

Ecological dynamics approach in the youth soccer: A short narrative review

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ABSTRACT

Introduction: The creative actions are a production of the individual who must meet the constraints of the task and the environment. Consequently, creative motor actions are understood as functional movement patterns that are new to the individual and/or group and adapted to meet the constraints of the motor problem. The literature argues that creative motor actions can be promoted by didactic interventions that favour exploration by manipulating constraints. **Methodology:** For the bibliographic search PubMed and Sport Discuss databases were used selecting articles published between 01/01/2014 and 10/09/2020. **Results:** The initial database search produced 12 results. After removing the duplicates (2) and studies on specific or tactical soccer skills (3), seven studies were selected, analysed and included in the narrative review. **Discussion and conclusions:** The spatial and task constraints affect the distances between the young players but not the passage ball angles nor the ball speed. Furthermore, one study in particular showed very high levels of vigorous and very vigorous physical activity in all the tasks designed with ecological dynamic teaching. This study show that the use of these new teaching methodologies has an impact on levels of physical activity in accordance with the recommended health parameters.

Keywords: Ecological dynamic; Constraints; Young soccer players; Motor learning.

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INTRODUCTION

The youth soccer training focused on tactic and technique learning in which often the coordinative aspects solicitation prevails. In recent years researchers and trainers shifted the attention on the cognitive function and on ability to solve motor problems (Giuriato & Lovecchio, 2018; Raiola, 2014 & 2017; Aitken and MacMahon, 2019).

This attention is justified because soccer is an open skills sport in which the player must continually adapt to a changing environment, seeking new solutions (Giuriato & Lovecchio, 2018).

This constantly changing environment in relation to the movements of all participants, teammates and opponents, requires the search for creative, non-stereotyped motor solutions (Woods et al., 2020; Davids, 2015; Savelsbergh & Van der Kamp, 2000).

The creative actions are a production of the individual who must meet the constraints of the task and the environment. Consequently, creative motor actions are understood as functional movement patterns that are new to the individual and/or group and adapted to meet the constraints of the motor problem. The literature argues that creative motor actions can be promoted by didactic interventions that favour exploration by manipulating constraints (Orth et al., 2017; Davids et al., 2015; García-Angulo et al., 2019; Silva et al., 2016).

This methodological approach is supported by the ecological dynamics theory: the ecological dynamics advocates that the relevant scale of analysis for understanding behaviour is the functionality of the individual–environment relationship (Araújo, et al., 2006). The mutuality and reciprocity of performers and their environments can result in an enhanced coupling of perception and action subsystems through learning. The skill acquisition derives as a consequence of indeterminate interactions between learners and the environment (Araújo, et al., 2007; Chow et al., 2011; Aitken and MacMahon, 2019).

This theoretical perspective reconsiders the transfer of skills and learning as a significant adaptation process to support creative motor solutions and, consequently, the talent development (Araújo & Davids, 2011, 2018; Seifert et al., 2019; . Savelsbergh & Wormhoudt, 2019).

In fact, the merging behaviours revealed in football interactions can be observed and facilitated through carefully designed practice tasks informed by '*principles of play*' rather than a rigid game model.

The soccer interactions are tuned by environmental information to function specifically in each unique situation, emphasising the need to understand the nature of the information that constrains movement. In stark contrast to predetermined passing patterns, practice should highlight informational constraints that allow players to learn new ways of acting adaptively through exploration (Woods et al., 2011; Giuriato & Lovecchio, 2018).

While the demands of football are very clear to coaches and researchers, the diffusion of this new approach is still very limited.

This happens both because the training of coaches is starting in recent years, and because this methodology requires a thorough knowledge of sport and how to teach it to children.

The aim of this paper is to provide a narrative review based on ecological dynamics theory applied on soccer teaching and training with young soccer players.

MATERIAL AND METHODS

Using the PRISMA model (Moher et al., 2009), a systematic review of the literature was performed to analyse the relationship between the ecological dynamics methodology and youth soccer training.

For the bibliographic search PubMed and Sport Discuss databases were used selecting articles published between 01/01/2014 and 11/09/2020. Two keyword groups were identified, using synonyms and similar terms, using the operator “OR”: 1) “*ecological dynamic*” OR “*ecological learning*” 2) “*young soccer players*” OR “*young football players*” OR “*youth soccer*”. Subsequently, all the categories were combined together using the “AND” operator. The last bibliographic search dates back to 11/09/2020.

RESULTS

The initial database search produced 12 results. After removing the duplicates (2) and studies on specific or tactical soccer skills (3), seven studies were selected, analysed and included in the narrative review on the basis of title and abstract and all studies were analysed in full text.

Five studies were excluded because were duplicated or analysed specific sports skills closed skills (penalty, for example).

An element emerges from the review that underlines the complexity of the motor tasks presented with an ecological approach: the role of the cognitive dimension is more prevalent than in analytical motor tasks (García-Angulo & García-Angulo, 2018).

The age of young players must be carefully considered: situational motor tasks can be extremely complex for younger children, with whom the environment constraints must be carefully manipulated (García-Angulo & García-Angulo, 2018).

In one of these analysed studies it is highlighted there is no need to reduce the training unit to individual players in team sports or to a subsystem in individual sports. Team collaborative properties like exploration, synergies and synchronization developed through challenging and varied environments, adequately diversify individual behaviour in a correlated way. While individual properties of players are important for building specific interactions within teams, these properties are best developed while playing in collective contexts. These collaborative properties may show up in a variety of game situations which can be defined at different levels and timescales, including player’s effectivities (speed, endurance, strength, etc.), player’s motivation, affection, flexibility, and creativity (Lopez-Felip et al., 2018).

These synchronized movements during the attack and defence phases observed with amateur footballers for fifteen weeks (and for thirteen matches) highlighted that synergies were formed and dissolved rapidly as a result of the dynamic creation of informational properties, perceived as shared affordances among performers. Practicing once a week led to small improvements in the readjustment delays between co-positioning team members, enabling faster regulation of coordinated team actions. These improvements have been limited, possibly due to the timescales of practice. No significant variations were found for number of shots, amount of ball possession and number of ball recoveries made (Silva et al., 2016).

Distances of attackers to the goal and ball, and distances of ball carriers to defenders, seemed to be coupled in a specific manner to guide interpersonal coordination tendencies between players during competitive performance in the futsal too (Vilar et al., 2014a).

Spatial dimensions represent a significant environmental constraint: the results of one interesting study showed existence of fewer opportunities to maintain ball possession on smaller pitches, compared to medium and larger pitches. Conversely, the different dimensions set to the pitch did not influence opportunities for players to shoot at goal, or to perform passes to other teammates. By examining the specific spatial-temporal relationships of players and key-task constraints, the data from this study explain how effects of manipulating pitch dimensions of small-sided games might enhance opportunities for acquiring specific movement and decision-making skills (Vilar et al., 2014b).

However, the spatial and task constraints affect the distances between the young players but not the passage ball angles nor the ball speed; and this was observed in the Under 15, 16 and 17 youth soccer categories (Menuchi et al., 2018).

Finally, there a study that has tried to understand whether the ecological approach and non-linear pedagogy can also meet the recommended physical activity levels for children (10-11 years old).

A quasi-experimental study was developed in which three tasks were applied using structural modifications of the football elements related to nonlinear pedagogy (modification of the number of players related to situations of inferiority, equality and numerical superiority; dimensions of the field of play):

The sample studied was composed of soccer players carried out each task for 10 minutes controlling heart rate by telemetry monitor. The results showed very high levels of vigorous and very vigorous physical activity in all the tasks designed (García-Angulo et al., 2019).

DISCUSSION

The purpose of this narrative review was to understand how many studies have been carried out with young players.

The review also aimed to identify transfers for field practice to improve the training quality of young soccer players (Ceruso et al., 2020; Ceruso et al., 2019).

Traditionally, the teaching of sports skills in soccer has been predominantly characterized by analytical motor tasks: these tasks were used by coaches to improve sport-specific technical aspects.

For some years it has emerged that this type of exercise does not activate the cognitive area and that the training of the player must make use of more complex tasks and motor problems.

Indeed, the success in soccer depends on how information are processed considering the complex and quickly changing environment (García-Angulo & García-Angulo, 2018; Wang et al., 2013; Vestberg et al., 2012). This close relation between the environment and the player decisions leads the coaches to train towards *plastic* players (Giuriato & Lovecchio, 2018; Raiola, 2014 & 2017).

The implications of this skill ecological conceptualisation are important to consider for young soccer players, as it suggests that motor tasks should promote an environment in which the young athletes are faced with continual problems, which they are required to solve. To enable this design approach, and aid ensuing exploration, the coaches could consider the manipulation of a range of key constraints to educate an athlete's attention towards features of their environment critical to the solving of emergent problems specific to his/her action capabilities (Woods et al., 2020; Raiola & Altavilla, 2020).

These environmental constraints may concern space, time, the use of balls of different sizes, the modification of the rules, the number of players, any spaces on the pitch where certain behaviours are / are not allowed, etc.

This narrative review has shown that research into the effects of constraints manipulating n youth soccer is still not enough.

Spatial constraints are the ones that have attracted the most research interest (Vilar et al., 2014a, 2014b; Villa et al., 2016; Menuchi et al., 2018).

The spatial and task constraints affect the distances between the young players but not the passage ball angles nor the ball speed (Menuchi et al., 2018).

Finally, the tasks presented with an ecological approach also satisfy a need for soccer training: they make it possible to ensure a significant metabolic stress by requiring the young player to practice at high intensity.

Indeed, one study in particular showed very high levels of vigorous and very vigorous physical activity in all the tasks designed with ecological dynamic teaching. This study show that the use of these new teaching methodologies has an impact on levels of physical activity in accordance with the recommended health parameters (García-Angulo et al., 2019).

CONCLUSIONS

In order to better guide the coaches of young soccer players, further research is needed that can support the methodological choices of the technical staff.

It is necessary to understand how long these exercises must last in order to be effective and adequate. And this for every age group, from 6 to 14 years old. Each age group may need different ways of organizing the learning environment. These guidelines can guarantee quality teaching that is appropriate to the training objectives in each sport.

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