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The effect of a physical literacy and differential learning program in motor, technical and tactical basketball skills

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THE EFFECT OF A PHYSICAL LITERACY AND DIFFERENTIAL LEARNING PROGRAM IN MOTOR, TECHNICAL AND TACTICAL BASKETBALL SKILLS

KEYWORDS: Skill acquisition, Performance analysis, Team sports, Non-linear pedagogy

ABSTRACT: The aim of this study was to examine the effect of a physical literacy and differential learning program in motor, technical and tactical basketball skills. Seventy-six college students (age 20.4 ± 1.9) were randomly allocated into control and experimental (BasketCAL) groups. The motor skills were assessed using Illinois Agility Test, technical abilities were evaluated through Taco Bell skills challenge and tactical variables were examined during a 4-on-4 full-court basketball game. Globally, the learning program and respective classes could be characterized by attentional breadth, large unpredictability and adaptation demands. The results indicated that BasketCAL group had a significant improvement in agility comparatively to the control group. Also, was noted that BasketCAL students decreased the unsuccessful actions performed during the game. Overall, this program prepares the players to attune the relevant stimulus through the development of adaptive behaviors to overcome environment constraints, leading to better game decisions.

Nowadays, team sports are characterized by large unpredictability, high decision making demands and a great diversity of players. Under such conditions, it is necessary that players are on the top of their physical, technical and tactical capacity to overcome all adversities imposed by competitive environments. Therefore, coaches should be capable to develop motor, perceptual and cognitive capacities, through different tasks (Haudum, Birklbauer, Kröll and Müller, 2012).

Regarding motor domain, the physical literacy training has been extensively used in teams sports (Giblin, Collins and Button, 2014). For instance, this type of work is important for basketball players because supports the proper development of footwork skills. Thus, a player with high motor ability enhances the probability of success in physically challenging situations. This is because the subjects will be more able to analyze, predict or anticipate the environment conditions, and finally react in a more capable and appropriate way (Higgs, 2010).

Contemporary research concerning skill acquisition, motor learning and expert performance highlights the advantage of using representative tasks, especially those who are highly relevant to performance and recreate the perceptual, cognitive and motor demands of competition, coupled with a lower focus of instruction (Ford, Yates and Williams, 2010). According to previous assumptions, recent training methods such differential learning approach, emphasize the importance of variability during learning, and can be characterized by adding random variable elements to a movement pattern. Thereby, it takes advantage of the fluctuations that occur, increasing them, without repeated actions and no corrections during the skill acquisition phase (Schöllhorn, Hegen and Davids, 2012; Schollhorn, Mayer-Kress, Newell and Michelbrink, 2009). Differential learning drills promote changes in system coordination and dynamics, providing a new set of experiences that force the subjects to discover the adaptive response (Torrents, Balagué, Perl and Schöllhorn, 2007). This method, intends to improve players' ability to adapt to new situations (Torrents et al., 2007) imposed by competitive environments. According to Schöllhorn, Sechelmann, Trockel and Westers (2004) the philosophy of differential learning is: "*never practice the right thing in order to play right*".

Recent evidence from motor learning has been debating how skill and game acquisition is supported by nonlinearity, where learning needs to be located in real-game contexts. Therefore, the aim of this study was to examine the effects of a training program grounded in physical literacy and differential learning approaches in motor, technical and tactical basketball skills.

Method

Participants

Seventy-six male and female college students (20.4 years ± 1.9) from a physical education degree volunteered to participate in this study. The sample, according with the syllabus of the curriculum, were attending basketball classes two times per week (120 min/class). The students was randomly distributed in two

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different groups: control (n = 38) and experimental (n = 38). All participants received a clear explanation of the nature and the demands of the study, and wrote an informed consent before testing. The investigation was approved by the local Institutional Research Ethics Committee and conformed to the recommendations of the Declaration of Helsinki.

Procedures

The motor skills were assed using the Illinois Agility Test, following the Cureton (1951) guidelines, to measure the ability to turn and accelerate in different directions at different angles (Lennemann et al., 2013). To measure the technical basketball skills, participants performed the Taco Bell challenge, adapted from a contest held during the annual All-Star Weekend (NBA). This test consist in a competition to test passing, ball-handling and shooting skills. The participant only advances in the circuit when his actions are successful and the total time used to complete the challenge was recorded by experienced researchers.

The assessments also included a competitive situation, specifically a 4-a-side basketball game. The tactical variables included: (a) *triple threat position*, refers to the initiative of the player with the ball that makes him in a position to (either) pass, shoot or dribble; (b) *field goal*, refers to any field goals that a subject has made or attempted (this includes both 2 points and 3 points); (c) *give-and-go*, refers to the player movement without the ball towards the basket after a successful pass; (d) *explore 1-on-1 game*, refers to the initiative of the player with the ball who, after weighting time and space available, decides to play against his direct opponent in order to score the basket. Two cameras were used to record the game events. Later, subjects' actions were analyzed in video and characterized according to their success (successful or unsuccessful). All tactical variables were normalized according to game ball possessions in order to account for differences in game space (Kubatko, Oliver, Pelton and Dan, 2007; Sampaio and Janeira, 2003). After an initial familiarization procedure, the aforementioned set of multilateral tests were executed twice during the program, pretest and posttest (first and last sessions, respectively).

BasketCAL program design

The program was performed during eight weeks (between October and December, 2013), for a total of sixteen classes. Classes had similar organization for both groups (control and experimental), composed by four distinct parts: (a) warm-up, the students performed exercises related to the contents of classes; (b) main part, the subjects executed basketball specific drills, with the purpose of increase and improve their technical and tactical knowledge about the game; (c) small-sided games, consisting in simple practices of play that promoted learning through play; (d) 5-a-side basketball game, allowing students to test the information learned (during class) in a formal game way. It was only during the main part of the class that groups were exposed to different tasks. While the subjects of control group executed specific basketball tasks, BasketCAL group performed drills related with differential learning and physical literacy approaches, always in accordance with the goals of each class. The physical literacy work, promotes an improvement in footwork, designed to enhance certain motor abilities such agility, coordination, balance, speed and acceleration capacities (Whitehead, 2010). The differential learning drills aimed to develop the technical capabilities, based on indeterminate interactions with different movements and actions among learners and the environment (Chow, Davids, Hristovski, Araujo and Passos, 2011). Training method emphasizes the motor, technical and perceptual development that contributes for a better game decision.

Statistical Analysis

The effects were tested using an analysis of covariance, were the pre-test scores were used as covariate, the post-test scores as dependent variable and the group as independent variable. Due to the nature of the variables, the previous procedure was parametric (ANCOVA) for the *Agility* and *Taco Bell* results and non-parametric (Quade test) for the remaining variables. All data were analyzed with the statistical package SPSS for Windows, version 21 (SPSS Inc., Chicago, IL). The level of statistical significance was set at $p \leq .05$.

Results

The Table 1 presents the results between control and experimental groups. The results revealed that BasketCAL subjects had a significant improvement in agility capacity ($F = 8.7$, $p \leq .05$). BasketCAL group also obtained a significant decrease in all unsuccessful actions when compared with control group. Nevertheless, only triple threat position ($F = 6.0$, $p \leq .05$) and give-and-go ($F = 16.5$, $p \leq .05$) presented significant differences.

Discussion

The purpose of this study was to examine the effects of a training program grounded in physical literacy and differential learning approaches in motor, technical and tactical basketball skills. The results suggests interesting findings, particularly the improvement in agility, and the decrease in all game unsuccessful actions, particularly in triple threat position and give-and-go actions. The training process is an essential key to achieve better performances regardless the sport context, however during the long term athletic development the physical literacy training is neglected. This approach makes individuals more physically capable, develops balance, improve agility and the performance of more fluid, graceful and efficient movements (Stafford, 2005). In this sense, agility improvements in a population whose age round, on average, twenty years can be explained by the fact that BasketCAL program combined physical literacy concepts with footwork techniques (Sheppard and Young, 2006). At first sight, developing fundamental movement competence (basic skills) and footwork abilities are essential to engage in advanced motor experiences (Giblin et al., 2014). These drills will enable players to better control their freedom degrees and therefore perform more fluid movements. However, this ability is better expressed and observed during complex movements, such as the actions performed in game. That is, the constant variation and adaptation will enable the individuals to master the basic movements and integrates them to produce complex motor skills (Seifert et al., 2013).

These complex skills acquisition have been developed in several training programs sustained on variability in motor learning and development under variable practice conditions (Button, Macleod, Sanders and Coleman, 2003). The differential learning approach has been subject of research by several researchers (Frank, Michelbrink, Beckmann, and Schollhorn,

Variables		Control (n = 38)			BasketCAL (n = 38)			*F*	*p*
		Pretest	POSTTEST	% Var	Pretest	Posttest	% Var		
Agility (seconds)		16.8 ± 1.5	15.9 ± 1.5	-5.5	16.1 ± 1.0	14.8 ± 1.0	-8.1	8.7	.004*
Taco Bell (seconds)		51.4 ± 15.5	43.9 ± 10.9	-10.6	46.7 ± 8.2	44.6 ± 9.5	-2.2	1.1	.284
Triple threat position	*Successful*	19.1 ± 10.2	31.4 ± 16.0	87.3	34.4 ± 22.6	30.7 ± 16.9	-33.9	2.0	.158
	Unsuccessful	7.0 ± 6.2	2.7 ± 5.2	-53.5	6.6 ± 8.1	.51 ± 1.8	-89.0	6.0	.016*
Field goals	*Successful*	7.6 ± 8.5	8.2 ± 9.2	6.1	10.7 ± 12.7	6.3 ± 7.3	-35.4	1.5	.218
	Unsuccessful	13.5 ± 9.3	14.6 ± 13.6	23.0	18.8 ± 16.0	15.6 ± 9.7	-10.1	0.4	.507
Give-and-go	*Successful*	6.3 ± 6.2	8.7 ± 9.5	26.7	7.6 ± 10.1	10.5 ± 10.1	41.2	0.3	.574
	Unsuccessful	9.8 ± 7.2	4.2 ± 6.8	-51.5	14.1 ± 13.1	.53 ± 1.6	-92.7	16.5	.000*
Explore 1-on-1 game	*Successful*	2.7 ± 3.0	5.9 ± 7.6	28.8	5.7 ± 9.0	6.4 ± 6.7	29.1	0.5	.465
	Unsuccessful	.91 ± 2.1	.82 ± 2.8	-55.5	.50 ± 2.1	.41 ± 1.3	-100.0	0.0	.891

* Significant differences at $p < .05$.

Table 1. Descriptive and inferential statistics (mean, standard deviation and variation percentage) for control and experimental groups

2008; Schollhorn et al., 2009), however the large majority of studies use the assumptions to improve the quality and efficiency of a specific technical movements, such handball throw (Wagner and Muller, 2008) or football shoot and ball control (Schollhorn, Hegen and Davids, 2012).

We decided to go a little further, and test the hypothesis that a basketball training program sustained on differential learning provided enhancements in performance indicators of basketball game. The tactical (in-game) variables were included in behavioral assessment, targeting possible improvements in students' ability to understand the game. Overall, the main findings revealed decreases in unsuccessful actions, which suggest that students concluded the program with a better understanding of the game. These facts also confirm that different stimuli imposed by differential training allows the development of the skills that individuals need to succeed in dynamic game situations (Haudum, Birklbauer, Josef and Müller, 2011). BasketCAL students were continuously exposed to different and varied stimuli, and perhaps this broad exposure allowed them to develop attentional mechanisms to facilitate their adaptation and attune relevant information to overcome game constraints. This finding is supported by Torrents and Balagué (2006) who consider that differential training had benefits on performance indicators and behavioral aspects of the game and highlighting the capability of the players to find the best solutions to constant environment changes, adapting their behavior according to the affordances resulting in better decision making. So, this study supports the idea that when complied a physical literacy and differential learning basketball program the benefits are highlighted in motor skills, like agility, but also in game performance indicators. Globally, this program prepares the players to attune the relevant stimulus through the development of adaptive behaviors to overcome environment constraints, which results in best game solutions.

EL EFECTO DE UN PROGRAMA DE CONOCIMIENTO MOTOR Y APRENDIZAJE DIFERENCIADO EN LAS HABILIDADES MOTORAS, TECNICAS Y TACTICAS DE BALONCESTO

PALABRAS CLAVES: Adquisición de habilidades, Análisis del rendimiento, Deportes de equipo, Pedagogía no lineal..

RESUMEN : El objetivo de este estudio fue examinar el efecto de un programa de alfabetización motora y aprendizaje diferenciado en el desempeño motor, habilidades técnicas y tácticas de baloncesto. Setenta y seis estudiantes universitarios (20.4 ± 1.9 años de edad) fueron asignados de modo aleatorio en grupos experimental (BasketCAL) y de control. Las habilidades motoras se evaluaron a través de la prueba la agilidad de Illinois, la habilidad técnica se evaluó a través de concurso Taco Bell y se examinaron las variables tácticas durante un juego de baloncesto 4 contra 4 en toda la cancha. En general, el programa BasketCAL y las respectivas clases podrían caracterizarse por la amplitud atencional, gran imprevisibilidad y demandas de adaptación. Los resultados indicaron que el grupo BasketCAL tuvo una mejora significativa en la agilidad comparativamente con el grupo control. Además, se observó que los estudiantes BasketCAL disminuyeron las acciones sin suceso durante el juego. En conclusión, este programa prepara a los jugadores para sintonizar el estímulo relevante a través del desarrollo de conductas adaptables para superar las limitaciones del entorno, lo que lleva a mejores decisiones en el juego.

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