

# From Traditional Approach to Ecological Dynamics Approach with the Italian Young Soccer Players

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## Abstract

The team sports are looking for a methodology capable of structuring more effectively the prerequisites necessary for the training of the future athlete/player. In recent years in the field of motor activities, methodological research has made it possible to outline new approaches aimed at involving the cognitive area together with the motor one. For many years, the demand for motor tasks in analytic form prevailed over other modes of presentation of the motor and technical task. This belief was due to linear motion patterns that were popular in motor behavior theories from the 1960s to 2000s and which somehow still prevail in current practice. However, the demands of mastering a soccer game require much more than just physical or technical skill. In fact, in sports open skills the perceptual, decisional and cognitive aspects play a very significant role in solving motor problems. This study describes the methodological paradigm change in the model of youth soccer starting in Italy, and aims to describe methods of intervention and phases that distinguish it from the traditional approach.

## Keywords

Ecological Dynamic, Constraints, Young Soccer Players

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## 1. Introduction

The team sports, also referred to as open-skill sports, and individual sports pursuing different types of motor and technical skills.

Open-skill sports are characterized by the repetition of high-intensity actions that require athletes to possess well-developed physical and physiological factors, such as agility, speed, power and strength (Abad Robles et al., 2020).

Additionally, such sports require well-developed technical and tactical skills.

Therefore, the team sports are looking for a methodology capable of structuring more effectively the prerequisites necessary for the training of the future athlete/player (García-Angulo et al., 2019; Giuriato & Lovecchio, 2018; Esposito et al., 2019; Ferrara et al., 2019; López-Felip et al., 2018; Severino et al., 2019; Sgrò et al., 2017 & 2019).

The physiological and technical demands analysis of elite sport (Sgrò et al., 2019; Sgrò & Lipoma, 2016) does not allow, during the training phase, to limit oneself to the conditional aspects or to counteract the involution of motor skills due to sedentary lifestyles (Greier et al., 2020; Colella et al., 2020; D'Elia, 2020; Esposito et al., 2020).

It is advisable to focus attention on methodological aspects which, together with metabolic and neuromuscular factors, are capable of promoting the ability to identify the most relevant information present in the external environment, the selection and programming of adequate movements and the solution of motor task problems (Giuriato & Lovecchio, 2018; Savelsbergh & Wormhoudt, 2019; Seifert et al., 2019).

Some theoretical concerns about the traditional and reductionist perspective of motor learning and movement coordination presented many years ago have highlighted the need to reconsider the reciprocity between the performer and the environment in which he moves (Davids et al., 1994; Handford et al., 1997).

Self-organization has been proposed as a strategy to explain the tendencies for individual performers to interact with each other in field-invasion sports teams, displaying functional co-adaptive behaviours, without the need for central control. The relevance of self-organization as a strategy that explains pattern-forming dynamics interactions in field-invasion sports has been sustained in the literature (Passos et al., 2013; Gonçalves et al., 2018; Ribeiro et al., 2019).

This relationship between the performer, the motor task and the environment, defined as deeply intertwined and non-linear, is animating the methodological debate (Woods et al., 2020a & 2020b; Raiola, 2014 & 2017; Sgrò & Lipoma, 2019; Raiola & Tafuri, 2015).

For example, the ecological dynamic approach leads to the use of Small-sided Games as tasks that have the same structure as the official game, but the size of the elements of play is reduced. In this environments based on the mutuality of the performer and the environment, learners can attune their movements to the essential information through practice, and this processes help them to establish strong “information-movement couplings” to guide their behaviours (Renshaw et al., 2007, 2009, 2010). For example, in mini-basketball, there is no three-point line and the areas of play are reduced, so its tactical complexity is assumed to be similar to that of the official game of basketball and adapted to the learners' characteristics. Alternatively, the pedagogical principle of exaggeration involves the modification of key elements of play to provide learners with the opportunity to explore specific tactical problems while maintaining the primary rules of the

game. For example, if the goals in soccer are removed, the tactical problem of how to keep the ball, using passes and get-free movements, will be enhanced.

## 2. Teaching Methods in Open-Skill Sports

### 1) The Teaching Game for Understanding

Each type of sport requires a particular methodological approach.

In recent years in the field of motor activities, methodological research has made it possible to outline new approaches aimed at involving the cognitive area together with the motor one.

The literature review highlights how the Teaching Game for Understanding (TGfU) model was the catalyst of a global movement involving the teaching of games which has resulted in many variations around the world (Barba-Martín et al., 2020; Wang & Wang, 2018; Stolz & Pill, 2014): the Game Sense, the Play Practice, the Games Concept Approach (Sgrò & Lipoma, 2019; Bunker & Thorpe, 1982; Thorpe, 2005; Launder & Pilz, 2012; Tan et al., 2012).

TGfU and the methods that have arisen have characterized above all school physical education: however these methods have often been superimposed on other methods that have spread mainly in the sports context (Sgrò & Lipoma, 2019; Renshaw et al., 2015; Chow et al., 2006, 2007a & 2007b).

In the sports field, the Constraints-Led Approach characterized the methodological debate on how to organize the learning environment.

This proposal has differentiated from the previous ones above all it is a complete picture that can explain the processes that underlie learning in human beings considered complex, adaptive, dynamic.

While TGfU and the derived methods have set themselves the goal of understanding the task through a teaching style based above all on questions that facilitate learning, the Constraints-Led Approach has the goal of executing/solving the task.

It accepts that there can be many personalized ways to achieve the same performance outcome and many ways to improve understanding (Renshaw et al., 2015; Silva et al., 2014).

### 2) The Constraints-Led Approach

The Constraints-Led Approach is an ecological model centred on the mutual relationship that emerges from interactions of each individual and a performance environment.

Here, it is each individual's relationship to specific environmental properties that changes with learning. Over time this relationship can become more functional, allowing the achievement of task goals, fluently, accurately and energy efficiently.

These theoretical considerations changed the traditional perspectives of skill acquisition, having profound implications for understanding the performer-environment relationship and for how coaches viewed their role in the preparation of athletes for performance.

The performer, the task and the environment (sporting activity) are seen as a complex and dynamic system in which the performer self-organizes the movement to respond to the characteristics and affordances of the environment and the related constraints (Woods et al., 2020b).

The affordances are defined as opportunities or invitations for action (Withagen et al., 2017): understanding the role of affordances present in the task and in the environment identifies in the coach the role of designer of the learning set (Woods et al., 2020b; Raiola, 2014 & 2017).

And it involves the topic of the teaching styles analysis that can favor or limit the affordances present in the learning context (Colella, 2019).

More specifically, if we consider a performance environment as a rich landscape of offerings (Hulsteen et al., 2018), some of them are designed by the coach and presented through a continuous variation of teaching styles, then such practice tasks are directing or guiding the search of the performers (Woods et al., 2020a; Colella, 2019; Sannicandro, 2020).

### 3. New Methodologies and Literature Support

The introduction of new methodologies for teaching tactical skills can make use of the results of some interesting studies.

In fact, decision making is considered a determining factor in sports open skills (Sannicandro, 2020; Diaz del Campo et al., 2011) and identifies the expert athlete compared to the novice (Diaz del Campo et al., 2011; Silva et al., 2014; Práxedes et al., 2018).

A few years ago a study wanted to verify the effects of a comprehensive teaching program, based on questioning on decision making, and execution in youth soccer, compared to traditional methods.

The intervention was based on the use of questions in a context of modified games, applied during 21 training sessions (in 18 weeks) with young players (age = 10 years old) and analyzed 1532 actions.

Results showed that after applying the intervention program, the players in the experimental group showed better decision making in the pass and dribbling actions, and better execution in the pass action, compared with the players from the control group. These results suggest that the application of questioning in a context of modified games must be taken into account to promote tactical training in young footballers and to improve their tactical behavior (Práxedes et al., 2016).

These advantages also seem to derive from the use of other models, for instance Sport Education - Invasion Games Competence Model (Mesquita et al., 2012) in which the effects of the modulation of the number of participants in attack actions (numerical superiority) were monitored: less pressure from the defenders allows for a greater “*time window*” to process the decision and therefore the methods of passing the ball (Mesquita et al., 2012; Práxedes et al., 2016).

The same technical skills, when adopting SSG with a number of players between 2 and 5 - 6, allowed greater participation in the game through a greater

number of ball contacts (Koklu et al., 2011) and a greater number of passes (Martins et al., 2016).

To confirm how much the modulation of the games is attracting the attention of the research for the elite players training, a study has also been published in the literature that aims to evaluate different physical and technical parameters during different repetitions of SSG in order to determine if SSGs can be useful exercises to identify talent. The study was attended by 16 young players (under 10) highly trained from a technical-tactical point of view (3 weekly sessions of technical-tactical training for a total of  $8 \pm 0.8$  h in addition to a weekly match) and physically active ( $7 \pm 1.6$  h of physical activity per week). The young players who participated in the study had been with the club for at least 2 years and spent 45 weeks of training during the year. The young players were divided into 2 groups of 8 elements each and performed a 4vs4 exercise with two small goals of  $2 \times 1$  meter. The SSG format was played for 6 reps of 5 minutes with a passive recovery of 3 minutes. During the different repetitions the players have always changed teammates, so that no player has played with the same three teammates on more than two occasions. The 4 vs 4 was played on a field of  $23 \times 18.3$  meters without the use of the coach's encouragement or technical-tactical indications. Those field dimensions, that duration and that format were used as they constituted the executive modalities that had characterized the development of the SSG and the methodology identified by the club during the usual training sessions. A pilot study, confirming the validity of the variables used, showed that the field size and the duration of the game used do not cause changes in the technical and physical aspects compared to a larger field with a shorter playing duration (Fenner et al., 2016).

Each player was assigned a score based on the outcome of the SSG (win 4 points, draw 2 points, loss 0 points) and a score from 1 to 5 on 10 technical and tactical skills; these scores were awarded by two coaches enabled. In addition, each player was also monitored with 10 Hz GPS devices to quantify the total distance traveled and the distance traveled at high speed. The distance traveled at high speed was defined as the meters traveled at over 60% of the maximum speed reached by the individual player during the SSG. The use of this threshold represents a value already used in the literature (Fenner et al., 2016). The results of the study show that there is a high and significant correlation ( $r = 0.758$ ,  $p < 0.001$ ) between the total points obtained in the different games with the total technical points of each player; a high and significant correlation ( $r = 0.547$ ,  $p < 0.05$ ) between the distance traveled at high speed and the score of technical skills; a significant and moderate correlation between the total distance covered and the score of the technical skills ( $r = 0.545$ ,  $p < 0.05$ ) and of the total points of play ( $r = 0.438$ ,  $p < 0.05$ ) (Fenner et al., 2016).

#### **4. From Traditional Approach to Ecological Dynamics Approach: The Youth Soccer Italian Model**

The search for new methods to be used on the field must also make use of the

comparison between different national soccer schools (and soccer Federations); but it must arise above all from scientific theories that support the sport-specific methodological proposals.

The debate about motor learning methods and the interactions between coaches and performers have also characterized youth soccer in Italy.

In fact, in the recent years there has been considerable debate on the identification of those acquirable and/or predisposed factors that can guide an individual through this adaptive process towards qualified performance levels and, ultimately, the achievement of competence.

This debate has characterized the quest for more effective learning in youth football: the effective learning occurs when activities are well defined, presented at an appropriate level of difficulty, when useful feedback is presented, and opportunities for repetition, error detection, and correction are provided (Práxedes et al., 2019).

For many years the demand for motor tasks in analytic form prevailed over other modes of presentation of the motor and technical task.

This belief was due to linear motion patterns that were popular in motor behavior theories from the 1960s to 2000s and which somehow still prevail in current practice.

The traditional technical method has been predominant in the soccer skills teaching. Through this form of teaching the coach plans a sequence of prescriptive exercises, which are based on simulations of a part of the game, and leads them with a direct command (Raiola & Tafuri, 2015).

The different tasks have a specific objective, usually in line with the development of some technical skill inherent to the game. This approach, therefore, assumes that a certain degree of skill must be acquired before an activity can be performed (Barba-Martín et al., 2020).

However, the demands of mastering a soccer game require much more than just physical or technical skill (Barba-Martín et al., 2020; Práxedes et al., 2016; Pizarro et al., 2016).

In fact, in sports open skills the perceptual, decisional and cognitive aspects play a very significant role in solving motor problems.

The literature has suggested that perception and action in many different sports game situations have a positive influence on improving tactical performance (Baker et al., 2003; Berry et al., 2008; Côté et al., 2003; Sannicandro, 2020; Serra-Olivares et al., 2015).

More specifically, unstructured playful involvement seems to play a crucial role in the tactical activity development in open-skill sport (Berry et al., 2008; Serra-Olivares et al., 2015).

While some authors have introduced the concept of “*deliberate play*” (Côté, 1999; Côté & Hay, 2002), more recently other researchers have distinguished tactical intelligence from tactical creativity (Memmert & Perl, 2009a & 2009b; Memmert & Roth, 2007).

This distinction helps to understand the theoretical distinction between convergent and divergent thinking: the first refers to the ability to identify the ideal solution to a problem; the second can be defined as the unique, innovative, unusual solution for the related task (Memmert & Roth, 2007).

Team sports, such as soccer, require players to use information to continually co-adapt their performance behaviors (actions, intentions and perceptions) to the movements of opponents and teammates in achieving task goals (Chow et al., 2006). Hence, players must be skilled in adaptive decision making and act autonomously in the game environment (Withagen et al., 2012).

Within a framework of ecological dynamics, players are trained to choose from a rich and diverse range of possibilities offered by their environment, available in a landscape of movement opportunities (Rietveld & Kiverstein, 2014).

Therefore, they are better equipped to perceive information, adapt their actions, make decisions and skillfully interact with the ecological constraints of competition (Davids et al., 2013).

To facilitate this interaction between perceptual, cognitive and motor processes, the technical staff must promote the autonomous player choice, facilitating active exploration during the game activity (Araújo et al., 2006).

In this regard, the relationships between motor and cognitive functions have been highlighted by neuroimaging studies providing evidence that motor and cognitive processes draw on common neural mechanisms and resources (Stuhr et al., 2018).

In addition to the evidence suggesting that motor skill components are linked to specific cognitive control processes, a number of studies have indicated that the relationship between these two processes is influenced by the novelty and difficulty of the task (Stuhr et al., 2018; Diamond, 2012).

Therefore, an analysis of the methodologies implemented and the organizational aspects that derived from traditional methodologies was started, noting that some significant aspects related to motor learning were strongly influenced by this type of communication and the motor tasks chosen by the coaches.

The reworking of the technical, tactical (and therefore cognitive) and athletic objectives has characterized the sports programs from under 9 to under 13 and has identified some learning areas that present a progressive executive difficulty.

To favor learning functional to the footballer of the future, but adequate to the footballer of the present, 6 stations have been provided for young footballers to practice at the same time: in fact, the quality of the learning environment and the intensity of the exercise are two key points of youth training in football (García-Angulo et al., 2019; Sannicandro et al., 2021; Harley et al., 2010).

The exercises and motor tasks that allow the handling of spatial, temporal and environmental constraints have been selected: this typology of motor tasks refers to the theoretical models that presuppose ecological dynamics. These argue that humans and groups are complex adaptive systems with inherent non-linear properties. The variability in such systems must be interpreted very carefully

(Woods et al., 2020a & 2020b).

In each operating station (there are 6 stations) the movement requests are continuously varied; similarly, the motor tasks presented require personal research and exploration by each participant.

Small-Side Games (SSG), reduced-rank competitions, suitably designed motor games and position games are just some of the exercises provided and alternate with those of functional technique or analytical technique.

Alongside the motor tasks identification, a training program has started that reaches the soccer schools defined as elite (i.e. those that have certain organizational and technical characteristics) and explains the reasons for this orientation.

Coaches traditionally have always been frightened by the variability of motor behavior so it is necessary to explain that this variability can represent a limit but often takes the form of a learning potential.

The playful activity, the SSGs and the positional games favor the skill adaptability and the skill variability becomes functional with respect to problem solving. As the motor experiences become more and more numerous, a decrease in variability is observed: there is consistent evidence that variability decreases as skill level increases (Busquets et al., 2016; Hiley et al., 2013; Betzler et al., 2012; Button et al., 2003).

These types of exercises ensure that task constraints during learning require perceptual-action relationships similar to those needed in competitive performance (Renshaw et al., 2010; Sannicandro & Cofano, 2019; Sannicandro et al., 2021).

For these exercises it is possible to identify different dynamics and different presentation methods (Table 1).

In light of these considerations, the error becomes a necessary step because that search for adaptability in many cases must temporarily pass from a poorly functional variability.

It remains to be understood how much variability tolerates the stability; that is, how different the repetitions of the motor patterns can be in order to guarantee stable learning over time: in this regard, not all recent literature agrees (Ranganathan et al., 2021; Cardis et al., 2018).

In this methodological context, the coach's communication and the management/teaching style become facilitators or obstacles to learning.

**Table 1.** How to present the SSG (Nunes et al., 2021a).

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- 1) Design of games that aim to provide a variety of motor and sport-specific experiences (with small goals, goals over the line, goals with a certain number of passes, etc.).
  - 2) Games that allow to vary the tactical complexity in relation to the skill level of the players (small, versus medium, versus large side games).
  - 3) Games with the same tactical requirements of the real game (off-side, corner, etc.)
  - 4) Games that emphasize particular tactical and technical elements of the game of soccer (numerical superiority/inferiority; playing areas associated with permitted or forbidden behaviors, etc.)
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Therefore, the motor task choice, the environmental constraints handling, the teaching style, the management of the variability of motor behavior and the increase in the motor activity time commitment through high-intensity exercises can constitute the path for the training of the present and future player.

## 5. Discussion

An implicit assumption was that skilled performance in sport is characterized by the invariance of the motor system. This notion has led sports biomechanics to pursue identification of an “*ideal*” movement model considered as an expert criterion performance and acquired through numerous repetitions.

Instead, the adaptive behavior arises from a continuous cycle in which those who move can prospectively control their actions by detecting information (Araújo et al., 2017 & 2018). Some authors suggest that direct learning develops knowledge related to the environment and that this is achieved by “*doing*” (Barnabé et al., 2016; Jacobs & Michaels, 2007). Performing tasks suitable for the changing environment involves learning to detect the key perceptual variables that influence the search for the motor solution (Renshaw et al., 2019; Silva et al., 2020).

This re-conceptualization of self-regulation and functional variability has important implications for the translation into practice: it suggesting that the commonly used term skill “*acquisition*” does not actually involve the acquisition of a physically reproducible motor memory stored in the brain. Rather, a more relevant description of the learning process in sport may be considered as “*skill adaptation*” (Woods et al., 2020b).

This reinterpretation of the methodological approach in the Italian model provides for two moments of comparison: one pre-training session and one post-session: in these two moments the exercise objectives are defined and, after training, the methods of communication and feedback provided to the kids and difficulties in performing different tasks are analyzed.

This further analysis of the teaching allows you to carefully modulate future sessions and identify further objectives to be achieved.

The introduction of two moments of reflection and analysis also represents a new mode of interaction, especially between the components of the technical staff.

The comparison helps the coaches to break down the task and to analyze the variants and constraints that have been presented, grasping the stages of the learning path of the each young players (Nunes et al., 2021b; Memmert & Perl, 2005; Rendell et al., 2011).

## 6. Conclusion

In conclusion, the challenge that awaits the methodological model for the Italian youth cast is that of paradigm change. Attempting to promote qualitative learning experiences will likely contribute to structuring a suitable and adaptive athlete.

The appropriate modulation of the analytical and simplified tasks together with the situational and more complex ones can allow the achievement of successful performances, in relation to the young soccer player skills.

Coaches, therefore, must acquire methodological skills capable of allowing a continuous variation of teaching and conducting styles in relation to the difficulties of execution and learning process.

### Conflicts of Interest

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

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