VISUAL REVIEW | 2023 | ISSN 2695-9631
International Visual Culture Review / Revista Internacional de Cultura Visual
https://doi.org/10.37467/revvisual.v10.4577

EFECTO DE LA ESTRATEGIA DE ENSEÑANZA IMPLÍCITA EN JUGADORES DE BALONCESTO

Effect of implicit teaching strategy on basketball players

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KEYWORDS

Teaching strategy
Implicit
Mental workload
Performance
Basketball

ABSTRACT

Incidental processes provide advantages to the basketball player, since they free resources for other cognitive processes. The objective is to analyze if implicit learning reduces stress and produces an effect on motor actions. Twenty-four students participated. Four experimental conditions were designed with temporal, motor and combination of both limitations. The modification in the practice conditions significantly influences the perceived effort of the players and certain individual and collective variables of the game. It is concluded that we can consider the temporal constraint as an effective means to increase the mental load in the training process.

PALABRAS CLAVE

Estrategia de enseñanza
Implícito
Carga mental
Rendimiento
Baloncesto

RESUMEN

Los procesos incidentales otorgan ventajas al jugador de baloncesto, pues liberan recursos para otros procesos cognitivos. El objetivo es analizar si el aprendizaje implícito reduce el estrés y produce un efecto en las acciones motrices. Participaron 24 estudiantes. Se diseñaron 4 condiciones experimentales con limitación temporal, motriz y combinación de ambas. La modificación en las condiciones de práctica influye significativamente en el esfuerzo percibido de los jugadores y en determinadas variables individuales y colectivas del juego. Se concluye que podemos considerar la restricción temporal como un medio eficaz para incrementar la carga mental en el proceso de entrenamiento.

Recibido: 07/ 09 / 2022
Aceptado: 12/ 11 / 2022

1. Introduction

Sports training aims to maximize the performance of athletes (Del Villar et al., 2014; Brewer, 2018). During this process, the subject is exposed to a workload, defined as the totality of training stimuli performed on the organism. An external load, which corresponds to the set of tasks or activities proposed to the players to provoke adaptations in their organism (duration of the exercise, number of repetitions, etc.), and an internal load, which corresponds to the individual response of the organism against the demands proposed by the external load (Bray et al., 2012; Lopes et al., 2012; Cause et al., 2017; Coutinho et al., 2017), assessable by different tools, such as heart rate, oxygen consumption, blood lactate, subjective perception of effort, etc (Cárdenás et al., 2013; Camacho, et al., 2019).

But team sports training also involves the use of different technical and tactical elements executed collectively, which makes it even more difficult to control the training load, due to individual differences in responses to physical and mental demands, which increase the difficulty in measuring and compressing workload levels (Abreu & Estevez, 2014). The combined effect of these physical and mental demands on the same task has received little attention in the scientific literature.

Therefore, physical fatigue is not the only type of existing fatigue that affects performance, but there is another type resulting from the cognitive and emotional activity of the subject, which receives the name of "mental fatigue", ignored for many years by sport scientists, develops in a manner quite similar to physical fatigue, involves changes in mood, information processing and behavior, and arises when behavior is abandoned because the energetic costs exceed the perceived benefits (Alarcón et al., 2018; Carbonell et al., 2021).

There are numerous studies that have tried to find out the factors that influence the workload endured by players during the game (Flavio et al., 2012; Fraser et al., 2012; Klusemann et al., 2012; Scanlan et al., 2014), mostly concluding that the provision of explicit information (explicit or intentional teaching strategies) to players by the coach limits performance under stressful or time-limited conditions (Rendell et al., 2011; Zhu et al., 2011; Lola et al., 2012; Buszard et al., 2013; Maxwell et al., 2016; Gamero Portillo et al., 2019). This is due to the fact that players, when supplied with rules or information explicitly, during their performance in the game will have the need to raise them to a conscious level, dedicating a large part of their cognitive resources for this purpose, and because the individual's memory and processing capacity is limited, this favors in many cases the deterioration of their performance (paralysis by analysis) in environments where they must make quick decisions (Wulf et al., 2013; Camacho, 2016; Balagué et al., 2019).

For all these reasons, if a large part of the actions that are executed in basketball reveal the need to make extraordinarily fast decisions, the training process should contemplate the development of the mechanisms that guarantee such mental agility, these being those that correspond to the most intuitive or incidental intelligence, related to unconscious processing (Abreu & Estevez, 2014; Borges et al., 2019: Caldeira et al., 2019). This type of processing hardly consumes attentional resources, since it is based on motor automation, and as a consequence does not generate high levels of mental workload (Capio et al., 2012), thereby freeing up these resources to devote to other processes, with the advantages that this entails.

That is why, in order to solve the above-mentioned limitations, some authors advise reducing the amount of information provided to the players by using incidental or implicit teaching strategies for this purpose, based solely on the manipulation of practice conditions (Carvalho et al., 2013; Correia et al., 2014; Cantos & Moreno, 2018; Clark et al., 2018; Camacho, 2019), thereby aiming to avoid artificial induction of focus of attention (Komar et al., 2013; Lohse et al., 2014; Saemi et al., 2016) and physical and psychological stress (Abernethy et al., 2012), balancing the same availability of rules for all players (Kalkhoran & Shariati, 2014) and favoring through constraints that they autonomously perceive, organize and interpret relevant information from the environment (Correia et al., 2014; Delextrat & Martinez, 2014; Gonçalves et al., 2016; Figueira et al., 2019).

2. Objectives

The main objective of our study is to analyze whether limiting the amount of information provided by the coach to basketball players for the teaching of certain individual and collective concepts exerts an effect on players' stress and on their motor actions under stress and time-limit conditions.

3. Metodology

3.1. Participants

Twenty-four college students between the ages of eighteen and nineteen years of age (16 males, 8 females, mean age 18.76 years, s = 1.14) voluntarily participated in this study. The recruitment and experimental procedures of this study were in accordance with the Declaration of Helsinki. All volunteers were informed of the experimental objectives and conditions, and signed an informed consent before the study. All participants were physically active and healthy subjects, with less than 2 years of basketball practice. The participants were divided into 3

groups of different level (level 1: 2 teams of 4 players each of low skill level; level 2: 2 teams of 4 players each of medium or moderate skill level; level 3: 2 teams of 4 players each of moderate-high skill level). In order to know the level of the participants, a classification session was carried out, in order to obtain the homogenization among the participants, explained in the following section. The players were randomly distributed within each group in order to achieve homogeneity among them. The teams only faced teams of the same level.

3.2. Design

A total of four experimental conditions were designed (CE1, CE2, CE3 and CE4). All of them involved a full-court basketball game of four attacking players against four defending players (4v4). The rules for each of these conditions were as follows: EC1, normal play; EC2, with time limitation of 9 seconds in each attacking possession; EC3, 4 passes maximum per possession; and EC4, a combination of conditions 2 and 3, i.e., a maximum of 9 seconds and 4 passes per possession. An intrasubject design with repeated measures pretest and posttest was elaborated on the situations mentioned above. The 3 experimental groups performed the 4 conditions. These conditions were counterbalanced in order to avoid the order effect.

Two sessions were carried out, a first classification session and two training sessions.

Qualifying session

The skill level of the players was evaluated in real 4v4 competition situations. The performance index (PIR), used in European competitions to evaluate the overall performance of a player, was used, calculated as follows: (points + rebounds + assists + steals + blocks + fouls committed) - (missed field goals + missed free throws + turnovers + rebounded shots + fouls committed). Once the evaluation was completed, the players were divided into 3 groups of different levels: group 1 of low level, group 2 of medium level and group 3 of moderate-high level.

Training sessions

In each session the groups performed the 4 experimental conditions. The sessions consisted of 5 minutes of play for each condition with the corresponding rules mentioned above. Participants were not provided with any other information, they were only informed about the corresponding rules of each experimental condition prior to the performance of each 4v4.

3.3. Variables and instruments

Mental workload

The mental workload was obtained through the rate of perceived exertion (RPE), using the Borg 6-20 scale (Borg, 1982), composed of values between 6 and 20, with 6 being equivalent to “no exertion” and 20 to “maximum exertion”. This scale records the levels of effort perceived by the participants in relation to the different experimental situations. This questionnaire was completed by the players at the end of each of the 4 experimental conditions.

Motor actions

To determine the motor actions of the players, these were grouped into 3 large blocks: (1) variables related to collective play: number of attack phase, duration of attack phase, number of passes in possession; (2) variables related to individual play: obtaining possession, completion of possession and duration of possession; and (3) variables related to space: ball recovery and first pass.

3.4. Statistical analysis

In relation to the mental workload (Borg 6-20), a first descriptive analysis is proposed, which will help us to obtain some initial conclusions on how the variables behave, and together with the correlation analysis, we can lay the foundations for the analysis of comparison of means, which will be carried out by means of the Student’s t-test. If it has three or more categories, the comparison of means will be carried out through the more general mathematical model called Analysis of Variance (ANOVA).

In relation to performance, a descriptive study of the variables that significantly affect the motor behavior of the players was carried out. Through a one-factor ANOVA comparison of means, taking the experimental condition as a factor, contrasts were made with each of the variables involved in the players’ performance.

4. Results

4.1. Mental workload

In the descriptive analysis, the mean and median values behave similarly to each other. The highest mean is observed in experimental condition 4 (6.92), with a median of 7, indicating that the players are very tired. There is a certain homogeneity in the data collected.

Pearson’s correlation, a statistical index that measures the linear relationship between two quantitative variables, was calculated. In the first correlation it is observed that when comparing CE1 with the other values of Pearson’s statistic, they are not the same. The correlation is moderate for CE3 (significant) and CE4 (significant) and slight with CE2Borg (significant). If we compare the other variables two by two, it is observed that significant

values are found, indicating that they are related.

A comparison of means analysis was then performed using the ANOVA test (Table 1).

Table 1. ANOVA

		Sum of squares	gl	Root mean square	F	Sig.
CE1	Between groups	55,917	12	4,660	3,683	,019
	Inside groups	13,917	11	1,265		
	Total	69,833	23			
CE2	Between groups	43,617	12	3,635	3,913	,016
	Inside groups	10,217	11	,929		
	Total	53,833	23			
CE3	Between groups	89,742	12	7,478	13,233	,000
	Inside groups	6,217	11	,565		
	Total	95,958	23			
CE4	Between groups	53,917	12	4,493	3,551	,022
	Inside groups	13,917	11	1,265		
	Total	67,833	23			

Source: Own elaboration.

The table calculates the sum of squares, the degrees of freedom, the quadratic mean, the F-Snedecor statistic and the p-value. We start from a significance level of 0.05. In each of the p-values obtained, all the values are lower than this one, so we are able to reject the null hypothesis: there are significant differences between the evaluations collected for the tests performed. The modification in the practice conditions, by means of time limitation, motor limitation or the combination of these, have a significant influence on the effort perceived by basketball players.

4.2. Motor actions

Through a one-factor ANOVA comparison of means, taking the experimental condition as a factor, the contrasts have been carried out with each of the variables involved in the study of the players' motor actions.

In relation to the variables of collective attacking play, table 2 shows those contrasts that are significant, with a significance level of 0.1. We can see that the variables that influence the experimental conditions are: "number of attacking phase", "duration of attacking phase" and "number of passes per possession".

Tabla 2. ANOVA collective play

		Sum of squares	gl	Root mean square	F	Sig.
Attack phase number	Between groups	31,160	3	10,388	2,087	,100
	Inside groups	5432,604	1090	4,974		
	Total	5434,780	1093			
Duration of attack phase	Between groups	480,700	3	161,900	20,767	,000
	Inside groups	8495,630	1085	7,794		
	Total	8882,343	1080			
Number of passes possession	Between groups	17,930	3	6,310	10,564	,000
	Inside groups	435,024	728	,590		

Source: Own elaboration.

It is observed that these three variables do not behave the same in the four experimental conditions. The „number of the attack phase" is significantly different in each of the experimental conditions. The same occurs when measuring the „duration in the attack phase" time, which is not the same in the four conditions. This also happens in the variable that measures the „number of passes per possession", as significant differences are found in the four experimental conditions.

In relation to the variables of individual attacking play, an ANOVA comparison of means was carried out for the variables that showed significant differences: „obtaining possession", „completion of possession" and „duration

of possession“ (Table 3).

Table 3. ANOVA individual play

		Sum of squares	gl	Root mean square	F	Sig.
Obtaining possession	Between groups	50,640	3	18,540	2,260	,068
	Inside groups	16010,195	1942	7,746		
	Total	16065,840	1945			
Termination of possession	Between groups	70,600	3	22,537	2,596	,043
	Inside groups	17716,690	2040	7,725		
	Total	17780,305	2056			
Duration of possession	Between groups	47,236	3	13,415	4,070	,007
	Inside groups	7214,149	2032	3,530		
	Total	7260,385	2035			

Source: Own elaboration.

There are significant differences in „obtaining possession“ when measured in each of the experimental conditions. Similarly, it can be affirmed that the variable measuring „completion of possession“ takes significantly different values in the four tests performed by the players. The third variable examined, „duration of possession“, shows significant differences among the four experimental conditions.

5. Discussion

The aim of the study is to analyze whether limiting the amount of information provided by the coach to basketball players for the teaching of certain individual and collective concepts exerts an effect on the players' stress and their motor actions under stress and time-limit conditions.

In relation to the mental workload, this was recorded through the Borg 6-20 subjective perceived exertion questionnaire (Borg, 1982), which measures the entire range of exertion that the individual perceives when exercising. This scale allows us to adjust for different exercise intensities in sports and sports rehabilitation. The concept of perceived exertion is a subjective assessment that indicates the subject's opinion of the intensity of the work performed.

The results indicated that the four experimental conditions recorded different fatigue values, these differences being significant. The effort required by test 1 is not the same as that required by test 2, test 3 or test 4.

These results show the mental cost of restricting the time available to decide and act. In the study by Cardenas et al. (2015), they pointed out that the possibility of making an accurate forecast of events depends directly on the time available to make the analysis of environmental conditions. Specifically, they pointed out that the reduction of the time to make decisions has two consequences that cause a significant increase in the mental load: on the one hand the greater cognitive difficulty and on the other the negative hedonic value that athletes must face after accumulating a greater number of errors (Eston, 2012).

In relation to motor actions, studies have been developed that highlight the importance of environmental constraints in the development of the sport experience (Araujo et al., 2010), since different combinations of the constraints performed in the tasks of the studies can provoke different responses in the players.

As stated by Cordovil et al. (2009), Craig and Watson (2011) and Duarte et al. (2013), interacting constraints in tasks can influence decision-making processes in team sports (defenders' posture, height of the basket, anthropometric characteristics of defenders, distance between players and areas of the field, among others), which once again highlights the thesis that the task being learned is a critical factor in the interpretation of study results.

There have been studies where a throwing task was developed in which the players' responses did not adapt to the imposed constraints (Rendell et al., 2011), which shows that the manipulation of these constraints must be carefully designed, in order to encourage players to extract the relevant information to guide their performance in the game at each moment.

But studies have also been developed whose results show that the uptake of some simple rules does not require intentional instruction (Cordovil et al., 2009; Esteves et al., 2011; Correia et al., 2012: Headrick et al., 2012; Chow, 2013).

This may be due to the concept of perceptual salience that Alarcón, Ureña and Cárdenas (2014) tell us about in their study, understanding this as the degree to which a concept can be perceived by the subject.

In relation to the level of experience of the participants, Adams (1971) suggests that in some motor skills performed in the early stages of acquisition players may encounter problems, because they have not yet developed

a perceptual imprint of the movement, so they need external feedback to guide them in this process. On the other hand, expert performance requires little conscious attention, as reflected in the study by Otten (2009), whose experimental subjects perform free throws in basketball, concluding that reversing attention to the task leads to greater cognitive and somatic anxiety, and may impair performance under pressure. Studies, such as those conducted in soccer by Poplu et al. (2003) and in handball by Raab and Laborde (2011), conclude that elite players perform more intuitive processing than novice players, the latter's processing being slower and more deliberate.

6. Conclusions

Taking into account the results mentioned above, in relation to the mental workload, we can affirm that the modifications made in the different experimental conditions have a significant influence on the effort perceived by the basketball players. The sources of this mental workload are mainly aspects related to time pressure (time available, time needed, etc...), aspects related to the amount of processing resources demanded by the task, and aspects of an emotional nature (frustration, stress level, etc...). The subject's successful performance will depend on his or her ability to allocate and maintain attention on relevant information for a sufficient time, filtering and discarding irrelevant information from the environment during this process.

However, this attention may be dispersed as a result of the characteristics of the environment (noise, temperature, etc.) and/or internal states of the subject (own thoughts, subjective feelings of fatigue, etc.), such distractors competing with the relevant cues from the environment, resulting in a lower allocation of resources for task execution (motor control and decision making).

Therefore, the results of this work show the convenience of considering temporal restriction as an effective means to increase the mental load in the training process.

In relation to the influence of the different constraints on the motor actions performed by the players during the game, the findings obtained in our studies reflect that the variables related to space, collective and individual play are influenced by environmental constraints.

The aforementioned results should be analyzed with caution, since we cannot affirm that the strategy followed by the players in this type of tasks has been only implicit, since all the measures carried out to reach these conclusions have been taken indirectly. The only way that would clarify more precisely what type of processing the subject uses would be the use of alternative techniques, such as the measurement of cortical activity (Glockner et al., 2012; Cooke, 2013).

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