	24	50
	Average (46-56)	9	18.75
	Severe (57 and more)	6	12.5

The mean scores of trait anxiety were reported 43.16 with a standard deviation of 10 and a mean state anxiety of 41.27 with a standard deviation of 9. In the categorization and interpretation of the questionnaire, individuals had a mild level of trait and state anxiety.

Table 3. Correlation matrix for all the subjects.

	State anxiety	Trait anxiety	Hands simple reaction	Feet simple reaction
State anxiety	1	0.703	0.125	0.072
Trait anxiety		1	-0.024	0.209
Hands choice reaction			1	0.095
Feet choice reaction				1

Table 3 displays the correlation matrix between the research variables. The results of Pearson correlation between variables indicated that there is a significant positive correlation between state anxiety and choice reaction time ($r = 0.121$, $p = 0.398$). This means that by increasing state anxiety, the individual's performance during the hand choice reaction time decreased.

State anxiety had a significant negative correlation with the hand choice reaction time ($r = -0.04$, $p = 0.894$), which means that trait anxiety is more associated with a less hand choice reaction time.

There is a significant negative correlation between the state anxiety and the simple reaction time ($r = -0.07$, $p = 0.625$), which means that by increasing state anxiety, the individual's performance improved during the feet reaction time. In addition, the trait anxiety had a significant positive correlation with the feet simple reaction time ($r = 0.209$, $p = 0.154$). This means that by increasing trait anxiety, the feet simple reaction time increases. All the correlations are displayed in the table.

Discussion

The objective of the present study is to investigate the relationship between anxiety and reaction time of physical education students of Tabriz University. The subjects of this study were not significantly different in the general variables such as age and height. The results of the one-way ANOVA test indicated that there is no significant difference between trait and state anxiety. This result is not in agreement with most of the research results in this field but is consistent with the result of the study by Mehdi Shahbazi (2011). However, the reaction time of the subjects' hands and feet was not equal, but their feet reaction time was better than their hands reaction time. The analysis of the reaction times were calculated five times for each subject, and each time a progress was witnessed in the hands and feet reaction time. This indicates the progression of perceptual-motor skills and the processing of athlete information as a result of movement repetition. (Mori, & Wherry, 2002).

The results indicated that there is a significant correlation between state anxiety and hand choice reaction time. This means that, increasing state anxiety was associated with more hands reaction time; this is consistent with the

findings of Ziaee (2006), Christine (2005), and Rigi (2009), and not in agreement with the results by Shahbazi (2011), Farshad Tejari (2000), Abbas Abolghasemi (2006), and Heinout (2006). On the other hand, the results indicated that state anxiety has a significant negative correlation with the simple reaction time of the feet, that is, with increasing state anxiety, the simple feet reaction time improves. These findings can be justified with the Inverted U hypothesis, in which, by increasing anxiety to a certain extent, the individual's performance improves and falls afterward. The peak performance depends on the type of skill, that is, a complex skill reaches to the peak of performance with an increase in anxiety. In this study, the feet reaction time was simply taken, but the hands reaction was taken selectively. Since the choice reaction test of the hands was more complex than the simple feet reaction, this skill reached to the peak earlier and dropped afterward. Positive correlation of state anxiety and the choice reaction of the hands as well as negative correlation of state anxiety and simple reaction time of the feet make this issue more prominent.

The results indicated that there was a positive correlation between the trait anxiety and choice reaction time of the hands. By increasing the trait anxiety, choice reaction time of the hands decreases and improves, while the simple reaction time of the feet decreases. Individuals with high trait anxiety respond much faster than those with low anxiety since they react to all stimuli more than ordinary people do. In the present study, subjects are among Physical Education students with a total average score of 16/43 indicating mild levels of anxiety that cannot have a perceptible effect on the performance of the reaction time. However, if the research sample were selected among people with higher levels of anxiety, the results could be different. It should be noted that the effect of intrusive and troublesome agents in the environment causes interference in performance, and since the reaction time test is very accurate, it increases with the smallest distraction. On the other hand, regarding the relationship between the trait-state anxiety and memory, Surge and Whitney (1992) demonstrated that in the reaction time test, short-term memory is involved, meaning that one should maintain a pattern in his working memory and then compare the stimulus with the mental pattern and respond in case of consistency. Considering this basis for the reaction time, the results of this study is only in agreement with the findings of the research

by Serge & Whitney (1992) regarding the time of the choice reaction time of the hands.

Conclusion

Findings of the present study indicate that the effect of anxiety on the individuals' performance is an inevitable fact and

hands and feet reaction in mild anxiety conditions act in contrary to each other. As a consequence, it is not always necessary to reduce the level of anxiety by instructors and sports psychologists.

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