

A Constraint-Led Approach to Coaching and Teaching Games: Can going back to the future solve the «they need the basics before they can play a game» argument?

La enseñanza y el entrenamiento deportivo desde un enfoque «Constraint-Led»¹. ¿Puede el retorno al futuro afrontar la idea de que «para jugar, lo primero son los fundamentos»?

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Abstract. Despite the continued popularity of Games Centred Approaches with tertiary level academics, the take-up by practitioners has been limited. In a recent survey of entry level HPE students undertaken at our university, 95% reported that they had received a predominantly traditional experience in school physical education lessons. This finding is in line with a common response when we engage with practitioners who strongly advocate the need for games players to

¹ La expresión *Constraint-Led* ha sido traducida en algunos lugares como teoría de los “limitadores”; sin embargo, en el campo de la EF y el deporte se mantiene a menudo la expresión inglesa (*constraint-led approach* o *constraint-led perspective*). En líneas generales, es una forma de intervención indirecta (a través de los condicionantes: entorno, tarea, jugadores) en la que se destaca la importancia del proceso de toma de decisiones del alumno o deportista. (Nota de los editores)

learn the basics before they can play a game. In this paper we will present concepts and practical exemplars demonstrating a Constraint-Led Approach (CLA) to games teaching and coaching. We will show that adopting a CLA has the potential to provide practitioners with the tools to address this significant barrier and potentially enhance the adoption of games-based approaches. We will argue that the technique-tactics dichotomy is a redundant framework as the intentions and actions of learners is a function of their current action capabilities. However, we will also propose that games-based practitioners need to develop pedagogical practices that initially develop intra-individual-environment co-ordination before moving onto a more traditional focus on inter-individual-environment co-ordination (i.e., how teams organise to solve games-based problems). A key focus will be on the need to consider the mutuality of the individual and the environment and how backyard games allied to CLA methods can help practitioners design better games based programmes that will meet the needs of all games players irrespective of age or ability level.

Keywords: Backyard games; constraints-led approaches; game centred approaches; ecological dynamics; nonlinear pedagogy.

Resumen. A pesar de la popularidad de los Enfoques Centrados en el Juego entre los académicos de educación superior, su aceptación por los enseñantes de niveles inferiores ha sido limitada. En un reciente sondeo llevado a cabo entre los estudiantes que iniciaban sus estudios de Salud y Educación Física en nuestra universidad, el 95% indicó que la EF recibida en su escolaridad había sido predominantemente tradicional. Este dato coincide con la respuesta habitual que nos encontramos cuando trabajamos con los enseñantes; éstos defienden la necesidad de que los jugadores adquieran los fundamentos antes de jugar a cualquier deporte. En este artículo, presentamos conceptos y modelos prácticos de enseñanza y entrenamiento deportivo basados en el Enfoque Basado-en-Condicionantes/Limitadores (*Constraint-Led Approach* –CLA–). Mostraremos que la adopción de este enfoque proporciona a los enseñantes herramientas que les permiten abordar dicho obstáculo, a la vez que incrementa las posibilidades de que adopten enfoques centrados-en-el-juego. Sostendremos que la dicotomía técnica-táctica es un marco inútil porque las intenciones y acciones de los aprendices son una función de sus capacidades para la acción. Sin embargo, explicaremos también que los enseñantes que siguen el enfoque basado-en-el-juego necesitan llevar a cabo prácticas pedagógicas en las que inicialmente desarrollen la coordinación intra-ambiente (i. e., cómo se organizan los equipos para resolver problemas basados-en-el-juego). Un punto clave será la necesidad de considerar la reciprocidad entre individuo y entorno, y el modo en que los juegos del patio y de la calle, aliados con los métodos CLA, pueden ayudar al enseñante a diseñar mejores programas basados-en-el-juego, que respondan a las necesidades de todos los jugadores, cualquiera que sea su edad o nivel de habilidad.

Palabras clave. Juegos del patio; juegos de la calle; enfoques basados-en-condicionantes/limitadores; enfoques centrados en el juego; dinámica ecológica; pedagogía no lineal.

INTRODUCTION

Games Centred Approaches (GCAs) to teaching and coaching such as Teaching Games for Understanding (TGfU) (Bunker & Thorpe, 1982), Game Sense (Thorpe, 2005), Sport Education (Siedentop, 2002) and the Games Concept Approach (Tan, Wright, McNeill, Fry, & Tan, 2002) have

created great interest across the world with academics suggesting that GCAs can make a positive contribution to physical education (PE). Advocates provide a number of benefits from adopting GCAs in lessons including (a) its potential to enhance participant motivation, (b) potential for tactical transfer, and (c) development of decision-making skills and effective decision-makers (Oslin & Mitchell, 2006). More recently, Harvey and Jarrett (2015) backed up this positive view of GCAs stating that:

...GCA pedagogies are of significant importance as they have the potential to promote change within current adult-centric cultures of youth sport and encourage engagement in physical activity over the life course (p. 279).

Harvey and Jarrett undertook a systematic review into GCA literature since 2006 focusing on how GCAs were able to meet the “5 big aims of PE”, namely, skill development; tactical knowledge and game performance assessment; fitness; personal and social development, and student’s attitudes. Overall findings were positive and a number of studies provided further support to the notion that GCAs can be more fun than doing drills and that students can be motivated when being taught with these approaches.

The lack of take-up by practitioners of GCAs, particularly the founding TGfU approach has been an ongoing theme from researchers, many of whom have demonstrated clear benefits to games teaching for practitioners. For example, as highlighted by Rossi, Fry, McNeil, and Tan:

Evans and Clarke (1988) sadly noted that Teaching Games for Understanding (TGfU) could not be described as being in widespread use. Only six years later, Laws (1994) argued that British school physical education (PE) departments who made TGfU the centre-piece of their games programmes were deluding themselves and such a commitment was akin to Sparkes’s (1990) description of innovation without change. (2007, pp. 93-94)

Indeed, one of the founders of TGfU suggested that “...the rationale seems to have passed by practitioners without any major effect. TGfU currently thrives in only a few areas where practitioners are faithful to the original approach” (Almond, 2010, vii). Has anything changed since then? As part of a recent study, we surveyed an incoming group of first year Physical Education Teacher Education (PETE) students to find out how they were taught in PE lessons. The findings can be seen in the table I below.

Table I. PETE students self-reported description of the predominant method used by their PE teacher and coach by level of games playing success (adapted from Moy, Renshaw, & Davids, 2014)

PETE students self-reported description of the predominant teaching and coaching method used by their PE teacher and coach	State/National (N=16)		Regional (N=20)		School/club (N=13)	
	<i>How Taught</i>	<i>How coached</i>	<i>How Taught</i>	<i>How coached</i>	<i>How Taught</i>	<i>How coached</i>
A. Traditional, Reproductive Approach	14 (88)	15 (94)	19 (95)	16 (80)	11 (85)	10 (77)
B. Game Centred Approach	1 (6)	1 (6)	1 (5)	4 (20)	0 (0)	3 (23)
C. Non-Teaching Approach	1 (6)	0 (0)	0 (0)	0 (0)	2 (15)	0 (0)

(Figures in parentheses are percentages)

As an added reflection, we recently gave our current first year exercise science and PETE students, 30 minutes to design a short activity to teach skills to a small group of their colleagues within a unit on coaching. Observation of the tasks set revealed that 95% designed and delivered a traditional drill. It would appear that Queensland students are receiving a very traditional, reproductive experience in PE lessons at school. Why should we have been surprised at this adherence to how PE has historically been taught? Well one reason is that the development of intelligent, thinking performers is a central theme in the Physical Education Senior Syllabus in Queensland, Australia. The Queensland Studies Authority (QSA) states that ‘intelligent performance is characterised by high levels of cognitive functioning, using both rational and creative thought. Students are *decision makers* [our italics] engaged in the active construction of meaning through processing information related to their personal experience and to the study of physical activity’ (QSA, 2010, 3). How then, we asked ourselves are young learners able to demonstrate ‘intelligent performance’ when they are essentially taught skills using teacher prescribed drills that deny them the opportunity to make decisions? We will park that thought with the reader for now!

While we were somewhat staggered by the extent of these figures, perhaps we should not have been surprised given the challenges of implementing ‘new’ approaches into mainstream teaching. A number of reasons have been suggested as to why GCAs are failing to take a foothold

in PE staffrooms. Harvey, Cushion, and Massa-Gonzalez (2010) found that TGfU challenged coaches' values, beliefs and dispositions. Rossi et al. (2007) support this viewpoint when they discussed the experience of 'Tiong' (a Singaporean teacher tasked with implementing the Game Concept Approach into his teaching) who found that the safety blanket of 'the deep-seated 'skills approach' was hard to step away from. They add:

Tiong knew what he was doing: his lessons could be structured; he could control; and he could monitor. He found that the long-held understandings of games pedagogy, those that he had once seen as 'unassailable truths' and which were in keeping with a Singaporean mindset of structure, organization and consistency, were being disrupted. For him, the GCA was a challenge to his professional self and perhaps exposed his entrenched mindset concerning PE and the role of compliance and control (p. 103).

Given the socio-cultural constraints acting on teachers, the initial induction processes to educate about new pedagogies is crucial. Forrest (2015) supports this view believing that implementing the processes of GCA lessons is reliant on the teacher delivering the model effectively. He argues that lessons which have all of the features of a GCA delivered well can produce high quality-learning outcomes, whereas, those with poor implementation produce shallow ones. The lack of support from 'experts' in the field was seen as a key barrier, with relatively short induction periods not permitting the development of sufficient pedagogical content knowledge to provide novice teachers with the conceptual understanding of GCAs and how to implement them in practice (e. g., Wright, McNeill, and Fry 2009). McNeill, Fry, Wright, Tan, and Rossi (2008) reported the need to challenge the idea that a GCA was 'a recipe', a factor we have also encountered when working with coach educators who were attempting to implement TGfU in sports clubs. For example, it would seem that the requirement to use questions in their practice rather than explicit instruction has led to some coaches asking questions simply for the sake of it, rather than questions related to what was actually taking place in the activity (Rogers, personal communication). When the approach is implemented incorrectly, or the model is not followed with sufficient knowledge and understanding, then the resultant poor outcomes often lead to rejection of the ideas by teachers and coaches.

Teachers appear to have adopted polarised views as to the efficacy of GCAs, perhaps based on their initial engagement with implementing the

model. For example, when mandated by their government to implement the Games Concept Approach, Singaporean PE teachers were split into two camps. One group of teachers believed that the Games Concept Approach was most appropriate for teaching primary school children, so they would have the basis for technical coaching in games in high school. Another group took up a polar opposite viewpoint, believing that the Games Concept Approach would be better left until some basic sports skills were in place and a high level of sophisticated games sense could then build on this foundation at secondary school (Rossi et al., 2007). In our current work we found that PETE students reported that the most frequent justification for doing ‘drills’ was their importance in teaching students specific technical skills before playing the game (Moy, Renshaw, & Davids, 2014). This is reflected in the following individual participant response: “This [teaching of technical skills using drills] is important to ensure the children are able to do the skills in the game properly”. This finding is in line with a common response when we engage with practitioners who strongly advocate the need for games players to learn the basics before they can play a game.

In the rest of this paper, we would like to dig a little deeper into this conflict of views and highlight some possible ways forward that would answer the wishes of both groups and demonstrating that if applied appropriately, GCA models can be effectively implemented for all ages and ability levels. We will propose that the effectiveness of GCAs can be supported by using the framework of Nonlinear Pedagogy (NLP), which is based on the ideas and concepts of ecological dynamics, implemented in practice via a Constraint-led Approach (CLA). We will briefly present key concepts before providing practical exemplars demonstrating how adopting a CLA to games teaching and coaching can satisfy the goals of practitioners and perhaps more importantly the goals of the learners with which they work. We will propose that games-centred practitioners need to develop pedagogical practices that meet the needs of individual learners respective to their history of engagement with the game. To that end, we will recommend that practitioners should initially design learning environments to develop intra-individual-environment co-ordination in beginner level performers by using a continuum of activities based on a CLA. A key point will be to ‘go back to the future’ and consider how backyard games played by individuals and small groups provide effective environments that underpin the emergence of adaptable co-ordination patterns and provide the foundation for later engagement in structured games. We will then move on to inter-individual-environment co-ordination (i.e., how teams organise to solve

games-based problems), prevalent in most games-based programmes of work. Specifically, we will show how practitioners can systematically manipulate key individual, task or environmental constraints to facilitate the emergence of functional inter-individual co-ordination patterns based on the principles of play. Through opportunities to explore the task demands, teams learn to attune to and ultimately exploit the key affordances (i.e. opportunities for action) available in the game to achieve success.

Traditional teacher-centred methods of teaching and coaching assume a gradual, linear process of learning, with teaching methods often characterized by blocked practice drills with augmented teacher instruction and feedback designed to help students develop *sound technique* or idealized motor patterns. Curtner-Smith, Todorovich, McCaughy, and Lacon (2001) presented compelling evidence that PE teachers spend most of their time (up to 78%) engaging in such teaching strategies. Somewhat ironically, such strategies can limit the amount of time that learners are actually engaged in physical practice. For example, evidence suggests that children in PE classes on average spend only 25% of the time actually engaged in physical activity (Tinning, 2006). When the largely singular focus is on optimising technical skills, only once this technique is perceived to be 'good' can it be exposed to the messy, complex environments found in games. Essentially, this premise is based on the "how can they play a game if they don't have good technique" argument we hear from many practitioners. However, the value of drills in enabling the emergence of functional techniques is questionable. For example, how does dribbling around cones, where the focus of attention is at the feet, enable a young player to travel with the ball in the game where there is a need to scan the environment to guide actions that take into account moving defenders? How can receiving a pass with no pressure from an opponent develop the ability to control the ball close to the body or perhaps more importantly away from the pressure of an oncoming defender? Indeed, games are messy and practitioners need to be sure that the techniques developed in unopposed or low-pressure practice environments are effective in the dynamic game.

A failure to do so, means that time is wasted and rather than preparing the young player, such practices actually disadvantage them going into games. Successful performance in games involves the individual learner solving problems and therefore emphasises the need to challenge them beyond mere repetition and imitation of a putative classic action (Chow, Davids, Button, & Renshaw, 2016). A key limitation of traditional pedagogical styles then is that they tend to prevent individual learners from

exploring and discovering their own functional movement solutions to a games problem, a more appropriate characterisation of learning in play (Davids et al., 2013). As highlighted above, the decomposition of tasks in traditional games teaching also brings into question the ‘transferability’ of movement patterns developed in drills to games. A number of studies across a range of games and sports have shown that these unrepresentative practice tasks do not facilitate the emergence of movement patterns that exhibit fidelity with those seen in performance environments (e.g., Pinder, Davids, & Renshaw, 2012; Dicks, Button, & Davids, 2010). This concern does not only apply to drills, but needs to be carefully considered in the design of small-sided games (SSG); a staple of GCAs. For example, adding in artificial rules in SSG such as playing ubiquitous two-touch games can result in over constraining and result in the emergence of less functional intra- and inter individual couplings between co-adapting team mates and opponents. For example, a game rule of two touches means that as soon as a defender sees the first touch of an opponent it gives them the answer as to where to stand to limit or prevent the pass. Simply adding in constraints without considering the expected and unexpected impact is a challenge for those keen to develop a CLA. This can be a particular problem for novice practitioners (i.e., student teachers or parent coaches) who may have little experience of implementing the approach and at the same time may have limited understanding of the principles of play of games.

A common claim of advocates of GCAs is that there can be transfer from similar categories of sports such as invasion games or net-court games. While some evidence exists for such transfer in terms of pattern recognition in invasion games (Smeeton, Ward, & Williams, 2004), the development of perception-action couplings may not transfer as easily. For example, while the hoop in basketball and netball require the same task goal (to shoot the ball through the hoop), the presence of the backboard changes the potential perception-action control mechanisms as it affords different possibilities to achieve the task goal. Issues such as these, highlight the importance of providing practitioners with the knowledge to base their learning design on a sound theoretical model of the learner and the learning process.

In the next section we propose that one theoretical model that can underpin learning design via a NLP for GCAs is ecological dynamics (a fusion of ecological psychology and nonlinear dynamics). Ecological dynamics considers individual games players and sports teams as “complex adaptive systems”, (i.e., systems composed of two or more

interacting components (e. g., the body of an individual games player or members of a team) (Chow et al., 2016). In a NLP, a key supposition is that practice task constraints should be designed to simulate the constraints of a performance environment (Davids, Araújo, Vilar, Renshaw, & Pinder, 2013).

1. ECOLOGICAL DYNAMICS, NONLINEAR PEDAGOGY AND THE CONSTRAINT-LED APPROACH

The theoretical foundation of NLP is ecological dynamics and therefore differs in many ways to traditional methods of teaching and coaching (Chow, Davids, Button, Shuttleworth, Renshaw, & Araújo, 2006; Chow et al., 2016). From a nonlinear dynamics perspective, learning to play games is viewed as a process of searching for appropriate preferred patterns of intra-individual and inter-individual coordination, into which a system can settle during a task or activity (Button, Chow, & Rein, 2008). The specific focus of practitioners is how behaviours can self-adjust or self-organise, with certain goal-directed behaviours emerging due to interactions between prevailing constraints at a point in time. Consequently, skill acquisition is seen as the development of a functional relationship between the performer and their environment (Araújo & Davids, 2011; Zelaznik, 2014).

Teaching games via a NLP is achieved through the implementation of a CLA. In a CLA, pedagogical principles such as self-organisation and the manipulation of constraints, representative learning design, infusion of variability, accounting for attentional focus and enhancing information-movement couplings work together to support the pedagogical channels of instructions, practice and informational constraints (see Renshaw, Davids, Chow, & Hammond, 2010; Chow, 2013, for detailed definitions of these underlying concepts).

The CLA is an individual-environment approach to teaching and coaching games and as such, in this paper we aim to focus on the fundamental concept of the mutuality of the performer and environment (Gibson, 1986). We believe this is the key concept for practitioners to take on board as in our opinion it frames all other aspects of the ecological dynamics approach.

The importance of the environment in which individuals learn and play games has tended to be neglected in the largely singular focus of practitioners whose aim is to develop enriched internal representations that bring about relatively permanent changes in a learner's movement

capabilities (e. g., Schmidt & Wrisberg, 2004). Essentially, practitioners have spent significant amounts of time aiming to develop ‘repeatable techniques’ in players based on their own mental model of what they judge to be ‘correct’ technique. As mentioned earlier, this approach often leads to the practicing of skills in training environments that are absent of the key information sources that guide intentions, perceptions and actions in games (Headrick, Renshaw, Davids, Pinder, & Araújo, 2015). For example, shooting a basketball when no defenders are present results in a different technique than shooting when there is a defender present (Gorman & Maloney, 2016). The environments in which games players learn to play is therefore highly significant in terms of the impact it has on the emergent movement patterns of young games players.

Gibson captures this concept when he suggests that “the words animal and environment make an inseparable pair. Each term implies the other. No animal could exist without an environment surrounding it” (1986, p.3). Gibson introduced the idea of affordances and described the environment in terms of what it ‘offers’ or ‘affords’ the animal. Environmental properties are considered in relation to the animal’s size or action capabilities rather than via measurements of scale such as metres and kilogrammes. More recently, theoreticians (e.g., Bruineberg & Rietveld, 2014; Rietveld & Kiverstein, 2014) who have focused on affordances have built on their relational nature to suggest that they are also resources that are available for animals (in our case games players) to use. The landscape of affordances available in junior sport environments therefore offers or invites individual players to develop a range of action possibilities to achieve ‘fitness’ to the specific environment. The key point is that the ‘abilities’ (i. e., technical skills, game understanding, intentions and emotional skills) that young games players are ‘allowed’ to develop are determined by the environments to which they are exposed over time. This is an important concept as games players will only become attuned to specific affordances within practice and performance environments through continued exposure to them. Gibson (1986) captured this idea when he considered how animals develop fitness for their world, or their niche as he described it. In evolutionary terms, the animals that best survive and thrive in their niche have adapted the abilities to exploit the affordances available in these worlds.

Taking the same ideas into games play, it is clear that the environments provided for young games players should be designed to mirror the demands of the competition environment in order to sensitize them to key information such as subtle differences in an opponent’s actions or the special skills of a

team mate that they can exploit. What should be clear for practitioners, and those interested in developing talented games players, is that more attention needs to be paid to the design of practice environments as well as the functional rules of games such as pitch or court size, ball dimensions, racket sizes and so on. While some sports have begun to address such issues and some research is emerging that looks at scaling in junior sport (see Buszard, Reid, Masters, & Farrow, 2016, to see how little research is out there), there is still much to be done.

The relational properties created by games rules and young games players have been captured in research using GCAs. For example, Rovegno, Nevett, and Babiarz (2001), stressed the importance of situating learning in the game, not only to learn off-the-ball movement skills, but also to learn the tactics that go alongside skills such as throwing and catching. Rovegno and colleagues highlighted the interdependence of motor skill execution and decision-making as well as the relational character of games. From the earlier discussion of affordances, what should be clear here is that the mutuality with the environment, and the interdependence between skill' execution, decision-making and social relations determines the players' success (MacPhail, Kirk, & Griffin, 2008). Tactics and motor skill execution cannot be separated as the action capabilities of individuals will shape how they attempt to play games to the best of their ability. Knowing how far you can throw a pass or how far away to stand to receive one requires exploration during games to learn to attune to key information sources such as the opportunities provided by the movements and action capabilities of team mates and or opponents.

When the environment in which you live determines the abilities that you are able to develop, the role of the 'practitioner' who is aiming to develop talent for later, is to design learning environments that will enable the development of abilities that will not only be useful now, but will be effective when those players reach the top of the pyramid. Of course, this does not mean that all coaches need to do is provide environments that relationally mimic elite level sport per se. A key skill of top level coaches is about educating the attention of the learner to enable them to selectively pick up some aspects of the environment while ignoring others (Rietveld & Kiverstein, 2014). This means selectively introducing the novice to the 'right' aspects of the environment and their affordances (Rietveld & Kiverstein, 2014) at any 'one moment in time'. In this way, the learner is directed towards a specific affordance and is therefore able to determine the possibilities for action in the game environment. Knowing what information

to guide learners towards is clearly a skilled ability on the part of the coach and how to decide what aspects of the environment to direct the learner towards requires the coach to understand the game and the current abilities of those playing it. A ‘failure to get the game right’ (Harvey, 2009) can result in negative transfer between game-situated practices and match play. Getting it right may not be easy and requires the teacher or coach to develop a sophisticated awareness of the affordances available in the environment for the novice performer to exploit. The role of the coach is therefore about understanding the individual-environment synergy and in line with the principles of a GCA, match task demands to the intrinsic dynamics of those playing the game.

As a brief aside, it should be clear from the preceding section that the abilities of PE teachers and coaches are also a product of their biographies as a receiver and provider of teaching or coaching. Consequently, for those of us interested in promoting ‘new’ ideas such as GCAs or the CLA it is important for PE teacher and coach educators to know the backgrounds of novice practitioners in order to understand the range of coaching abilities with which they arrive. For example, a practitioner brought up on drill based approaches may lack the game observational skills to work out the key rate limiters in young players’ current performance levels. Knowing the backgrounds of novice practitioners is also important given that affordances have a socio-cultural context (i.e. there is a cultural expectation of what teaching and coaching looks like as well as how players are expected to act in sporting environments (Zevenbergen, Edwards, & Skinner, 2002). This notion indicates that the everyday coaching environment offers a range of more or less inviting affordances (Withagen, de Poel, Araújo, & Pepping, 2012) and the skilled intentionality of practitioners is related to that individual’s openness and responsiveness to the landscape of available affordances (Kiverstein & Rietveld, 2015). Consequently, practitioners will interact with a surrounding environment through their perception of what the affordances that a specific environment offers them, because of their unique skill set. From this viewpoint, those individuals working to change thinking in games teaching and coaching need to be aware of the potential for functional fixedness (e.g. seeing limited ways of using an available affordance) and hence resistance to new ways of delivering games education.

2. LEARNING DESIGN FOR INTRA-INDIVIDUAL-ENVIRONMENT COORDINATION

While PE has always formed part of the school curriculum, it is only relatively recently that formalised coaching programmes have emerged for children, with start ages getting younger and younger. For example, in Australia some programmes are targeting children as young as 4 years old. While sports organisations often provide junior clubs with well thought out coaching manuals, the actual delivery of sessions is largely undertaken by the parents of the children taking part. While the fabric of junior sport would breakdown without these commendable volunteers, a major challenge is their lack of knowledge of how to coach and how children learn.

Consequently, a tour of junior clubs on a weeknight can be met by the depressing sight of queues of children waiting in line to take a shot at a goal or hoop, or for the coach to hit, kick or pass a ball to them. Another common observation is two static lines of children passing back and forward to each other. An interesting comparison is to consider this coaching approach to the earlier ways that children learned sports, namely through informal play via backyard games with parents, siblings and friends, or even on their own. This less formal way of learning had many benefits and included significant hours playing (or practicing?) the chosen sport.

The importance of these early experiences is captured perfectly in the story of cricket legend Don Bradman's childhood. Famously, Bradman honed his hand-eye co-ordination by constantly hitting a golf ball with a cricket stump against a round water tank at the side of his house. Not only did the hours of challenging practice enable Bradman to develop superb hand-eye co-ordination it also led to the emergence of his unique technique, which many have suggested underpinned his great success (Glazier, Davids, Renshaw, & Button, 2005). When considering learning experiences such as Bradman's it could be viewed that the young Bradman was undertaking significant and boring blocked practice by simply repeating the same thing over and over. However, a key feature of his practice was the variability in the way the golf ball rebounded from the tank, meaning that he constantly had to make adjustments in his co-ordination patterns to successfully hit the ball. Bradman was essentially following the principles of repetition without repetition (Chow et al, 2016).

While previous work focusing on the CLA has emphasised the importance of ensuring practice is representative of performance environments, we would also add that the key focus of the CLA is matching

the task to the current needs of the individual. For example, we posit here that rather than being asked to play team games before they are ready and have the requisite action capabilities, a better approach would be to provide significant amounts of individual or 1 with 1 or 1 v 1 practice to enable the development of ballpark co-ordination patterns as the primary goal (Chow et al., 2016). To that end, solitary practices indulged in by children for generations such as hitting or kicking balls against walls, throwing or shooting balls at targets are valuable learning activities to support games play. Some might argue that constantly repeating the same task over and over when playing such games would lead to children being bored and is no different to doing drills. However, taking such a view would be to fail to consider that the child is choosing to complete the task rather than being forced to do it.

Autonomy is a powerful force underpinning effort and engagement and is crucial to developing intrinsic motivation – see Renshaw, Oldham, & Bawden (2012) for a more extensive discussion of how NLP and Self-Determination Theory (Deci & Ryan, 2000) may be a good fit for meeting basic psychological and skill learning needs–. An additional, positive consequence of the child being in charge is that they will decide if, when, and how to change the difficulty of the task to match their emergent abilities. For example, once a young female basketball player can score easily from underneath the basket, she may move her shooting position back or perhaps move off to the side. Alternately, she may choose to shoot with her weaker hand. Individual practice is therefore shaped by the proactive engagement of the learner who can choose when and how to manipulate individual, task, or environmental constraints (Renshaw et al., 2012).

These ideas can provide some useful pointers for practitioners working with young games players. Despite the challenges of working with greater numbers than typically seen in backyard games, practice environments can still be designed to focus on intra-individual skills by basing the design on the CLA and matching tasks to individual abilities. We will illustrate this idea by considering practice tasks designed to help young footballers to learn to travel with the ball.

To start the session, players will engage in a warm-up game where they have to travel with a ball to go through 2 m gates placed on the circumference of three different size circles (15 m, 10 m, 5 m diameters) connected by two bridges. Players stand outside the circles and choose where to enter. Their task is to travel through each circle and return to their start position as quickly as possible. By giving players this broad task

instruction in line with the principles of the CLA where the player is told what to do, not how to do it (Chow et al., 2016), the player attempts to 'solve the problem' in a way that meets their current ability levels. While there are no direct opponents (i.e., who can take the ball from them or knock it away), each player is challenged to get back to their base as soon as possible. Once the first person is back to their base, the coach will begin to count out loud to tell each player how many seconds later they finished. This enables the start to be staggered on the second attempt in an attempt to create a handicap 'race' where all players finish at the same time. One further trial is undertaken with further refinement of timing.

The design of this task follows the principles of the CLA and in particular aims to develop perception-action skills that would be used in 'real' games. For example, by requiring players to travel with the ball in a dynamic environment they have to raise their heads in order to navigate around other players. This task creates emergent actions as players must search for space, or perhaps stop the ball or swerve to change direction quickly to avoid another player. Using three different size circles is a deliberate manipulation of time and space with the aim of inviting players to develop different perception-action couplings appropriate to keeping the ball in more or less congested spaces. Players therefore develop their own ways of managing these environments through exploration and searching for functional solutions. Between each attempt, practitioners may choose to share knowledge by asking players what strategies they used in each situation and what worked best for them, encouraging other players to try some of these strategies in their next attempt.

The design of the CLA session also attempts to meet the basic psychological needs of individual players as it provides autonomy by allowing them to solve the problem in their own way, matches task difficulty to current competency level (by handicapping the task) and encourages sharing between individuals in terms of how to improve (Renshaw et al., 2012).

Of course, playing alone has its limitations and many of the early sporting experiences of young children are also with parents, siblings or friends. Common to these games is the low numbers involved as games are often 1 v 1 or 1 with 1 or informal SSG. In the next section, we focus on how playing informal games or games designed on the principles of the CLA can provide the necessary grounding for future expert performance.

3. LEARNING DESIGN FOR INTER-INDIVIDUAL-ENVIRONMENT COORDINATION

In contrast to the early specialization talent pathway programmes experienced by today's young players across the world, informal games have been the traditional breeding ground of future champions. Games such as “pelada” (street football) in Brazil, pick-up basketball games in New York (see <http://doinitinthepark.com/film> for an excellent documentary on the subject) and backyard cricket in Australia (see Cannane, 2009) as well as enabling young people to have fun have also provided many champions. The hours that young games players spend engaged in such pursuits demonstrates their inherent capacity to create intrinsic motivation by meeting the psychological needs of children (Deci & Ryan, 2000). While these environments are fun, it is not to say there is a lack of competitiveness seen in the games. Indeed, in street basketball and “pelada” there are highly structured socio-cultural constraints that impact on even getting a start in such games. For example, in the pick-up basketball games of New York and “pelada” in Brazil, when there are more players available than required, players must wait their turn to get on court. Once a game has finished the winning team stays on and ‘next on’ is determined by the best waiting player who chooses who he wants on his team. Consequently, as the winning team in the next game stays on, the obvious choice will be to pick the next best four players. This meritocracy has some important consequences for any player who is not picked and attaches personal value in wanting to play in the game. Effectively, the only way to get on court is to get better and the onus is on ambitious players to go away and do this in their own time.

The competitiveness seen in many informal games is neatly captured by current Australian cricket selector and former Head Coach of the Australian Cricket Centre of Excellence, Greg Chappell, who reflected on the importance of the backyard games he had with his brothers, both of who went onto become international players. As Greg notes, after playing backyard cricket against his older brother (Ian), the mental demands of Test cricket were ‘a breeze’ (Cannane, 2009). Taking part in such highly competitive ‘backyard’ games prior to playing formalised games provides an environment ‘safe’ from adult scrutiny and provides the conditions that result in the development of often unique skills, requisite mental toughness and the physical conditioning underpinning later expertise (Cannane, 2009; Cooper, 2010; Renshaw & Chappell, 2010).

A key advantage of game play lacking an overt organizer, as in formal coaching settings, is that it maximises the time actually spent 'doing' as well as allowing the learner to make decisions about what to do and how to do it. Perhaps this is a key factor, as the absence of well-meaning adults who want to tell young players what to do and how to do it means that children can try things and make mistakes without having to face the demoralization of fronting disappointed parents.

Coaching team games is obviously more complex than coaching in a 1 v 0, or 1 v 1 game and requires a deep knowledge of the game and the theoretical principles that underpin the emergent dynamic self-organisation that occurs within the game. In this section we will discuss these ideas and make some suggestions to help novice practitioners to implement the CLA in their sessions.

When observing game play in order to teach or coach players, the practitioner needs to consider the emergent behaviours of individuals in the context of the multiple dynamic individual learner-environment interactions taking place within the complexities of a team game (Chow, Renshaw, Button, Davids, & Wee Keat, 2013). These individual responses are a consequence of the complex interactions of the individual learner's intrinsic dynamics (e. g., perceptual attunement to free team mates, passing skill or kicking range), the environmental constraints (e. g., the pitch surface or weather as well as the context of the game as being part of a practice session or lesson or a competition game) and the task constraints (e. g., game rules), within the game context (Chow & Atencio 2014; Chow, Davids, Hristovski, Araújo, & Passos, 2011; Chow et al., 2013; Renshaw et al. 2010). For example, in a football game an attacking player's passing response to an open teammate 30 metres downfield is a consequence of the complex interaction of the individual player's kicking ability, the presence of any strong head wind, and the context of the game (e.g. behind by 1 goal with 1 minute to play).

Team games are complex adaptive dynamical systems made up of a number of interacting sub-systems that can abruptly change (Davids, Glazier, Araujo, & Bartlett, 2003). Behaviour emerges as spontaneous patterns are formed from the interactions of individual players within the team game (Kauffman, 1993). Individual players within a team function as part of this larger system co-adapting their actions to the actions of teammates and opposition players (Kauffman, 1993; Passos & Davids, 2015). For example, in a soccer game the actions of the player with the ball, their teammates, and opposition players are systematically linked to each

other, that is, when a player starts dribbling, teammates may respond by moving into space to receive the ball and opponents may pressure the dribbling player. These co-adaptive and regulated interactions result in ongoing information that is emergent, necessitating emergent interactions in response.

Further complicating game play prediction and enabling practitioners to make interventions that will enhance learning is that, from an ecological dynamics perspective, a player's behaviour is attuned to their own action capabilities and those of their teammates and opponents, making affordances subjective to the individual (Fajen, Riley, & Turvey 2009). Different opponents and teammates afford different movement possibilities and different game play patterns emerge when challenged to play with and against different opponents. For example, if a player has the capability to dribble quickly and skilfully between two defenders, the gap between defenders acts as an affordance for action. However, if the player in possession knows that one of the defenders is also quick and a skilful defender, attacking the gap (i.e., affordance) may be considered, but not executed.

To better understand and interpret players' responses a coach needs to be able to perceive these affordances from the perspective of the players rather than their own (Fajen, Riley, & Turvey 2009). Given the complexities of 'full number' games with multiple affordances, it is suggested that coaches' or teachers' initial experiences implementing a CLA or GCA approach use SSGs no bigger than 4 v 4. The relatively lower level of complexity should enable coaches to identify the key rate limiters of teams and implement constraints in games as required. For example, one typical challenge for young players is one of creating space as a team by using the principles of width and depth in their play. Coaches could therefore manipulate task constraints by requiring the ball to go through a channel out wide before a team can score. However, it is important that task constraints such as these are not designed into the session for too long as this could lead to over constrained actions by players who may fail to become attuned to other functional affordances with the landscape available during games. For example, forcing players to go wide may stop them looking for an opportunity to play a more penetrative pass to a free team mate up the centre of the field.

4. SUMMARY AND CONCLUSIONS

In summary, in this paper we have suggested that a key limitation for adoption of GCAs is the biographies of practitioners who have developed abilities shaped by the landscape of traditional views of PE teaching and coaching. We have considered why this is a potential issue for young games players who are being denied significant opportunities to develop the abilities needed in 'real' games by practice that has not incorporated the affordances available in games. In our discussion of ecological dynamics as a suitable framework for underpinning GCAs, we particularly focused on the importance of considering the mutuality of the individual and the environment when designing environments for learning to play games. This founding principle of ecological dynamics provides the framework on which to scaffold the implementation of a CLA to developing talented players with the adaptability to succeed in games.

We also highlighted how the key ideas of backyard games fits well with the principles of the CLA and can help practitioners design learning environments that are focused on individual learning needs as well as meeting the basic psychological needs of young players. Most importantly, learning in 'formal' CLA based sessions in line with these fun backyard environments can create the conditions that lead to a lifelong love of games. Through this 'romance' with games (see Bloom, 1985) players develop the intrinsic motivation needed to underpin the significant amounts of play and practice necessary to develop high level performance skills (Renshaw & Chappell, 2010). Backyard games have far more to offer than just fun and maybe there are some key take home messages about their 'success' that those responsible for designing junior sports programmes could take on board. Young players are constantly told they must 'work' hard if they want to achieve their goals. However, we would urge caution in the use of such language. The use of the term 'work' may subliminally be sending messages to young players that high achievement can only be attained through engagement in years of drudgery, of boring repetitive training to perfect skills. In contrast, think of the messages sent to players if they were told they can play and have fun on their way to success!

To conclude, we suggest that given that young people love playing games and engage voluntarily in play, administrators and coaches responsible for talent development programmes should perhaps be studying the characteristics of back yard games and incorporating them into their programmes. A key message is that there is no need to rush to play the

proper adult game and it is suggested that programmes that have an initial focus on developing intra-individual-environment co-ordination before moving onto inter-individual-environment co-ordination of team games are implemented. A key consideration in designing such games is that they are relational and representative of the landscape of affordances of the ‘final product’ (the adult game) and ensure that the abilities developed by young players will be reflective of those needed later. Finally, we suggest that administrators charged with increasing numbers would do well to look at backyard games in conjunction with the CLA; for example, who would not be happy if they created a programme that resulted in young players ‘playing’ all day in attempts to ‘get better’ without realizing they were ‘working hard’. Maybe, sport organisations could benefit from a visit back to the future?

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