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Original article

EFFECTS OF CONTEXTUAL INTERFERENCE ON LEARNING OF SOCCER SKILLS

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Abstract*

Aim. Traditionally, scholars of motor learning have sought to bridge the gap between theory and practice by making their research findings relevant to practitioners .The contextual interference effect has been one such finding that researchers have attempted to apply in pedagogical settings. The contextual interference phenomenon refers to the relatively consistent finding that practicing several related tasks in a randomized order, defined as high contextual interference, results in inferior performance during acquisition, but enhances retention and transfer in comparison to a blocked or repeating practice schedule. The purpose of this study was to investigate the effects of contextual interference on learning of soccer skills for college students.

Methods. Twenty college students were randomly allocated to receive either two months of learning program, the experimental group used contextual interference(n = 10). In addition, the control group learning through the traditional method (n = 10). The data collected before and after the program for the two groups.

Results. Statistical analyses showed that:

- The experimental group had significantly higher than the control group in performance level of basic soccer skills (Juggling, Dribbling, Shooting and Head a Soccer Ball).

Conclusions. Under the conditions of our study, use of contextual interference in learning for college studentsresulted an improvement in basic soccer skills (Juggling, Dribbling, Shooting and Head a Soccer Ball).These results have to be taken into account by instructors in order to better understand and implicated of these concepts for technical effects of teaching.

Keywords: Shooting, Contextual Interference, Soccer

Introduction

Throughout life, the human being goes through several changes in their behavior in the most diverse domains such as cognitive, affective and motor.

Such changes arise from the interactions between of new knowledge and skills in each domain, which ultimately result in increased efficiency relatively long lasting. In the motor domain, the Motor Learning, it is the field of research that more provides theoretical subsidy on this process, investigating the problems related to the acquisition of motor skills and the factors that influence it.

Among these factors, the structuring of practice is one of the topics that have gained greater prominence in recent decades.

A thematic of great evidence in the field of research on the structuring of practice is that of the contextual interference. In general, the studies carried out on this topic seek to verify which is the best way to structure the varied practice, which is characterized by the practice of two or more variations ofthe same skill, or by practicing two or moreskills in one practice session.

According to (Schimidt & Wrisberg, 2001), in the history of motor learning we can distinguish clearly from the phases; A first phase that stretches from the 1920s to the 1960s, influenced mainly by the ideas of behaviorist models, Phase in which two lines coexisted without too much communication between them, the line Neurophysiological and psychological.

The second phase, from the decade of the 70s, like consequence of the influence of cognitive models, there is a synthesis of both lines and in the investigations is passed of an exclusive interest by the execution or the product to an interest in the process.

Entering into the teaching-learning process of a motor skill, we multiple factors directly or indirectly affecting degree in this process. These can be classified into three main sections, one the first section of factors linked to the subject, a second section of factors linked to the task and a third and final section of factors linked to the teaching situation (Blázquez, 2006).

As for the first group, subject-related factors include all those factors that are directly related to the learner, such as the level of activation or motivation of the subject, their previous knowledge and experiences. In the group of factorslinked to the task, we find the factors linked to the perceptual aspect, the decision and execution. Finally, in the

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third group, factors linked to the situation ofteaching-learning, we include the factors of the situation in which it occurs.

The teaching-learning process, such as the transmission of information, adaptation from the teaching-learning situation to the characteristics of the students, theSpecificity of this situation, the quantity and the conditions of practice (Blázquez, 2006).

Many variables affect the practice conditions causing different effects on learning.

The strategy of Practice (analytical and global), the distribution of practice (concentrated or distributed),Variability of practice (variable or constant).The teaching styles defined by (Magill, 1993) and the organization of the practice (random, blocked, serial). (Farrow, Maschette, 1997), which will be considered as an independent variable of ourwork.

As for the strategy of practice, there are many methods used, but the most of the publications on motor learning and sports training

The total method, and the partial or analytical method, existing between both multiple combination possibilities. In the specialized literature, we find a dispute over the superiority of one method or another by not reaching anagreement. (Weeks, et al., 1991; Wegman, 1999).

In a pioneering study, (Shea, Titzer, 1993) stated that high Contextual interference, have a negative influence on the acquisition, but positively on the retention and transfer; while low levels of contextual interference the opposite, that is to say, higher levels of acquisition but lower levels of retention and transfer, thus breaking with the idea established to date.

Magill, (2000), define contextual interference as the degree of functional interference encountered in a practical situation when several tasks are to be practiced together. In other words, the effect of contextual interference refers to the degree to which the varied practice of different abilities interferes with their learning.

The order of teaching of skills during practice affects performance inacquisition and retention of a skill during their learning (Shea & Morgan, 1979).

This is why the Human Movement Science professional seeks to establish themore efficient method for the teaching of motor skills (Whitehurst & Del Rey, 1983; Smith & Davies, 1995).

Random and block practice are two techniques of programming and composition used to structure learning experiences; which present characteristics of interference during physical practice, this is called contextual Interference.

With the application of this technique is intended to generate a relatively permanent change in the ability to move a person based on thepractice-called motor learning- (Schimidt, 1982, Wegman, 1999).

Random practice, as its name says, proposes a sequence of certainnumber of skills in a random order, while block practice is atesting of the same skill repetitively (Brady, 1997; Wrisberg & Liu, 1991).

Shea & Morgan (1979) conducted the first study on motor learning EIC. Where two groups of subjects practiced three tasks of arm movement, fast and sequenced, under conditions of random practice and / or by blocks. The results showed that there was a clear advantage in the performance of subjects under block conditions during the acquisition phase. However, when the subjects underwent a transfer test, the random practice proved to be more efficient.

The Effect of Contextual Interference Occurs when Better Learning isgivenof skill in using random practice, compared to block practice (Magill & Hall, 1990).

Contextual interference may be high or low. The high contextual interference (random practice) occurs when the tasks to be apprehended are performed in a random manner (ACABBABC tasks ...) while the low contextual interference (block practice) occurs when tasks are performed by blocks (AAA tasks). (Wood & Ging, 1991)

More specifically, block practice is characterized by the execution of all attempts of a given ability to subsequently start if the task's execution and / or next skill is considered to be of low contextual interference. When, on the other hand, we find the random practice, considered of high contextual interference, which is based on a non-systematic order of execution of the skills to be practiced (Corrêa & Pellegrini, 1996).

Two hypotheses evaluate this effect: Elaboration hypothesis - proposed by (J.B Shea, & R.L. Morgan 1979)reconstruction Hypothesis of the action plan - proposed by (Lee, et al., 1987). The first mentions that when performing random practice the personmore and different strategies of the execution of the movement, and when comparing thepracticed variants can elaborate a better representation of the skill in theirmemory. On the other hand, the second hypothesis states that the person forgets the plan ofperformance of the skill due to the high interferencevariants, so you must rebuild an action plan for each attempt (Magill & Hall, 1990).

Different authors mention that the age, the ability of the person and thecomplexity of the skill interact with the use of the Contextual Interference technique (Brady, 2004; French, et al., 1990), to achieve an improvement in the performance ofthe skills. In contrast, there are authors who consider

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that the actual effect of variousvariables in motor performance has not been thoroughly investigated (Santos, 1997).

The Contextual Interference Effect has generated in the last years great amountof research, in which a variety of results have been found in some, the authors indicate that random practice (High Contextual Interference) damages orreduces the acquisition of a skill, but improves the retention and transfer of thesame, while block practice (Low Contextual Interference) favors theacquisition of skill, but reduces the retention and transfer of it (Gabriele et al., 1987; Brady, 1997).

On the other hand, there are studies in which the authors mention that the type ofpractice does not affect performance improvement (Magill, 2000; Wrisberg & Liu, 1991).

Several researches have sought to explain the variables that affect the acquisition of motor skills. However, two major epochs characterized research in the area of motor learning, one prior to the 1970s, where they aimed to verify which factors affected the acquisition of motor skills, such as practice in whole or in part, to mass or distributed practice, type of feedback, instruction among others, these researches used complex tasks such as sports skills.

The focus on the task made such research known to have a task-oriented approach (TOA), whose main limitation lay in the fact that the studies did not explain why this or that mode of practice, feedback or instruction resulted in better learning.

Following the 1970s, following the revolution in cognitive psychology, researchers began to investigate the processes underlying the acquisition of motor skills in a process-oriented approach (AOP). These studies were characterized by excessive simplification of the study object and lack of ecological validity, that is, there was a lack of correspondence between the results obtained and the real situation (Tani, 1992).

Tani, (1992) noted that it necessary to control the variables more rigidly, leading to the increasing use of simple and artificial motor tasks commonly used in the laboratory. However, although AOP research has provided a great advance in the knowledge about the motor learning process, there was a distancing of this knowledge and its applicability in real situations of the practice of motor skills.

The purpose of this study was to investigate the effects of contextual interference on learning of soccer skills for juniors.

Methods

Twenty juniorswere randomly allocated to receive either two months of learning program, the experimental group used contextual interference(n = 10). In addition, the control group learning through the traditional method (n = 10). The data collected before and after the program for the two groups.

Table 1. Shown the age and Anthropometric Characteristics of the Groups (Mean ± SD)

Group	N	Age [years]	Weight [kg]	Height [cm]
Experimental	10	9 ± 1.5	25 ± 5.67	128 ± 7.22
Control	10	9 ± 1.6	23 ± 6.44	129 ± 6.39

Table 1 shown the age and anthropometric characteristics of the subjects. There no significant differences were observed in the anthropometric characteristics for the subjects in the different groups.

The tests:

Juggling (time)

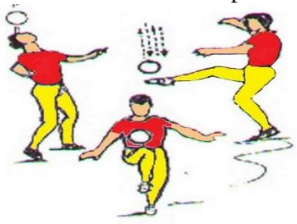
Measure the player's sensitivity to the ball and its ability to control

Performance Method:

The player stands in the center of the circle with the ball and when given a starting signal. The student lifts the ball from the ground and moves it within the limits of the circle with feet or one foot. The player performs two attempts.

Measurement:

Time measured from the moment the start signal given until the ball falls on the ground or out of the circle and records the best attempts.



Dribbling

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Measuring the ability of the player to control the ball while running between the lists (measuring the skills of running the ball).

Performance Method:

The player stands with the ball on the starting line and when the starting points are given, the player played between the lists until he reaches the last one, turns the ball and returns to the beginning in the same way.

Measurement:

The player is counted for the nearest second from the moment he is given the start until he returns to the starting line.

Shooting on goal

Measure the accuracy of the ball straightening on the goal

Performance Method:

The ball is placed on the point of the shot to fit the ball firmly and accurately the best foot and any part of it to the right part of the goal and the left part of the goal and the goal of the handball, and if the ball hit one of the lists will be retried and if you go outside the goal.

Measurement:

The score is 100 degrees divided 40 for the right, 40 for the left, 20 inside the middle of the handball and the score is the three attempts.

Head a Soccer Ball

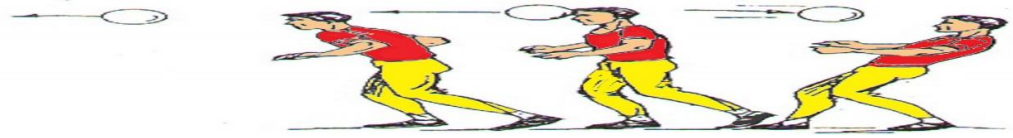
Measuring the player's ability to control the ball when hit by the head (accuracy of the head blow)

Performance Method:

Time one minute the player stands holding the ball and when he gives the starting signal he shoots the ball high to hit the head against the wall to bounce him to hit again and so when the fall of the ball on the ground continues to repeat the performance after holding it with his hand and play the same way the beginning until the end of the test.

Measurement:

Record the number of times the ball hit by the head on the wall.



Statistical analysis

All statistical analyses were calculated by the SPSS statistical package. The results are reported as means and standard deviations (SD). Differences between two groups were reported as mean difference ±95% confidence intervals (meandiff ± 95% CI).Student's t-test for independent samples was used to determine the differences in parameters between the two groups. The $p<0.05$ was considered as statistically significant.

Results

Table 2. Shown Mean ± SD,change Rate, and "T" sign between Pretests and Posttests for experimental group in Juggling, Dribbling, Shooting and Head a Soccer Ball

Variables	Unit	Pretests		Posttests		Rate %	T sign
		M	SD	M	SD		
Juggling	Number	3.66	0.18	9.34	1.2	155.19	Sign
Dribbling	Second	35.85	0.54	28.68	0.87	20	Sign
Shooting	Degree	18.74	0.89	25.73	0.93	37.30	Sign
Head a Soccer Ball	Degree	24.15	0.64	33.28	0.76	37.81	Sign

Significant differences, p< 0. 05

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It is clear from Table (2) that a statistically significant differences between the pretests and posttests for the experimental group in all soccer skills.

Table 3. Shown Mean ± SD, change Rate, and "T" sign between Pretests and Posttests for control group in Juggling, Dribbling, Shooting and Head a Soccer Ball

Variables	Unit	Pretests		Posttests		Rate %	T sign
		M	SD	M	SD		
Juggling	Number	3.24	0.23	6.57	1.11	102.78	Sign
Dribbling	Second	35.68	0.67	32.55	0.99	8.77	Sign
Shooting	Degree	18.29	0.94	22.43	1.03	22.64	Sign
Head a Soccer Ball	Degree	24.64	0.78	28.57	1.06	15.95	Sign

Significant differences, p< 0. 05

It is clear from Table (3) that a statistically significant differences between the pretests and posttests for control group in all soccer skills.

Table 4. Shown Mean ± SD and "T" Test between two Groups (experimental and control) in Juggling, Dribbling, Shooting and Head a Soccer Ball

Variables	Unit	Experimental group		Control group		T sign
		M	SD	M	SD	
Juggling	Number	9.34	1.2	6.57	1.11	Sign
Dribbling	Second	28.68	0.87	32.55	0.99	Sign
Shooting	Degree	25.73	0.93	22.43	1.03	Sign
Head a Soccer Ball	Degree	33.28	0.76	28.57	1.06	Sign

Significant differences, p< 0. 05

It is clear from Table (4) that a statistically significant differences between the posttests for the experimental and control groups in all soccer skills.

Discussion

The structuring of practice is one of the topics of study of motor learning, especially in refers to the order of performance of the skills practiced. Traditionally, studies on this have been carried outbased on two main lines of research: the variability of practice (Del Rey, et al., 1987) and the effect of contextual interference (Bortoli, et al., 1992) to discuss the variability of practice it is important to describe initially the theoretical reference in which this line supports. The Theory of Schema (Wegman, 1999) is a theory about the control and the learning of motor skills, which proposes the generalization of motor skill through the generalized Motor program and the postulation of recognition and Remembrance Schemes.

Generalized Motor Program (GMP) is a program motor that defines a movement pattern (eg the position-independent pitch) instead of a specific movement (eg a specific pitch, in single position). This flexibility in behavior allows the performers to adapt the GMP to produce variations in the pattern in order to meet the new environmental demands. The GMP aspects that remain relatively invariant (which identity to that pattern of movement) during the ability performance attempts, such as sequencing of movements, relative time and relative strength.

On the other hand, the concept of scheme abstract relationships generated by experiences in similar situations enable individuals to form a rule about how to deal with similar situations future16. With each movement performed, four types of information are abstracted and related: the conditions the specifications of the response, the consequences of sensory and the result of the response as the information detailing the final effect of the movement. The combination of abstracted information forms the basis for the concept schema. A reduced number of rules, that is, schemes, can produce innumerable movements, which never before executed.

Specifically, the Remembrance Scheme, responsible for the production of movement, it stores the information initial specifications, response specifications and result of the response, whereas the Recognition, responsible for detecting errors, store the relationship of the condition information of the sensory consequences and the outcome of the answer. Schemes are responsible for the variants of motion, such as total force, time total and range of motion.

Other studies such as (Del Rey, et al., 1982; Gabriele, Hall, 1989; Sekiya, et al., 1996; Wulf, Lee, 1993; Wrisberg, 1991) which used tasks closer to the real situation, obtained similar results.

Conclusions

To explain this phenomenon of the effect of contextual interference, we find two explanatory hypotheses: the hypothesis of elaboration and forget fulness.

Presented by (Shea, Morgan, 1979) the Elaboration hypothesis proposes that random practice acts directly in the active memory in order to provide a multiple processing that lead to the development of processing strategies.

Block practice produces better performance when evaluated in the task acquisition phase, but when we compare the performance of the groups in retention and transfer tests, we find results that lead to a better performance of random practice rather than practice in blocks (Schimidt, 1982).

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