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Original article

PRACTICAL MOTOR EXAMPLES USED BY COACHES TO OPTIMIZE THE LEARNING PROCESS FOR YOUNG HURDLES RUNNERS - A REVIEW

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Abstract*

Aim. In the last years there has been a growing interest in the motor learning as part of the adaptation process to different situations pointing out that all the motor patterns are part of the training helping the coaches to understand the behavior of the motor skills that will be consolidated neurologically. The interest for contextual interference, practice variability and differential training is motivated by its applicability to the modern hurdles training that requires motor adaptation from the start to finish (hurdle clearance and landing, running between hurdles).

The main objective of the article is to present a theoretical review of the practical motor examples that coaches can use to create new motor learning experiences that will improve the performance of their athletes. The practical motor examples are focusing on contextual interference, differential training and their relationship with motor learning and motor potential.

Conclusion. It seems that the practical motor design can determine changes in a positive way for the young athlete that acquire new skills helping them in different situations specially in the upcoming competitions.

Keywords: practical motor examples, contextual interference, differential training, motor potential, hurdles.

Introduction

In the last years there has been a growing interest in studies that focus on connections between motor learning and sports performance. The focus of recent research has been on attempting "to make clear the distinction between learning and performance effects of practice, as well as to illustrate how track and field coaches can benefit from understanding the distinction" (William, Philip, 2002).

Namely according to (Iskra, 1995, p.51) "the 110 meters hurdle race belongs to the group of athletic events in which a high motor potential is as important as the level of technical preparation" connecting technical aspects with motor potential. "(Jan, João, Pedro, 2015, p.16). The author (William, 1992, p.45) predicted that coaches need to understand that "to optimize performance is to optimize learning. Unfortunately, the relationship between the two variables is not straightforward. It appears that there are times when optimal motor skill learning results from using a practice sequence that produces less than optimal performance". The well known hurdles coach Santiago Antunez, who trained the Olympic champion and world holder in the 110 m hurdles, Dairon Robles according to (Nassau, Bahamas, 2003, p. 107) is planning his hurdles training based on "pedagogy of teaching of motor learning, and teaching progressions for the hurdles at different stages of development".

When it comes to hurdles motor progression, coaches need to work with practice variables, manipulating changes of distances and highs of the hurdles for different age groups, rhythm between hurdles, minimizing the time over the hurdles etc.

Motor progression incorporates contextual interference, practice variability and differential training (differential learning) as part of the training. Even though the efficiency of this concepts is well known "coaches need to design an appropriate practice schedule that is appropriate of the performer stage of learning. Sometimes this is referred to as matching the level or difficulty in practice to the learner's level of development" (<http://www.d.umn.edu/~dmills1a/courses/motorlearning/labs/Contextual%20Interference.htm>).

The challenge that coaches can face during learning is to "understand that manipulating contextual interference during practice can maximize the learning of each young athlete" (http://wiki.ubc.ca/Course:KIN366/ConceptLibrary/Contextual_Interference).

Coaching Effectiveness during motor training for hurdles.

According to (William, Philip, 2002, p.36) "to maximize coaching effectiveness, it is important for coaches to understand which variables affect performance temporarily (called performance variables) and which affect

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performance in a relatively permanent way (called learning variables)".Part of the methodical perspective, coaches can develop skills for hurdling "following a sequence that leads from good sprint mechanics and posture towards hurdles running"(Will, 2015, p.150).

According to (William, 1992, p.46) discuss thrower and 110 m hurdler "involve closed skills and stereotyped movements " that can be used by coaches. An important step in the effective coaching is understanding the meaning of motor learning stages which incorporate: the cognitive, associative and the autonomous stage."Most people move from stage to stage as they learn skills. However, some might not arrive at the last stage as a result of the training demands, the complexity of the task, or a lack of motivation"(Will, 2015, p. 234).

Nevertheless for the hurdles event the "most important motor skill to learn in order to hurdle well is the sequence of clearing first the lead leg and then the trailing leg over the hurdle. This

sequence must be done very quickly and with a minimum of clearance height over the barriers so the hurdlers can return their feet to the track to continue sprinting"

(http://www.coachr.org/teaching_beginners_to_hurdle.htm).

During training sessions coaches will develop skills for their athletes that can range from simple to complex and " movements or drills must be done at 85 to 95% or greater speed in training. Movements that mimic the skills of an event will not be transferred to the execution if the pace of the skill practice is not close to the execution of the event"

(http://www.hurdlecentral.com/Docs/Coaching/Parke_BasicConceptsForCoachingAthletics.pdf).

To emphasize the coaching effectiveness , coaches will find themselves implementing ideal training methods that incorporate different motor learning approaches Figure 1: variability of practice, contextual interference, differential learning (learning).

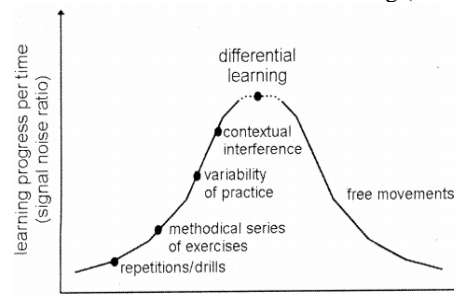


Figure 1. A framework for different motor learning approaches (Schollhorn, Mayer-Kress, Newell & Michelbrink, 2009) (https://www.sport.uni-mainz.de/Dateien/Stochastic_pertubations.pdf)

Contextual interference into track and field

According to (William, Philip, 2002, p.38) "track and field practice is often blocked, presumably because it is easier for a coach to organize and/or because it results in effective performance. Research suggests, however, that when learning is the goal, random practice should be the method of choice".

The track and field coach who schedules training practice for more than one skill for a training session needs to " know that there are high learning benefit resulting from performing multiple skills in a high contextual practice schedule (e.g.

random), when compared to performing the skill in low contextual interference schedule (e.g., blocked)"(<http://www.d.umn.edu/~dmillsa/courses/motorlearning/labs/Contextual%20Interference.htm>).Studies have shown that "if contextual interference is used, the person actually spends less time working at each skill than use blocked practice. The coach has to decide whether time is best spent on one activity or on several. The use of skill circuits can aid contextual interference" (Terry, Tudor, 2006, p.116). Table 1 is presenting the following examples of contextual interference that can occur during hurdles training.

Table 1. Practical motor examples for hurdles

Coaches focus on:	Contextual interference
<i>Changing the athlete motor behavior over the hurdles</i>	<p style="text-align: center;"><i>Motor Learning Activity Model</i></p> <p>According to (Will, 2015, p.149) the contextual interference in 110 meters hurdles event "occurs when the hurdler adjusts his effort to changing circumstance (e.g., hurdles that are closer together) to become neurologically aware of correct performance. This process aids in the</p>



overall learning to correct technique. By developing a quicker rhythm, the hurdler develops new motor patterns that are imprinted neurologically.

Quicker rhythm to the first hurdles

Example of hurdles practice: Coaches are using two athletes (one will clear the first hurdle and the other athlete will do a normal sprinting from the blocks. Purpose of this exercise is to improve the acceleration of the hurdler runner before the first hurdle.

Hurdles practice drills for the leading leg and trailing leg

Blocked, Serial, Random practice

Variability of practice into track and field

Hurdles can be demanding when it comes to skill acquisition and transfer stage because of that coaches schedule practice from general to specific to facilitate the development of skilful athletes during the motor learning process. The hurdles beginners face themselves with the unknown whereas the advanced hurdler will master all this situation based on his experience. According to (Magill, 2011, quoted in Gavin, 2016, p.412) "Early learners tend to benefit from reduce variability in practice whereas advanced learners benefit more from increased variability in practice"

In the hurdles event practice variability will take place in different circumstance of the hurdles race."There are numerous practice variables that may influence performance, however, some of these produce effects that are relatively temporary. For example, skill performance can be affected by, warm-up, fatigue, etc" (William, Philip, 2002, p.36). Spacing and height for hurdles will change from one stage (group age) to another (Table 2), coaches trying to integrate training with the new requirements (Table 3).

Table 2. FRA (Romanian Athletic Federation) - hurdles spacing and height for different age category (<http://www.fra.ro/fisiere/1321868110.pdf>)

	Age category		
	Juniors second Category (men)	Junior First Category (men)	Senior men
<i>Distance to first hurdle</i>	13,72 m	13.72 m	13.72 m
<i>Distance between hurdles</i>	9.14 m	9.14 m	9.14 m
<i>Run in distance</i>	14.02 m	14.02 m	14.02 m
<i>Hurdles height</i>	0,914 cm	100 cm	106.7 cm

Table 3. Practical motor examples for hurdles

Coaches focus on:	Practice variability
	<i>Motor Learning Activity - Model</i>
<i>Beginners training: first impact with the hurdles heights and racing spacing</i>	For athletes who are learning for the first time hurdles, first they need to gain self confidence to overcome the barriers height and "if the hurdles are threatening, the athlete will be reluctant to run aggressively and will learn improper techniques. As the athlete develops the motor skills needed for good hurdling, the barriers should be adjusted in both height and spacing as long as the athlete can run with the correct rhythm and technique. Practice done with hurdles that are too high or too far apart for the athlete's ability forces the athlete to adjust to get over the hurdle in a way that results in deceleration. This leads to incorrect motor patterns that delay skill development. As the athlete progresses, hurdles can be adjusted higher and closer to the normal racing spacing. Regardless of hurdle height or spacing, the athlete must achieve the correct running rhythm at all times. Even after achieving proficiency, practicing with modified hurdles can help the athlete race at quicker tempos" (Will Freeman 2015, p.148).



7 steps approach

For better results coaches can use for tall athletes seven steps approach to the first hurdle either then eight steps approach. Athletes must increase his lower limb power and also changing the blocks distance from the start line.

Examples of practice variability in the 110 m hurdles training adapted (William Berg, 1992, pp.48-49) - shot put:

Adapting to different practice variability

- vary steps between hurdles (5 steps, 4 steps, 3 steps)
- vary training methods
- vary the leading leg (left/right)
- vary the hurdles drills use to improve technique.
- vary acquisitions from other sports.

Differential training (learning) into track and field.

"Differential training induces continuous changes in movement executions by avoiding repetitions, removing corrective instructions and emphasizing discovery practice - Positive benefits of differential training (e.g. shot putting, soccer skills, basketball, hurdles, speed skating, and skiing) (https://www.trainer-imleistungssport.de/sites/default/files/winkelmann_nick_learning_to_sprint_40th_0.pdf). "Differential learning (learning from differences) combines the knowledge of possible movement technique adaptations and compares the execution of movements within possible solutions to "errors". This method focuses on learning from differences through the use of varied exercises" (http://www.sportwissenschaft.unisalzburg.at/spo/uploads/media/TF_TennisFootwork4_07.pdf)

Progress in the hurdles race using differential training have been made by Thomas Jaitner, David Kretzschmar , Wolfgang Hellstern (2003) ; Wolfgang I. Schollhorn, Hendrik Beckmann, Daniel Janssen and Jurgen Drepper (2010).

Thomas, David, Wolfgang (2003) have conducted a study on hurdles technique and performance using differential learning they reached at the conclusion that "differential learning approach seems to provide an alternative for effective and motivating training" (https://www.sport.unimainz.de/Dateien/tws_ChangesOfHurdle.pdf).

Wolfgang, Hendrik, Daniel and Jurgen (2010) have studied the difference between traditional training and differential training for hurdles runners and benefits for motor learning and changes that occur during hurdles race. When it comes to differences over the hurdles, when adapting to differential training according to Wolfgang, Hendrik, Daniel and Jurgen (2010) hurdles runners make a change in positions, angles of the lower and upper body over consecutive hurdles

Discussions

Differential learning is learning by discovery creating adaptations and individualization for hurdles runners. Furthermore "Variation" seem to

be the main distinctive pattern between differential training (learning), contextual interference and practice variability according to (Shea & Morgan, 1979)(https://www.sport.unimainz.de/Dateien/Stochastic_pertubations.pdf).

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Conclusions

In conclusion designing drills for beginners need to be accustomed with the movement pattern over the hurdles. There are a number of ways in which track and field coaches can adapt contextual interferences, practice variability and differential training for young athletes in 110 meters hurdles, adaptability is the essential key point having a significant effect for learning and performance.

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