

# Ecological Dynamic Approach and Young Soccer Player Training: The Aim Is the Flexible Behavior

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## Abstract

The study analyzes the main literature references that face up to the topic of learning methodology in the training of young soccer player. Flexible learning involves not only technical skills but also it extends to athletic competencies and athletic skills. The coaches and the staff of athletics and conditioning may submit to the same methodological approach: the dynamic ecological approach. The study meets the topic of motion transfer and suggests some types of tasks that give more effectiveness to the young soccer player in the structuring of flexible learning. Finally, some exercises are proposed that can help the young footballer to make his learning flexible.

## Keywords

Young Soccer Players, Ecological Dynamic Approach, Motor Learning, Transfer

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## 1. Introduction

It is useful to consider, in the young soccer player training, the methods that can be helpful to train players who can respond to of high performance requirements from a physiological and a cognitive point of view.

From the best of our knowledge, the combination of motor (i.e., soccer specific motor skills) and basic psychological (i.e., cognitive functions) is a very topical matter research.

The understanding of motor and specific soccer skill learning is relevant to developing the young talent and enhancing athlete expertise (Ribeiro et al., 2021).

One of the problems in the methodology of training young soccer players

concerns the structuring of the learning environment: in fact, it must seek to solicit the same cognitive strategies that the young soccer player invokes during the competition.

Research in this area has important implications for the professional support work of practitioners such as coaches, trainers and sport scientists (Davids et al., 2021; Woods et al., 2021; Altavilla et al., 2022). Ecological dynamics is a contemporary, transdisciplinary theory of motor learning, expertise and talent development in sport, which considers dynamic person-environment relationships and interactions. The ecological perspective conceptualizes athletes and sports teams as complex adaptive systems (Invernizzi et al., 2022; Davids et al., 2021; Scharfen & Memmert, 2019).

In these complementary systems, intentional behaviours emerge from a process of exploration and learning before being stabilized into functional action patterns (Seifert et al., 2013; Altavilla et al., 2022; Sgro et al., 2019). Therefore, in a performance environment, the suggestions are the most significant information sources that bind athlete conduct, which provide invitations or opportunities for action given by the perception of each individual in useful relations with a performance environment.

## 2. Non-Linear Pedagogy

Through these methodological principles, nonlinear pedagogy emphasizes the no linearity and no proportionality between the amount of practice undertaken and the skills acquisition (i.e., the level of expertise). This philosophical orientation to practice contrasts completely with ideas from the theory of deliberate practice, which are beginning to be discredited in the field of expertise acquisition (Hambrick et al., 2014; Seifert & Davids, 2017).

In contrast to such a linear pedagogical orientation, that prescribes the movement to be learned by giving numerous verbal instructions, non-linear pedagogy supports behavioral exploration, tasks interaction and environmental constraints.

The literature proposes several methodological principles for a non-linear pedagogy in motor learning area: the representativeness of the situation, focus of attention, functional variability through exploratory behaviors, manipulation of constraints, and ensuring relevant information-movement couplings (Ribeiro et al., 2021; Chow et al., 2011).

Quantity of “*play*” time is an important factor in supporting the acquisition of physical literacy (Rudd et al., 2021). However, the quality of “*play*” should also feature prominently in making a difference to how children adapt and acquire movement skills (Chow et al., 2021).

How the staff are organized to ensure the quality of training and practice? How, actually, these learning environments are designed? Are they functional to skills transfer?

Precisely to answer these questions, the debate today is open to understand the usefulness of specific training versus general training (Ribeiro et al., 2021; Woods et al., 2020).

When is the right moment for the students to be exposed to general movement experiences to develop underlying skills and functional abilities of perception, movement and cognition, and when do they need to be specialize in training with highly sport-specific experiences?

The literature tried to emphasize the relevance of an underlying motor skill, which is more or less general, more or less inherent, supporting the identification and selection of individuals to learn specialized motor skills easily and to become proficient in a target domain (Smith, 1973; Ribeiro et al., 2020; Woods et al., 2020; Barba-Martín et al., 2020).

The debate between specific training and general training has often been to the advantage of specificity.

Consequently, the centrality of the topic has been lost: the complementary relationships between exercise types, the relationships between perceptive functions and the motor problem solutions research, regardless of the type of skills used by the young soccer player.

The training sessions structuring based on directive and analytical tasks, which involve the use of the specific means, are oriented towards a methodology with the coach in the center of learning process: he establishes the motor tasks, the execution methods, the training load and the time to perform the skills.

Instead, the preparation of learning environments to be explored, environments in which “*play and find the solution*” even if they do not use the specific tool, are oriented towards a methodology that sees at the center of the learning process the research of solutions for the young soccer player.

In the first methodological approach, a high adherence to an ideal model of movement is sought; in the second, a high level of adherence to the modalities of perception and problems resolution, characteristic of sports open skills, is sought (Schöllhorn et al., 2022; Ribeiro et al., 2021; Otte et al., 2021; Sannicandro, 2022).

The first methodological approach believes that learning is a linear process; the second one believes that the acquisition of flexible and transferable learning is a non-linear process.

In absence of a defender, in a training session, practicing kicking could be useful as a form of general learning transfer but it is going to be lacking of the critical perceptual information that could guide better the adaptations of functional movement, which would be needed when the young player comes up against opponents to attempt a kick to goal.

The non-linear pedagogy advocates practice contexts that incorporates motor situations that challenges the learner to “replicate” the movement skill in different and dynamic contexts since many of these more representative “practices” will never challenge the learner in exactly the same way (Gibson, 1979).

### **3. The Key Points of the Dynamic Ecological Approach**

In order to structure truly functional learning contexts to development of appropriate soccer demands sport skills, it is appropriate to outline the key points

of the dynamic ecological approach:

1) The Ecological dynamics approach emphasizes that the context is significant in a theory of motor learning focused on the coordination (between system degrees of freedom within each learner and between the learner and the environment).

2) The coordinative processes rise up from the continuous interaction that support the skills adaptation and, therefore, allow a positive functional relationship between the young athlete and the performing environment. These coordination processes can support skill adaptation (Araújo & Davids, 2011) which helps athletes to obtain an increasingly functional relationship with a performance environment.

3) The environment is a priority issue: it interacts with the performer through the affordances present. The environment information are leading the behaviors of complex systems: the affordances are particular properties of a performance environment, which are perceived in “animal-relevant” terms, i.e., what do they offer, invite or demand in terms of actions into an organism. The concept of affordances provides a powerful way of understanding how processes of perception and action work in the complex adaptive systems, since, within the theory of affordances, perception is an invitation to act and action is an essential component of perception (Gibson, 1979).

4) The affordances are defined by the complementary relationships between an individual and an environment.

5) An ecological perspective identifies sport practitioners as training and practice environment *designers* that provide affordances as opportunities, which are planned *to invite* specific actions from athletes and teams needed in competitive performance (Davids et al., 2021; Scharfen & Memmert, 2019).

6) The design of learning environments in a dynamic ecological context can benefit from the interaction of multidisciplinary staff who, together, contribute to the identification of the main environmental constraints (Otte et al., 2021; Krause et al., 2018).

7) The concept of “*repetition without repetition*” focuses attention on the need for variability in learning (Bernstein, 1967). Despite having acquired data relating to the variability of movements even in closed tasks (Ranganathan et al., 2020), in practice we often witness repetitions of “*ideal*” movement solutions, not sought after by the practitioner. The idea of teaching to repeat a good result without repeating the same movement is the criterion that must guide the design of the environment and its constraints. For example, instead of repeatedly slalom-dribbling through a set of static cones prior to shooting at goal from a pre-determined position, players could be encouraged to repeatedly solve 3 vs 2 attacking situations near goal that create/prevent different dribbling and kicking opportunities in the playing area. This practice design will help learners to repeat the attacking problem with the same outcome in mind, but the solutions to solve this problem are varied (Otte et al., 2021; Krause et al., 2018).

#### 4. From Learning Environment to Skills Transfer and Flexibility

The search for motor solutions and the environment unpredictability in which the action takes place are interdependent (Ranganathan et al., 2020).

This is particularly relevant for open skills such as soccer or futsal (Ranganathan et al., 2020), where the unpredictable nature of the environment constantly requires coming up with novel solutions in both short and long time scales that cannot be directly practiced. One such example of emergent flexibility comes from optimal feedback control, where flexible ways of achieving the task outcome can emerge because rather than choose first a solution, the system constantly looks for a solution that minimizes both error and effort to achieve the task outcome (Ranganathan et al., 2020).

The flexibility of a movement can be observed on a short or long time scale.

In this regard, the literature reports experimental evidence both in the case of a short time scale (Bernstein, 1967), and in the case of longer time scales requiring relearning of a new movement pattern or implementation of another movement technique or strategy (Wallis et al., 2002; Napier et al., 2015; Gray, 2018; Chow et al., 2021).

When dealing with the issue of variability, the concept of stability or consistency of movement often arises.

Some authors place the issue of movement stability in relation to that of flexibility, while underlining that no mutual influence is recognizable (Chow et al., 2021): they argue about stability that can be present at two levels: “task-level” stability (measured by variability of the task outcome) and “movement-level” stability (measured by movement variability). On short time scales, flexibility is associated with high task-level stability and (relatively) low movement-level stability, in order to use multiple movement solutions. However, on longer time scales, (e.g., modifying someone’s kick technique) flexibility involves increasing movement-level stability of new solution so that the non-young soccer player returns to the old movement (Chow et al., 2021).

The relationships with the constraints present in the environment where the practitioner moves are very strong. The variability can arise because there is a process of perception and anticipation that forces the young player to change strategy and therefore to choose a different movement (different strategy) or, it may be enough, to adapt the freedom useful degrees to achieve the same movement.

The opportunities can be solicited both only if the structured exercise is presented according to the dynamic ecological approach rather than the traditional/analytical method.

Practically, the variability of movement translates into effective movement.

Namely, only the adaptation of those functional components is carried out to meet the environment request, leaving the rest unchanged.

Indeed, identifying the movement suitable for the motor situation/problem

and the environment does not necessarily mean varying all the parameters of the movement (Bosch, 2010).

The young player chooses the movement that he has already learned in previous situations and he adapts only some parameters: he modifies and adapts only those parameters that come from the evaluation of the environment affordances.

To give an example, the movement of the run remains unchanged, what will be the parameters to allow a successfully run on both grass and sand or on uneven or sloping surfaces.

The young player, in learning movements capable to settle multiple situations/problems, has little interest to internalize patterns and movements that “work” only in a few contexts of motor/sports/tactical.

Instead, the biological system of the young player is interested in the acquisition of movements to be used flexibly and in a large number of situations.

According to the theory of complex biological systems, the movement is kept and performed until stability is guaranteed: as soon as this is no longer safeguarded (even in the case of minimum/very small disturbances), the system makes use of a new movement (Kelso, 1995).

In summary, the variability is tolerated and assured as long as stability is guaranteed. Because stability ensures efficiency and therefore energy saving.

## 5. Which Are the Motor Tasks to Choose?

After analyzing the theoretical framework that legitimizes the choice of a football skills teaching methodology different from the traditional one, this section describes some types of motor tasks that can meet the criterion of motor behavior transferability.

The traditional analytical teaching methodology that for many years has characterized the training of the young player cannot represent the only methodological approach.

This mode of tasks presentation of sport-specific motor and technical guarantees only a high number of repetitions, with always the same or very similar executions.

It limits the relationship between perception-environment-assignment that is present in the real competitive context.

Which modalities, then, to choose alternatively?

The coach becomes a designer of learning environment and directs the attention towards exercises to allow the discovery and the exploration of the environment where everything takes place.

Therefore, the playing time takes precedence over the exercise time.

The “*problem-situations to solve*” increase while simplified exercises decrease: the young player is busy to perform a technical gesture for an unspecified number of times that it will never be same as the previous one because it adapts (flexible) to the constraints/affordances that the game environment offers.

Accordingly, all the variants of small-sided games and games on smaller spaces (Sannicandro, 2019 & 2022) and with modified rules (even during the performance) are relevant, because they require a continuous discovery of the ways in which to perform the technical skill.

The dimensions and shapes of the court, in the small-side games, can be changed, even during the same exercise (without interruption) to constantly allow a technical and above all a cognitive adaptation (Sannicandro, 2019 & 2022).

Therefore, the tasks must be mainly of a playful nature and not too structured and rigid.

The possibility of presenting motor tasks and games that can be repeatedly modified during execution requires, a search for new solutions: this results in a flexible cognitive strategy that can lead to flexible and transferable motor behavior.

The motor tasks, in other words, must provide multiple solutions to guarantee the continuously research and exploration of the environment and of the constraints/affordances.

## 6. Conclusion

The most recent literature provides relevant guidelines for structuring the training of the young player.

The traditional methodology, which mainly involved the presentation of very analytical tasks, must leave more room for the dynamic ecological approach. This approach, continuously, places the young player in situations to be solved through repetition of gestures always different (repeat without repetitions).

The relationship between environment, perception and the ability to settle problem situations can help to structure flexible and transferable skills.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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