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How Can Games Be Functional in the Implementation of Long-Term Athletic Development (LTAD) in Youth Sports?

—Exploratory Learning Experiences and Opportunities to Increase Physical Efficiency

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Abstract

The literature highlights the search for alternative methodological and organizational models to traditional ones that often conceal the risk of early specialization. Long-Term Athletic Development (LTAD) is a model of sports initiation that aims to reduce the risk of early specialization. The potential of games in teaching physical education and LTAD in sports is explored. Games are configured as the content that ensures learning continuity between preschool play and recreational experiences and sports activities. The dynamic ecological methodological approach characterizes play-based teaching and allows for the solicitation of free exploration and guided discovery: increased search for original solutions, increased motor engagement time and teaching styles by production can ensure the quality and transferability of motor learning. Subject-specific literature becomes a necessary support to legitimize these methodological choices in LTAD.

Keywords

Games, Athletic Development, Small-Sided Games, Learning Environments, Movement Development

1. From Games to Sports Activities: What Common Characteristics?

Games are the first form of learning experience for children and allow them to learn about their environment (Alcaraz-Muñoz et al., 2020).

Through games, children experience basic movements and adapt their execu-

tion in relation to the demands of the environment.

In fact, games represent the experience in common between the play-type activities that characterize the preschool years and the educational experience in sports: games can ensure the character of continuity if they make use of certain types of content common to one and the other sphere of experience.

The character of experiential continuity can support the number and quality of learnings that, in the two different contexts, are substantiated by different demands and specific levels of difficulty.

In fact, it is for this reason that in physical education we try to identify or structure games that can be functional for future sports experiences (Sannicandro, 2022a).

This transition must be supported and ensured to reduce the risks associated with a number of factors that already characterize the sports experience.

The difficulties of the developmental sports experience stem from the misalignment between biological age and chronological age, which limits the effectiveness of interventions aimed at increasing physical efficiency, underscoring the complexity of the relationship between growth, maturity, and motor and sports training (Sannicandro, 2022b).

Regardless of whether young people are involved in so-called organized sports, there are often different levels of motor skill development and a general lack of coordinated planning among professionals (think school and out-of-school) who are ultimately responsible for the long-term well-being of young people. As a result, despite recommendations on overall physical activity and the existence of models for identifying and developing sports skills, the number of young people showing lower levels of physical fitness, muscle strength and motor skills is increasing globally (Cohen et al., 2011; Moliner-Urdiales et al., 2010). The presence of reduced levels of physical activity in the youth population translates into an increase in the number of young people who may incur training that falls far short of the requirements it presents and is complex because of the demands it places on them.

To overcome these potential obstacles that may limit the quality of the educational experience in sports, the use of playful content, in its different forms and modalities, can actually be beneficial to the number and quality of motor learning.

The characteristics of playful activity in its different organizational and expressive forms thus become the common thread between recreational and specifically sports-related motor activities.

The possibility of increasing through play the functional levels of motor abilities useful in competitive sports is an additional methodological advantage.

Young people can thus be oriented to positive experiences through sports and physical activity to maximize well-being. In fact, the main reason why children start sports and movement education pathways are precisely the fun and enjoyment of motor experiences related to different activities (Allender et al., 2006).

Similarly, lack of enjoyment is commonly the main cause of dropping out of sports (Crane & Temple, 2015). Aspects to look for as strongly related to the idea of well-being for young practitioners have been identified in the literature and can be identified within playful activity: 1) a growth-oriented attitude, 2) self-determined motivation, 3) perceived competence, 4) confidence, and 5) resilience (Crane & Temple, 2015; Salvy et al., 2012).

Learning through play is a fun and functional way to make that transition from spontaneous, self-determined activity to structured motor activity that the child will learn about in physical education at school or in the sports experience.

Motor learning through play presupposes the experience of free play, guided play, building play, collaborative play, etc. (Weisberg, Hirsh-Pasek, & Golinkoff, 2013).

2. Involutionary Trends in Motor Skills and Demands of Sports Competition

Current trends in playing strategies and increasing external workload have led to the need to structure increasingly fast and well-conditioned athletes in modern sports. More recently, for example, advances in speed, coordination, power, and endurance have been observed in elite players over the past decade: and this trend is reflected in the training of young sportsmen and women (Gonaus et al., 2023).

Therefore, the socio-cultural transformations impose a new reading of the contents that can be more effectiveand functional in the pathway to sports initiation.

In fact, alongside the reduction of physical activity levels in developmental age are the effects determined by this very phenomenon, on the evolution of motor skills that take on a worrying trend in the last ten to fifteen years (Mačak et al., 2022; Colella & Morano, 2011; Monacis et al., 2022).

Empirical evidence also suggests that children who do have well-developed functional movement skills seek out physical activity and experience better health outcomes compared to their peers who present low physical activity and high sedentary behavior levels (Rudd et al., 2020; Monacis et al., 2022). With the consequences on some fundamental abilities of the individual (Invernizzi et al., 2020), the structuring of introductory pathways to sports practice marked solely by meeting the demands of sports disciplines no longer seem responsive with respect to the training needs of young and very young practitioners.

The choice to join a single sport discipline in extracurricular settings has become predominant. There is greater pressure to participate in disciplines with a high level of sports qualification, to specialize early in a sport, and to play year-round, often with multiple teams.

This choice is linked to a desire to participate in projects aimed at developing young practitioners with particular aptitudes; aptitudes that often fall under the evaluation of so-called sports talent.

Although a number of existing development models are designed to optimize athletic talent toward a senior level, a pertinent question that professionals must ask themselves is this: is it desirable to be interested only in the development of elite young athletes? The number of young people who can expect to successfully follow the path from grassroots youth sport to elite professional sport is relatively modest, looking at the percentages of those who reach professional sport, compared to the number of practitioners.

Conversely, it can be observed that a large proportion of the youth population who choose to participate in sports only recreationally, or as current data suggest, do not participate in organized sports and fail to meet minimum levels of daily physical activity within the guidelines recommended by leading health authorities (Mačak et al., 2022; Chaput et al., 2020; World Health Organization, 2010; Belcher et al., 2010).

Movement culture, therefore, should convey messages regarding the potential benefits that come from motor and sports practice that does not exclusively chase performance but, that pursues health through movement itself.

In doing so, it further broadens and articulates the theme of movement and sports activities in developmental age, directing attention not only to the quality and quantity of activity but, above all, to the time horizon within which this training must be provided.

3. Can Games and Learning Transferable Movements Be Useful for LTAD?

The literature shows how study groups are constantly looking for new ways of organizing sports training, identifying and proposing new alternative models to traditional ones (Launder & Pilz, 2012; Lloyd et al., 2015; Sannicandro & Raiola, 2021; Woods et al., 2020a, 2020b).

The Long-Term Athletic Development is a multi-stage training, competition and recovery pathway guiding an individual's experience in sport and physical activity (Lloyd et al., 2015).

The idea of developing talent and athletic competences in youth is the goal of many coaches and sports systems. Consequently, an increasing number of sporting organizations have adopted long-term athletic development models in an attempt to provide a structured approach to the training of youth. It is clear that maximizing sporting talent is an important goal of long-term athletic development models. However, ensuring that youth of all ages and abilities are provided with a strategic plan for the development of their health and physical fitness is also important to maximize physical activity participation rates, reduce the risk of sport- and activity-related injury, and to ensure long-term health and well-being (Lloyd et al., 2015).

Why is LTAD opposed to early specialization? What advantages does it provide?

As an integral component of athleticism, motor competence refers to an individual's ability to perform a wide range of motor tasks, where outcomes are un-

derpinned by movement quality, control, and coordination (Burton et al., 2022; Hulteen et al., 2018). Motor competence consists of multi-dimensional movement capacities (simple, combined, and complex) that are all inter-related and are subdivided into locomotor (walking, sprinting), object control (throw, catching), and stability (hold, balance) skills (Hulteen et al., 2018).

All these skills can be introduced and improved through games (traditional, cooperative, competitive, sports).

Games allow these fundamental skills to be solicited in the form of problem solving and allow interaction between all personality areas.

The structure of the LTAD provides that each period of children's maturation can be characterized by the methodological emphasis on some specific motor skills: games represent the motor proposals useful for this purpose because they involve all of the child's motor skills in high-intensity, problem-solving tasks.

Therefore, the more traditional didactics that involved extensive use of analytical motor tasks gives way to a methodology that allows repetition without repetition (Bernstein, 1967; Travlos, 2010; Ranganathan et al., 2020; Apidogo et al., 2021; Apidogo et al., 2022) through game-centered instructional interventions and that allows increasing levels of motor skill evolution (Abate Daga et al., 2020; Formenti et al., 2021).

The first considerations concern the learning effectiveness: for many years the motor task demands prevailed in analytic form 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.

And this methodological trend has characterized youth sports training in all sports.

For example, the traditional technical method has been predominant in the soccer skills teaching. Through this teaching approach, 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. 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[1]. However, the demands of mastering a soccer game require much more than just physical or technical skill[1].

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

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 (Sannicandro & Raiola, 2021; 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).

The second considerations concern the young practitioner health: although it may be common opinion that an accumulation of greater volumes and intensity of sports practice at a young age leads to sporting success, the attention to the type of load and its distribution on a multi-year basis is the most accredited scientific evidence since many years (Lloyd et al., 2014; Sannicandro & Raiola, 2021).

Repetition without repetition at high execution rates imposes constant and continuous adaptation to the environment by also strongly stressing neuronal plasticity and learning transferability.

Plasticity is defined as the brain's ability to respond to experiences with structural changes that alter the behavioral repertoire (Lindenberger et al., 2017). It is a key feature of learning, remembering and adapting to changing body and environmental conditions (Power & Schlaggar, 2017).

During learning a new skill, studies of brain development have shown that plasticity mechanisms can be modeled as a two-stage process, with an overproduction phase preceding a pruning phase (Lindenberger et al., 2017).

The increase in the number of synapses at the beginning of the plastic episode corresponds to an initial phase of exploration as the learner searches for a functional solution to the task (Chow et al., 2015). Once identified, stabilization occurs, with appropriately selected active connections and nonfunctional neural patterns being ignored instead.

As a result, changes in brain gray matter volume are specific with respect to experiences undertaken, with the Central Nervous System showing significant and large-scale changes in organization in response to experience (Power & Schlaggar, 2017; Pinder et al., 2011).

This point has important implications for learning and motor practice design, highlighting the need for careful consideration to promote functional neural organization. And it raises questions about the transferability of learning achieved in virtual environments where perceptual modalities and motor interactions are significantly different from what emerges in reality (Formenti et al., 2019).

4. The Structuring of Learning Environments and the Role of Games in Motor and Sports Education

The significant relationship identified between the motor, affective and cognitive demands of play and those of sports games places these two containers of motor learning in educational continuity.

The prerequisites necessary for the participation of play and sports games are very often the same, drawing on the individual's conditional and coordinative requirements.

Specifically, open-skill sports are characterized by the repetition of high-intensity actions that require practitioners to possess well-adapted motor and functional prerequisites, think speed, strength and muscle power (Abad Robles et al., 2020).

Moreover, such sports require well-developed technical and tactical skills that

evolve precisely from the problem-solving present in early play experiences.

Choosing to make use of traditional or competitive games, therefore, allows one to stress the conditional assumptions related to physical efficiency (and to counteract the involution of motor skills) and to turn one's gaze to motor tasks that increase the ability to identify the most relevant information present in the external environment, the selection and programming of appropriate movements, and the problem solving of the motor task (Greier et al., 2020; Colella et al., 2020; Savelsbergh & Wormhoudt, 2019; Seifert et al., 2019).

This methodological choice allows us to distance ourselves from what has often been considered indispensable in the sports training of the very young: the transmission of performance techniques and the high number of repetitions for the acquisition of technical skills.

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

Self-organization has been proposed as a strategy to explain the tendencies of individuals to interact with each other especially in invasion sports, exhibiting functional co-adaptive behaviors without the need for rigid central control. The relevance of self-organization as a strategy explaining dynamic pattern formation interactions in situational sports is widely supported in the literature (Passos et al., 2013; Gonçalves et al., 2018; Ribeiro et al., 2019).

Indeed, this relationship between performer, motor task and environment, defined as deeply integrated and especially nonlinear, is increasingly animating the methodological debate (Barba-Martín et al., 2020; Woods et al., 2020a, 2020b; Sannicandro, 2022a).

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

The literature review highlights how the Teaching Game for Understanding (TGfU) model has been the catalyst for a global movement involving the teaching of games that has led to many variations around the world 28, 29, 30: the Game Sense, the Play Practice, the Games Concept Approach (Bunker & Thorpe, 1982; Thorpe, 2005; Chow et al., 2006; Launder & Pilz, 2012; Tan et al., 2002; Renshaw et al., 2015; Sgrò & Lipoma, 2019).

The TGfU and the resulting methods have mainly characterized school physical education: however, these methods have often overlapped with others that have spread especially in sports (Chow et al., 2007a, 2007b).

In the field of sports, the Constraints-Led approach has characterized the methodological debate on organizational arrangements related to the learning environment.

This proposal differed from its predecessors primarily because it emerged as a more comprehensive framework capable of explaining the processes underlying

human learning, which is considered a complex, adaptive, dynamic element.

Whereas TGfU and its derivative methods have aimed to understand the task through a teaching style based primarily on questions that facilitate learning, the Constraints-Led approach aims to increase primarily the experiences in which the practitioner performs/solves the task.

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

The Constraints-Led Approach is an ecological model focused on the reciprocal relationship that emerges from each individual's interactions with the environment in which movement or performance is to occur.

In this methodological approach, it is each individual's relationship with specific properties of the environment that changes with learning. Over time, this relationship can become more functional, enabling the achievement of task goals, in a smooth, accurate and energy-efficient manner.

These theoretical considerations changed traditional perspectives on skill acquisition, having profound implications for understanding the individual-environment relationship and for how sports coaches viewed their role in preparing young athletes for competition.

The performer, task, and environment (specific to the sport discipline) are viewed as a complex and dynamic system in which the performer self-organizes movement to respond to the features and affordances of the environment and its constraints (Woods et al., 2020b).

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

And it involves the issue of analyzing the teaching styles that can foster or limit the affordances present in the learning context (Woods et al., 2020b).

More specifically, if one considers the environment in which the young practitioner moves as a rich landscape of offerings (Hulteen et al., 2018; Sannicandro, 2020), some of which are designed by the teacher and presented through a continuous variation of teaching styles (Colella, 2019), then such practical tasks are likely to direct or guide research by young athletes (Withagen et al., 2017; (Woods et al., 2020b; Sannicandro, 2020).

5. Transferable Learning and Motor Experience in Games

Within sports lesson planning, coaches are continually looking for motor tasks that can promote transferable learning: in fact, especially in open skills sports, adaptation of movement to a constantly changing environment is an indicator of talent (Stodden et al., 2021; Seifert et al., 2017).

The use of traditional, pre-sports and sports games in their various variants (small-sided games, SSG) makes it possible to meet another indicator linked to

the quality of teaching: the increase in motor commitment time.

The involutionary trend in motor skills at a developmental age, associated with the modest levels of physical activity carried out in a deliberate and/or recreational form, requires a remodelling not only of the minimum objectives, but above all of the organisational forms and the most appropriate content, within the physical education and sports initiation lessons.

The motor commitment time, which is conditioned by the organisational forms, learning content and teaching style, makes it possible to modulate the intensity levels of the lesson.

The wealth of content deriving from traditional games, together with the very rich offer within the pre-sports games, configures itself as a vast and functional container with respect to the objective of increasing the participants' real activity time.

The continuous interaction with the solicitations coming from the learning environment, as well as those guaranteed by the role of the teacher who invites the participants to explore the potential of movement and resolution present in the didactic context, make it possible to ensure a high level of motor engagement time.

The use of teaching styles by production (Colella, 2016), guarantees that the individual motor repertoire can be experimented with, through the discovery and realisation of unusual or original motor solutions without pauses: each moment during the game activity, if it does not see the participant physically active, always induces him/her to a continuous cognitive reworking useful to decode the motor dynamics that are being developed or modified.

The interplay between content that allows for the exploration of movement and teaching styles that solicit its exploration has a significant advantage in terms of motor learning.

Indeed, the recourse to already known and acquired skills, to resolution strategies adopted in circumstances similar to those the participant has encountered, favour the transferability of learning.

These contents and production styles provide the opportunity for the child to become autonomous or even a creator of knowledge, transforming what has already been learnt into a new executive variant functional to the resolution of the motor task.

In fact, the environment in which the performance of open skills sports is realized is characterized by significant uncertainty that causes the practitioner to search for the solution: this search often results in a series of trial and error.

The same exploratory-type behavior characterizes all games.

The transferability of learning is the ultimate goal of developmental sports training, where the choice of a sporting discipline is often transitory, limited in time, and where it is hoped that what has been experienced in a specific sporting area may be useful for the continuation of sporting activity in another discipline and permanently for the course of the individual's life.

Transferability concerns not only movements, but above all motor and cogni-

tive behaviour.

Learning environments created according to this methodology exploit the concept of affordances to promote the motor behaviors sought or to be promoted (Stodden et al., 2021).

Contrary to traditional information processing theories, movement is not a pre–determined entity stored in the central nervous system, but rather is a dynamically changing process resulting from the interaction between environmental constraints and the internal resources of the performer in light of the task at hand (Stodden et al., 2021; Seifert et al., 2017; Pesce et al., 2019).

Constraints can inhibit or encourage behaviors by altering information embedded in the performance environment: which movements invite and which can be performed?

The individual learners would differ in some ways with reference to their individual physiological structure, mobility, leg strength, flexibility etc. that would impact the specific way that the skill would be executed. In order to take advantage of the affordances present in a motor task, young athletes should be prompted in unusual or otherwise always new contexts to avoid the risk that they will rely on already known motor behaviors.

In fact, it has been suggested that the discovery of diverging production for action (one might talk about personal creativity) may be enhanced when individuals act close to their maximal action capabilities (Orth et al., 2017). Conversely, it has been proposed that in everyday tasks, individuals tend to stay in a safe region in-between the boundaries of their action capabilities to preserve the possibility to adapt their behavior (Fajen, 2005). For instance, studies show that children playing in a climbing playscape stay within a safe region of their action boundaries and keep a security margin when they climb (Croft et al., 2018; Prieske et al., 2015).

In fact, it seems that performers should explore a large range of their action capabilities during learning to develop efficient exploratory activity, and acting close to their action boundaries may encourage performers to find new movement solutions that would extend their maximal action capabilities and their possibility of exploration (Hacques et al., 2021).

Why is exploration more relevant than block repetition (or analytic repetition) in learning skills in open skills sports?

The idea that *explore-discover-adapt* is at the heart of the dynamic ecological approach. And recent research on the effectiveness of partly structured motor activities or free play on fundamental human movements confirms this idea (Tortella et al., 2022; Behan et al., 2022).

6. Motor Games as Functional Environments for Teaching by Dynamic Ecological Approach

In order to enable us to understand the extent and significance of teaching interventions that promote a teaching-by-production style, it may also be useful to

observe the results obtained from research paths applied in the field of sport, which have carefully measured the outcomes of this type of teaching and interaction with participants.

A teaching perspective that makes use of ecological dynamics proposes that the body is understood as a complex adaptive system that interacts with the environment in which it performs in a functionally integrated manner, emphasising that the interaction between motor processes, cognitive and perceptual functions and the constraints imposed by the sporting activity can be better understood by analysing the performer-environment or if you will athlete-environment relationship (Bergmann et al., 2021; Renshaw et al., 2019; Chow et al., 2015).

For this type of analysis, the so-called situation sports are best suited, as is easy to guess, due to the characteristics of the learning environments and the demands of competition.

Indeed, the introduction of new methodologies for teaching tactical skills can benefit from the results of some interesting studies.

Within situational sports activities, decision-making is considered a determining factor for practice and motor success (Diaz del Campo et al., 2011; Práxedes et al., 2018) and is capable of discriminating and identifying the experienced athlete versus the novice (Silva et al., 2014; Diaz del Campo et al., 2011; Práxedes et al., 2018).

A few years ago, a study aimed to verify the effects of a comprehensive teaching programme based on the use of frequently asked questions capable of eliciting decision-making and executive choice in youth football, compared to more traditional methodologies.

The intervention was based on the use of questions in a modified game context, presented to the participants during 21 training sessions (over 18 weeks) with young players, followed by the analysis of 1532 game actions.

The results showed that after applying the intervention programme, the players in the experimental group showed better results in decision-making related to passing and dribbling actions, and better gestural effectiveness in passing actions, compared to the players in the group that had received more traditional teaching. These results suggest that the adoption of teaching styles in sports that privilege the involvement of the cognitive area through the presentation of questions, in the context of modified games, should be considered to promote the improvement of decision-making processes and, consequently, improve their tactical behaviour (Práxedes et al., 2016; Chaouachi et al., 2014).

These advantages also seem to derive from the use of other models, such as the Sport Education - Invasion Games Competence Model (Mesquita et al., 2012) in which the effects of modulating the number of participants in attacking actions, the so-called numerical superiority, were monitored: less pressure from defenders allows for a greater 'time window' to process the decision and thus the effectiveness of technical gestures with particular reference to the ability to transmit the ball (Mesquita et al., 2012; Práxedes et al., 2016).

Confirming the extent to which game modulation is attracting the attention of research for the training of elite players (Koklu et al., 2011; Martins et al., 2016; Bergmann et al., 2021; Renshaw et al., 2019; Sannicandro, 2019 & 2022a), a study has also been published in the literature that aims to evaluate different physical and technical parameters during different SSG repetitions in order to determine whether this type of content can actually be effective in the long-term training process (Fenner et al., 2016).

The structuring of learning and action opportunities (affordances) within the motor literacy or sport initiation pathway is left to the teacher who assumes the role of learning designer: in the dynamic ecological theory of learning, in fact, performance is not a behaviour already possessed by the trainee but arises from the dynamic relationship between the latter, his/her abilities and the constraints presented by the motor task (Renshaw et al., 2019; Araújo & Davids, 2011).

Less structured motor tasks, games essentially in their most diverse executive and organisational applications and variants, allow for self-organised behaviours, which are opposed to those organised from within (pre-planned by the Central Nervous System when predicted by rigidly structured motor tasks) or from outside (the teacher's demands or the rules of a virtual game).

Motor performance is not prescribed by internal or external structures, but within the existing constraints of the game activity: it can be said that there are generally a limited number of stable solutions that can achieve the desired result (Araújo et al., 2017). From the point of view of the participant, whether youth or elite athlete, the task is to exploit the physical (e.g., the characteristics of the playing area, the rules of the game) and perceptual-informative (e.g., the movements of other players, opponents, the speed of the ball, etc.) constraints to stabilise the motor behaviours that are functional for the resolution of the motor task. Constraints have the effect of reducing the number of solutions available to an athlete; this means that task resolution patterns emerge due to the presence of constraints as less functional movement patterns are eliminated.

This dynamic and continuous interaction allows one to improve one's adaptability to the environment and try to maintain the stability of one's performance (even the simplest) even in the presence of perturbations in the environment.

It is important to emphasise that changes in the constraints of motor behaviour can lead the perceptual-motor system towards bifurcation points where choices emerge as more specific information about the activity being performed becomes available (Araújo et al., 2006): this conditions the environment-individual system to move towards motor behaviour that is more functional with respect to the demands of the task (Araújo et al., 2006).

The added value deriving from the dynamic ecological approach derives from the neuroplastic changes induced by this type of motor and sport activity: they become more lasting when motor practice is self-motivated and self-determined, rather than imposed by a decontextualised motor task that is not recognised as

functional (Farmer et al., 2004).

7. Conclusion

The study attempted to draw a connection between the individual's play experience and the demands of training the young sportsman.

A methodological approach based on the presentation of games (in their executive and organizational variants) may be a guarantee for transferable and effective motor learning. Scientific evidence in the literature seems to support this methodological hypothesis. The physical education or sports teacher becomes the designer to outline and structure effective learning environments that meet the learning needs of children and adolescents.

The learning modalities provided by the movement exploration experience can ensure the transferability of motor learning. Finally, the value of self-determined and personally sought motor practice can ensure lifelong learning practice for children and adolescents.

Conflicts of Interest

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

References

Abad Robles, M. T., Collado-Mateo, D., Fernández-Espínola, C., Castillo Viera, E., & Giménez Fuentes-Guerra, F. J. (2020). Effects of Teaching Games on Decision Making and Skill Execution: A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health, 17,* Article 505. https://doi.org/10.3390/ijerph17020505

Abate Daga, F., Baseggio, L., Gollin, M., & Beratto, L. (2020). Game-Based versus Multilateral Approach: Effects of a 12-Week Program on Motor Skill Acquisition and Physical Fitness Development in Soccer School Children. *The Journal of Sports Medicine and Physical Fitness, 60,* 1185-1193. https://doi.org/10.23736/S0022-4707.20.10726-6

Alcaraz-Muñoz, V., Cifo Izquierdo, M. I., Gea García, G. M., Alonso Roque, J. I., & Yuste Lucas, J. L. (2020). Joy in Movement: Traditional Sporting Games and Emotional Experience in Elementary Physical Education. *Frontiers in Psychology, 11,* Article 588640. https://doi.org/10.3389/fpsyg.2020.588640

Allender, S., Cowburn, G., & Foster, C. (2006). Understanding Participation in Sport and Physical Activity among Children and Adults: A Review of Qualitative Studies. *Health Education Research, 21,* 826-835. https://doi.org/10.1093/her/cyl063

Apidogo, J. B., Burdack, J., & Schöllhorn, W. I. (2021). Repetition without Repetition or Differential Learning of Multiple Techniques in Volleyball? *International Journal of Environmental Research and Public Health, 18,* Article 10499. https://doi.org/10.3390/ijerph181910499

Apidogo, J. B., Burdack, J., & Schöllhorn, W. I. (2022). Learning Multiple Movements in Parallel—Accurately and in Random Order, or Each with Added Noise? *International Journal of Environmental Research and Public Health, 19,* Article 10960. https://doi.org/10.3390/ijerph191710960

Araújo, D., & Davids, K. (2011). What Exactly Is Acquired during Skill Acquisition?

Journal of Consciousness Studies, 18, 7-23.

Araújo, D., Davids, K., & Hristovski, R. (2006). The Ecological Dynamics of Decision Making in Sport. *Psychology of Sport and Exercise, 7,* 653-676. https://doi.org/10.1016/j.psychsport.2006.07.002

Araújo, D., Hristovski, R., Seifert, L., Carvalho, J., & Davids, K. (2017). Ecological Cognition: Expert Decision-Making Behaviour in Sport. *International Review of Sport and Exercise Psychology, 12,* 1-25. https://doi.org/10.1080/1750984X.2017.1349826

Barba-Martín, R. A., Bores-García, D., Hortigüela-Alcalá, D., & González-Calvo, G. (2020). The Application of the Teaching Games for Understanding in Physical Education. Systematic Review of the Last Six Years. *International Journal of Environmental Research and Public Health, 17,* Article 3330. https://doi.org/10.3390/ijerph17093330

Behan, S., Belton, S., Peers, C., O'Connor, N. E., & Issartel, J. (2022). Exploring the Relationships between Fundamental Movement Skills and Health Related Fitness Components in Children. *European Journal of Sport Science, 22,* 171-181. https://doi.org/10.1080/17461391.2020.1847201

Belcher, B. R., Berrigan, D., Dodd, K. W., Emken, B. A., Chou, C. P., & Spruijt-Metz, D. (2010). Physical Activity in US Youth: Effect of Race/Ethnicity, Age, Gender, and Weight Status. *Medicine and Science in Sports and Exercise, 42,* 2211-2221. https://doi.org/10.1249/MSS.0b013e3181e1fba9

Bergmann, F., Gray, R., Wachsmuth, S., & Höner, O. (2021). Perceptual-Motor and Perceptual-Cognitive Skill Acquisition in Soccer: A Systematic Review on the Influence of Practice Design and Coaching Behavior. *Frontiers in Psychology, 12,* Article 772201. https://doi.org/10.3389/fpsyg.2021.772201

Bernstein, N. (1967). *The Co-Ordination and Regulation of Movements*. Pergamon Press.

Bunker, D., & Thorpe, R. (1982). A Model for the Teaching of Games in Secondary Schools. *The Bulletin of Physical Education, 18,* 5-8.

Burton, A. M., Eisenmann, J. C., Cowburn, I., Lloyd, R. S., & Till, K. (2022). Youth Motor Competence across Stages of Maturity: Perceptions of Physical Education Teachers and Strength and Conditioning Coaches. *PLOS ONE, 17,* e0277040. https://doi.org/10.1371/journal.pone.0277040

Chaouachi, A., Chtara, M., Hammami, R., Chtara, H., Turki, O., & Castagna, C. (2014). Multidirectional Sprints and Small-Sided Games Training Effect on Agility and Change of Direction Abilities in Youth Soccer. *Journal of Strength and Conditioning Research, 28,* 3121-3127. https://doi.org/10.1519/JSC.0000000000000505

Chaput, J. P., Willumsen, J., Bull, F., Chou, R., Ekelund, U., Firth, J., Jago, R., Ortega, F. B., & Katzmarzyk, P. T. (2020). 2020 WHO Guidelines on Physical Activity and Sedentary Behaviour for Children and Adolescents Aged 5 - 17 Years: Summary of the Evidence. *The International Journal of Behavioral Nutrition and Physical Activity, 17,* Article No. 141. https://doi.org/10.1186/s12966-020-01037-z

Chow, J. Y., Button, C., Davids, K., & Koh, M. (2007a). Variation in Coordination of a Discrete Multiarticular Action as a Function of Skill Level. *Journal of Motor Behavior, 39,* 463-479. https://doi.org/10.3200/JMBR.39.6.463-480

Chow, J. Y., Davids, K., Shuttleworth, R., Button, C., Renshaw, I., & Araújo, D. (2007b). From Processes to Principles: A Constraints-Led Approach to Teaching Games for Understanding (TGFU). *Review of Educational Research, 77,* 251-278. https://doi.org/10.3102/003465430305615

Chow, J. Y., Davids, K., Button C., J. Y., & Renshaw, I. (2015). *Nonlinear Pedagogy in Skill Acquisition: An Introduction*. Routledge. https://doi.org/10.4324/9781315813042

Chow, J. Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araúo, D. (2006).

Nonlinear Pedagogy: A Constraints-Led Framework to Understanding Emergence of Game Play and Skills. *Nonlinear Dynamics, Psychology, and Life Sciences, 10,* 71-103.

Cohen, D. D., Voss, C., Taylor, M. J., Delextrat, A., Ogunleye, A. A., & Sandercock, G. R. (2011). Ten-Year Secular Changes in Muscular Fitness in English Children. *Acta Paediatrica, 100,* e175-e177. https://doi.org/10.1111/j.1651-2227.2011.02318.x

Colella, D. (2016), Stili di insegnamento, apprendimento motorio e processo educativo. *Formazione & Insegnamento, XIV,* 25-34.

Colella, D. (2019). Insegnamento e apprendimento delle competenze motorie. Processi e Relazioni. *Formazione & Insegnamento, XVII,* 73-88.

Colella, D., & Morano, M. (2011). Gross Motor Development and Physical Activity in Kindergarten Age Children. *International Journal of Pediatric Obesity, 6,* 33-36. https://doi.org/10.3109/17477166.2011.613661

Colella, D., Monacis, D., & Limone, P. (2020). Active Breaks and Motor Competencies Development in Primary School: A Systematic Review. *Advances in Physical Education, 10,* 233-250. https://doi.org/10.4236/ape.2020.103020

Crane, J., & Temple, V. (2015). A Systematic Review of Dropout from Organized Sport among Children and Youth. *European Physical Education Review, 21,* 114-131. https://doi.org/10.1177/1356336X14555294

Croft, J. L., Pepping, G. J., Button, C., & Chow, J. Y. (2018). Children's Perception of Action Boundaries and How It Affects Their Climbing Behavior. *Journal of Experimental Child Psychology, 166,* 134-146. https://doi.org/10.1016/j.jecp.2017.07.012

Davids, K., Handford, C., & Williams, M. A. (1994). The Natural Physical Alternative to Cognitive Theories of Motor Behaviour: An Invitation for Interdisciplinary Research in Sports Science? *Journal of Sports Sciences, 12,* 495-528. https://doi.org/10.1080/02640419408732202

Diaz del Campo, D. G., Gonzalez Villora, S., Garcia Lopez, L. M., & Mitchell, S. (2011). Differences in Decision-Making Development between Expert and Novice Invasion Game Players. *Perceptual and Motor Skills, 112,* 871-888. https://doi.org/10.2466/05.10.11.25.PMS.112.3.871-888

Fajen, B. R. (2005). Perceiving Possibilities for Action: on the Necessity of Calibration and Perceptual Learning for the Visual Guidance of Action. *Perception, 34,* 717-740. https://doi.org/10.1068/p5405

Farmer, J., Zhao, X., Van Praag, H., Wodtke, K., Gage, F., & Christie, B. (2004). Effects of Voluntary Exercise on Synaptic Plasticity and Gene Expression in the Dentate Gyrus of Adult Male Sprague-Dawley Rats *in Vivo*. *Neuroscience, 124,* 71-79. https://doi.org/10.1016/j.neuroscience.2003.09.029

Fenner, J. S., Iga, J., & Unnithan, V. (2016). The Evaluation of Small-Sided Games as a Talent Identification Tool in Highly Trained Prepubertal Soccer Players. *Journal of Sports Sciences, 34,* 1983-1990. https://doi.org/10.1080/02640414.2016.1149602

Formenti, D., Duca, M., Trecroci, A., Ansaldi, L., Bonfanti, L., Alberti, G., & Iodice, P. (2019). Perceptual Vision Training in Non-Sport-Specific Context: Effect on Performance Skills and Cognition in Young Females. *Scientific Reports, 9,* Article No. 18671. https://doi.org/10.1038/s41598-019-55252-1

Formenti, D., Rossi, A., Bongiovanni, T., Campa, F., Cavaggioni, L., Alberti, G., Longo, S., & Trecroci, A. (2021). Effects of Non-Sport-Specific versus Sport-Specific Training on Physical Performance and Perceptual Response in Young Football Players. *International Journal of Environmental Research and Public Health, 18,* Article 1962. https://doi.org/10.3390/ijerph18041962

Gonaus, C., Müller, E., Stöggl, T., & Birklbauer, J. (2023). Determining the Effect of One

Decade on Fitness of Elite Austrian Youth Soccer Players Using Propensity Score Matching. *Frontiers in Sports and Active Living, 5,* Article 1186199. https://doi.org/10.3389/fspor.2023.1186199

Gonçalves, B., Folgado, H., Coutinho, D., Marcelino, R., Wong, D., Leite, N., & Sampaio, J. (2018). Changes in Effective Playing Space When Considering Sub-Groups of 3 to 10 Players in Professional Soccer Matches. *Journal of Human Kinetics, 62,* 145-155. https://doi.org/10.1515/hukin-2017-0166

Greier, K., Drenowatz, C., Riechelmann, H., Ruedl, G., Kirschner, W., & Greier, C. (2020). Longitudinal Association of Motor Development and Body Weight in Elementary School Children—A 4-Year Observational Study. *Advances in Physical Education, 10,* 364-377. https://doi.org/10.4236/ape.2020.104030

Hacques, G., Komar, J., Dicks, M., & Seifert, L. (2021). Exploring to Learn and Learning to Explore. *Psychological Research, 85,* 1367-1379. https://doi.org/10.1007/s00426-020-01352-x

Handford, C., Davids, K., Bennett, S., & Button, C. (1997). Skill Acquisition in Sport: Some Applications of an Evolving Practice Ecology. *Journal of Sports Sciences, 15,* 621-640. https://doi.org/10.1080/026404197367056

Hulteen, R. M., Morgan, P. J., Barnett, L. M., Stodden, D. F., & Lubans, D. R. (2018). Development of Foundational Movement Skills: A Conceptual Model for Physical Activity across the Lifespan. *Sports Medicine, 48,* 1533-1540. https://doi.org/10.1007/s40279-018-0892-6

Invernizzi, P. L., Signorini, G., Colella, D., Raiola, G., Bosio, A., & Scurati, R. (2020). Assessing Rolling Abilities in Primary School Children: Physical Education Specialists vs. Generalists. *International Journal of Environmental Research and Public Health, 17,* Article 8803. https://doi.org/10.3390/ijerph17238803

Koklu, Y., Asci, A., Kocak, F. U., Alemdaroglu, U., & Dundar, U. (2011). Comparison of the Physiological Responses to Different Small-Sided and Conditioned Games in Elite Young Soccer Players. *Journal of Strength and Conditioning Research, 25,* 1522-1528. https://doi.org/10.1519/JSC.0b013e3181e06ee1

Launder, A. G., & Pilz, W. (2012). *Play Practice: The Games Approach to Teaching and Coaching Sport* (2nd ed.). Human Kinetics.

Lindenberger, U., Wenger, E., & Lövdén, M. (2017). Towards a Stronger Science of Human Plasticity. *Nature Reviews Neuroscience, 18,* 261-262. https://doi.org/10.1038/nrn.2017.44

Lloyd, M., Saunders, T. J., Bremer, E., & Tremblay, M. S. (2014). Long-Term Importance of Fundamental Motor Skills: A 20-Year Follow-Up Study. *Adapted Physical Activity Quarterly: APAQ, 31,* 67-78. https://doi.org/10.1123/apaq.2013-0048

Lloyd, R. S., Oliver, J. L., Faigenbaum, A. D., Howard, R., De Ste Croix, M. B., Williams, C. A., Best, T. M., Alvar, B. A., Micheli, L. J., Thomas, D. P., Hatfield, D. L., Cronin, J. B., & Myer, G. D. (2015). Long-Term Athletic Development—Part 1: A Pathway for All Youth. *Journal of Strength and Conditioning Research, 29,* 1439-1450. https://doi.org/10.1519/JSC.0000000000000756

Mačak, D., Popović, B., Babić, N., Cadenas-Sanchez, C., Madić, D. M., & Trajković, N. (2022). The Effects of Daily Physical Activity Intervention on Physical Fitness in Preschool Children. *Journal of Sports Sciences, 40,* 146-155. https://doi.org/10.1080/02640414.2021.1978250

Martins, D. A., Gonçalves, S., Varanda, B. S., Margarida, A., Da Eira, A. J., & Correia, N. M. (2016). Manipulating the Number of Players and Targets in Team Sports. Small-Sided and Conditioned Games during Physical Education Classes. *Revista de Psicologia del*

Deporte, 25, 169-177.

Mesquita, I., Farias, C., & Hastie, P. (2012). The Impact of a Hybrid Sport Education-Invasion Games Competence Model Soccer Unit on Students' Decision Making, Skill Execution and Overall Game Performance. *European Physical Education Review, 18,* 205-219. https://doi.org/10.1177/1356336X12440027

Moliner-Urdiales, D., Ruiz, J. R., Ortega, F. B., Jiménez-Pavón, D., Vicente-Rodriguez, G., Rey-López, J. P., Martínez-Gómez, D., Casajús, J. A., Mesana, M. I., Marcos, A., Noriega-Borge, M. J., Sjöström, M., Castillo, M. J., Moreno, L. A., & AVENA and HELENA Study Groups (2010). Secular Trends in Health-Related Physical Fitness in Spanish Adolescents: The AVENA and HELENA Studies. *Journal of Science and Medicine in Sport, 13,* 584-588. https://doi.org/10.1016/j.jsams.2010.03.004

Monacis, D., Trecroci, A., Invernizzi, P. L., & Colella, D. (2022). Can Enjoyment and Physical Self-Perception Mediate the Relationship between BMI and Levels of Physical Activity? Preliminary Results from the Regional Observatory of Motor Development in Italy. *International Journal of Environmental Research and Public Health, 19,* Article 12567. https://doi.org/10.3390/ijerph191912567

Orth, D., Van der Kamp, J., Memmert, D., & Savelsbergh, G. J. P. (2017). Creative Motor Actions as Emerging from Movement Variability. *Frontiers in Psychology, 8,* Article 1903. https://doi.org/10.3389/fpsyg.2017.01903

Passos, P., Araújo, D., & Davids, K. (2013). Self-Organization Processes in Field-Invasion Team Sports: Implications for Leadership. *Sports Medicine, 43,* 1-7. https://doi.org/10.1007/s40279-012-0001-1

Pesce, C., Croce, R., Ben-Soussan, T. D., Vazou, S., McCullick, B., Tomporowski, P. D., & Horvat, M. (2019). Variability of Practice as an Interface between Motor and Cognitive Development. *International Journal of Sport and Exercise Psychology, 17,* 133-152. https://doi.org/10.1080/1612197X.2016.1223421

Pinder, R. A., Davids, K., Renshaw, I., & Araújo, D. (2011). Representative Learning Design and Functionality of Research and Practice in Sport. *Journal of Sport and Exercise Psychology, 33,* 146-155. https://doi.org/10.1123/jsep.33.1.146

Power, J. D., & Schlaggar, B. L. (2017). Neural Plasticity across the Lifespan. *Wiley Interdisciplinary Reviews: Developmental Biology, 6,* e216. https://doi.org/10.1002/wdev.216

Práxedes, A., Moreno, A., Gil-Arias, A., Claver, F., & Del Villar, F. (2018). The Effect of Small-Sided Games with Different Levels of Opposition on the Tactical Behaviour of Young Footballers with Different Levels of Sport Expertise. *PLOS ONE, 13,* e0190157. https://doi.org/10.1371/journal.pone.0190157

Práxedes, A., Moreno, A., Sevil, J., García-González, L., & Del Villar, F. (2016). A Preliminary Study of the Effects of a Comprehensive Teaching Program, Based on Questioning, to Improve Tactical Actions in Young Footballers. *Perceptual and Motor Skills, 122,* 742-756. https://doi.org/10.1177/0031512516649716

Prieske, B., Withagen, R., Smith, J., & Zaal, F. T. J. M. (2015). Affordances in A Simple Playscape: Are Children Attracted to Challenging Affordances? *Journal of Environmental Psychology, 41,* 101-111. https://doi.org/10.1016/j.jenvp.2014.11.011

Ranganathan, R., Lee, M. H., & Newell, K. M. (2020). Repetition without Repetition: Challenges in Understanding Behavioral Flexibility in Motor Skill. *Frontiers in Psychology, 11,* Article 2018. https://doi.org/10.3389/fpsyg.2020.02018

Renshaw, I., Araújo, D., Button, C., Chow, J. Y., Davids, K., & Moy B. (2015). Why the Constraints-Led Approach Is Not Teaching Games for Understanding: A Clarification. *Physical Education and Sport Pedagogy, 5,* 459-480. https://doi.org/10.1080/17408989.2015.1095870

Renshaw, I., Davids, K., Araújo, D., Lucas, A., Roberts, W. M., Newcombe, D. J., & Franks, B. (2019). Evaluating Weaknesses of "Perceptual-Cognitive Training" and "Brain Training" Methods in Sport: An Ecological Dynamics Critique. *Frontiers in Psychology, 9,* Article 2468. https://doi.org/10.3389/fpsyg.2018.02468

Ribeiro, J., Davids, K., Araújo, D., Guilherme, J., Silva, P., & Garganta, J. (2019). Exploiting Bi-Directional Self-Organizing Tendencies in Team Sports: The Role of the Game Model and Tactical Principles of Play. *Frontiers in Psychology, 10,* Article 2213. https://doi.org/10.3389/fpsyg.2019.02213

Rudd, J. R., Pesce, C., Strafford, B. W., & Davids, K. (2020). Physical Literacy—A Journey of Individual Enrichment: An Ecological Dynamics Rationale for Enhancing Performance and Physical Activity in All. *Frontiers in Psychology, 11,* Article 1904. https://doi.org/10.3389/fpsyg.2020.01904

Salvy, S. J., De La Haye, K., Bowker, J. C., & Hermans, R. C. (2012). Influence of Peers and Friends on Children's and Adolescents' Eating and Activity Behaviors. *Physiology & Behavior, 106,* 369-378. https://doi.org/10.1016/j.physbeh.2012.03.022

Sannicandro, I. (2019). Small-Sided Games Configuration Pitch and External Motor Load Relationship in Young Soccer Players: Narrative Literature Review. *Journal of Physical Education and Sport, 19,* 1989-1993.

Sannicandro, I. (2020). Ecological Dynamics Approach in the Youth Soccer: A Short Narrative Review. *Journal of Human Sport and Exercise, 15,* S1133-S1139. https://doi.org/10.14198/jhse.2020.15.Proc4.14

Sannicandro, I. (2022a). From Traditional Approach to Ecological Dynamics Approach with the Italian Young Soccer Players. *Advances in Physical Education, 12,* 201-216. https://doi.org/10.4236/ape.2022.123016

Sannicandro, I. (2022b). *Specializzazione precoce e rischio di infortunio*. Cleup.

Sannicandro, I., & Raiola, G. (2021). Game Based and Multilateral Approach in Youth Soccer Training: A Choice So That Health and Sporting Targets Can Coexist. *The Journal of Sports Medicine and Physical Fitness, 61,* 1314-1315. https://doi.org/10.23736/S0022-4707.21.12247-9

Savelsbergh, G. J. P., & Wormhoudt, R. (2019). Creating Adaptive Athletes: The Athletic Skills Model for Enhancing Physical Literacy as a Foundation for Expertise. *Movement & Sport Sciences—Science & Motricité, 24,* 125-134.

Seifert, L., Araújo, D., Komar, J., & Davids, K. (2017). Understanding Constraints on Sport Performance from the Complexity Sciences Paradigm: An Ecological Dynamics Framework. *Human Movement Science, 56,* 178-180. https://doi.org/10.1016/j.humov.2017.05.001

Seifert, L., Papet, V., Strafford, B. W., Coughlan, E. K., & Davids, K. (2019). Skill Transfer, Expertise and Talent Development: An Ecological Dynamics Perspective. *Movement & Sport Sciences—Science & Motricité, 25,* 178-182.

Sgrò, F., & Lipoma, M. (2019). Riflessioni sull'utilizzo dei Tactical Games Model nella scuola primaria. *Formazione & Insegnamento, XVII,* 193-205.

Silva, P., Travassos, B., Vilar, L., Aguiar, P., Davids, K., Araújo, D., & Garganta, J. (2014). Numerical Relations and Skill Level Constrain Co-Adaptive Behaviors of Agents in Sports Teams. *PLOS ONE, 9,* e107112. https://doi.org/10.1371/journal.pone.0107112

Stodden, D., Lakes, K. D., Côté, J.., Aadland, E., Benzing, V., Brian, A., Draper, C. E., Ekkekakis, P., Fumagalli, G., Laukkanen, A., Mavilidi, M. F., Mazzoli, E., Neville, R. D., Niemistö, D., Rudd, J., Sääkslahti, A., Schmidt, M., Tomporowski, P. D., Tortella, P., Vazou, S., & Pesce, C. (2021). Exploration: An Overarching Focus for Holistic Devel-

opment. *Brazilian Journal of Motor Behavior, 15,* 301-320. https://doi.org/10.20338/bjmb.v15i5.254

Stuhr, C., Hughes, C. M. L., & Stöckel, T. (2018). Task-Specific and Variability-Driven Activation of Cognitive Control Processes during Motor Performance. *Scientific Reports, 8,* Article No. 10811. https://doi.org/10.1038/s41598-018-29007-3

Tan, S., Wright, S., McNeill, M., Fry, J., & Tan, C. (2002). Implementing the Games Concept Approach in Singapore Schools: A Preliminary Report. *REACT, No. 1,* 77-84.

Thorpe, R. (2005). Rod Thorpe on Teaching Games for Understanding. In L. Kidman (Ed.), *Athlete-Centred Coaching: Developing Inspired and Inspiring People* (pp. 229-243). Innovative Print Communication Ltd.

Tortella, P., Haga, M., Lorås, H., Fumagalli, G. F., & Sigmundsson, H. (2022). Effects of Free Play and Partly Structured Playground Activity on Motor Competence in Preschool Children: A Pragmatic Comparison Trial. *International Journal of Environmental Research and Public Health, 19,* Article 7652. https://doi.org/10.3390/ijerph19137652

Travlos, A. K. (2010). Specificity and Variability of Practice, and Contextual Interference in Acquisition and Transfer of an Underhand Volleyball Serve. *Perceptual and Motor Skills, 110,* 298-312. https://doi.org/10.2466/pms.110.1.298-312

Weisberg, D. S., Hirsh-Pasek, K., & Golinkoff, R. M. (2013). Guided Play: Where Curricular Goals Meet a Playful Pedagogy. *Mind, Brain, and Education, 7,* 104-112. https://doi.org/10.1111/mbe.12015

Withagen, R., Araújo, D., & De Poel, H. J. (2017). Inviting Affordances and Agency. *New Ideas in Psychology, 45,* 11-18. https://doi.org/10.1016/j.newideapsych.2016.12.002

Woods, C. T., McKeown, I., O'Sullivan, M., Robertson, S., & Davids, K. (2020a). Theory to Practice: Performance Preparation Models in Contemporary High-Level Sport Guided by an Ecological Dynamics Framework. *Sports Medicine-Open, 6,* Article No. 36. https://doi.org/10.1186/s40798-020-00268-5

Woods, C. T., McKeown, I., Rothwell, M., Araújo, D., Robertson, S., & Davids, K. (2020b). Sport Practitioners as Sport Ecology Designers: How Ecological Dynamics Has Progressively Changed Perceptions of Skill "Acquisition" in the Sporting Habitat. *Frontiers in Psychology, 11,* Article 654. https://doi.org/10.3389/fpsyg.2020.00654

World Health Organization (2010). *Global Recommendations on Physical Activity for Health.* WHO Press.