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TEACHING GAMES FOR UNDERSTANDING CONFERENCE SUPPLEMNET FROM THE
GERMAN SPORT UNIVERSITY

Just Play It—“Innovative, International Approaches to Games”

6th International Teaching Games for Understanding Conference (TGfU) Meets the 10th
German Sports Games Symposium of the German Association of Sport Science (DVS)
July 25–27, 2016, at the German Sport University in Cologne

Organized by the Institute of Cognitive and Team/Racket Sport Research

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The Institute of Cognitive and Team/Racket Sport Research team warmly welcomes the international sports games community to the 10th Sportspiel Symposium by the German Association for Sport Science (DVS) in combination with the 6th International Teaching Games for Understanding (TGfU) Conference at the German Sport University Cologne (DSHS).

Together with the German Research Community, the Federal Institute of Sport Science, the North Rhine-Westphalia (NRW) Ministry, and prominent national sports game federations (German Football Association [DFB], German Handball Federation [DHaB], German Field-Hockey Federation [DHoB], German Basketball Federation [DBB], German Volleyball Association [DVV], and German Table Tennis Association [DTTB]), we are very pleased to organize the TGfU Conference for the first time in Germany in the city of Cologne—after being held in New Hampshire (United States), Melbourne (Australia), Hong Kong (China), Vancouver (British Columbia, Canada), and Loughborough (United Kingdom). Furthermore, it is a great honor to host the DVS Sportspiel Symposium, which was held here in 2004, for the second time at the DSHS. We would like to express our sincere gratitude for the trust of the TGfU Special Interest Group (SIG), to all members of the SIG Executive, and to the DVS Commission sports games.

By bringing together the national German sports game community and an international scientific community in a joint conference held between the European Football Championship in France and the Summer Olympic Games in Brazil, we hope to foster the interdisciplinary discussion of team and racket sports in the fields of sport pedagogy, sport didactics, sport psychology, computer science, human movement science, and training science. The conference aims to cover the entire spectrum of sports sciences through the Plenary Opening Lecture, three keynote speakers, nine invited talks, invited papers, practical workshops, coaching clinics, oral presentations, and poster presentations. We particularly want to thank the scientific advisory board, with its 41 members from all over the world, for helping to establish the overarching conference themes and scrutinizing the quality of submitted contributions.

The conference theme “just play it—innovative, international approaches to games” is not only addressed to national and international scientists, but also explicitly to coaches, teachers, and practitioners. In this respect, the conference will provide an ideal opportunity to exchange information, expand existing cooperation, and inspire future collaboration. We are delighted to offer a platform for this international and interdisciplinary exchange, which unquestionably characterizes this conference.
Simone de Beauvoir (1953, p. 66) has famously said that “the body is not a thing, it is a situation.” She thus contradicts the distinction drawn by Descartes between the body and the mind—a division that has haunted the physical education curriculum for many years, as many physical educators have attempted to educate the body, rather than educate the human being through the body. In this presentation, I suggest that the space opened up by de Beauvoir’s distinction is the space in which teaching games for understanding (TGfU) was born and still exists. It is a distinction that aligns our teaching, our philosophical stances, our research, and our governance.

To see the body as a “thing or vessel” that exists for and by itself implies that it can (and must be) “schooled” through individualistic skills-based approaches to teaching and learning. Traditionally, these approaches have involved students being taught skills through teacher-directed side-by-side or serial drills. Along with many other TGfU commentators and educators, I have drawn attention to the dangers and limitations of these approaches, which ignore important components of learning, including transfer, tactical understanding, problem solving, and social and ethical learning. To see the body as a “situation,” on the other hand, honors and explores the ways in which students connect to other bodies and to the sociopolitical context in which they live and breathe, as it engages them in collective learning in context. Thus, the intentions, beliefs, and actions of teachers look very different as they implement the TGfU approach within a worldview I have described as ecological complexity.

As Parker Palmer (2007) suggested, this philosophical orientation determines who we are when we teach. When we facilitate TGfU learning experiences effectively, we naturally become focused on emergent learning and can be described as emergent learning-focused teachers. Such educators understand that their work takes place in contexts and intersections that include the group, the team, the class, the school, and the community. They are interested in learning that is sustainable and serves the interests and needs of all these different bodies. When teachers situate themselves in this way, their entire pedagogy will tend to flow in a certain direction when it comes to such issues as authority, decision making, and knowledge sharing. They become part of a dynamic and sustainable system of learning that aligns itself with other educational initiatives that seek to accommodate and encourage new democratic forms of participation (The New London Group, 1996).

As I trace and discuss the history of TGfU during the last 30 years, I will also suggest that the orientation of ecological complexity has influenced and guided the development of its etymology and governance, so that its organizational and political structures have emerged looking somewhat different from the hierarchical governance structures more typical of traditional educational organizations. TGfU has always been and still is a grassroots organization (somewhat akin to social movements such as Occupy) as it has gained ground with practitioners and theorists alike through small conferences, town hall meetings, informal networks, and new media sites. Its activities have been organized through flexible and adaptive communities of practice such as the TGfU Task Force, the Association Internationale des Écoles Supérieures d’Éducation Physique TGfU Special Interest Group, and its International Advisory Board. It has also learned from and emphasized local initiatives throughout the globe and drawn them together in a dynamic community of practice that has paid attention both to theoretical investigation and practical implementations. In this way, TGfU has reflected new forms of decentralized organization, composed of individuals who may not be from the same countries or institutions but nonetheless come together as a virtual community.

To survive and stay robust, such grassroots decentralized communities must remain flexible and adaptive as they attend to changing circumstances. They do so by reflecting the collective voice, responding to accepting emergent ideas and new directions, and
paying attention to the sociopolitical contexts in which learning occurs.

As TGfU advocates have espoused constructive learning theories, so have they attempted to close the gap between practice and theory as the movement has reached out to practitioners and theorists alike. This kind of inclusivity bodes well for continued research alliances between researchers and practitioners as TGfU continues to develop. Here I will draw upon Memmert et al.'s (2015) meta-analysis of current research and future research directions.

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Alan Launder (2001) posed the question, “Is teaching games for understanding (TGfU) a model only test pilots can fly?” in the first edition of his book Play Practice. His question, in part, reflected the widespread view that some 20 years after the introduction of TGfU to the physical education teaching and sports coaching communities, this approach to games was still regarded as something of a novelty, as a radical departure from so-called “traditional” methods of teaching and learning in games. The question also held a possible explanation for this situation, which was that TGfU is too complex and demanding for “ordinary” teachers and coaches. This explanation was one for which Launder himself had some sympathy.

As I will elaborate on in the first part of this talk, this explanation continues to be used by scholars puzzled by the apparent reluctance of teachers and coaches to fully embrace TGfU. I will cite a range of studies published since 2001—for example, Butler (2005), Diaz-Cueto, Hernández-Álvarez, and Castejón (2010), Evans and Light (2007), Harvey, Cushion, and Sammon (2015), Harvey and Jarrett (2014), and O’Leary (2015)—that report on a lack of progress with the use of TGfU among preservice and experienced teachers and among participation and professional sports coaches. These authors and others offer a range of explanations, in addition to the complexity and demanding features of TGfU, for the continuation of this situation for more than 30 years, despite its merits as an approach, which Butler (2005, p. 226) claims with some exasperation “seem blindingly obvious to its proponents.”

I will show that many of these authors have important and helpful things to say about how teacher and coach development might progress within game-centered approaches. I will also argue, however, that few of these studies identify the sources of the impediment to the more widespread use of TGfU and related approaches, and as such, some of their valuable recommendations will be bound to fail because they cannot address and resolve the root causes of the problems in games teaching and learning.

In the second part of the talk, I build on my analysis set out in the book Physical Education Futures (Kirk, 2010a) to argue for a different explanation for the 30-odd-year conundrum of TGfU in physical education and sport. The crux of my argument is that there are different explanations for the lack of progress of TGfU in physical education teaching compared with sports coaching. Although both activities are ostensibly pedagogical practices, it is a mistake to assume that they also share the same explanation for the apparent preference for traditional pedagogies over TGfU.

The case of physical education teaching is the main focus of Physical Education Futures (PEF; Kirk, 2010a) and is possibly more complex. In the book, I use Rovegno’s (1995) concepts of the molecularization of learning and the hegemony of biomechanics to reveal in detail the dominant form of physical education in schools, which I call “physical education as sports techniques.” I revisit these concepts here to show what the so-called traditional approach to physical education looks like in practice, which is the approach TGfU ostensibly seeks to replace and is thus often portrayed in the literature as the antithesis of TGfU. This traditional practice is what TGfU is not. I point out that many scholars in physical education have taken this sports technique-based approach seriously, as a valid (if flawed) pedagogical practice.

I will argue here that this misconception has led to lines of research that compare traditional sports technique-based approaches to TGfU. I argued in a keynote talk I gave to the first TGfU conference held in New Hampshire in 2001 (Kirk, 2001, 2005) that such comparative studies should cease because they sought to compare two approaches to games that had fundamentally different purposes. In PEF, I explained in historical detail why I made this call. The so-called traditional approach to physical education is not practiced today because it is a valid and effective pedagogical practice. In its own terms, it has been shown by any number of empirical studies to be an ineffective pedagogy (e.g., Van Der Mars, 2006). The practice has survived nonetheless.

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from its historical roots in a gymnastics-based form of physical education because it is effective for single teachers working with classes of up to 30 or more pupils who have a wide range of abilities in and motivation for physical education. The so-called traditional approach is centrally concerned, as was its gymnastics/drilling and exercising predecessor, with the social regulation of children’s bodies in time and space. In short, it is primarily a practice of social control required by the school as an institution—what Lawson (2009) dubbed “the industrial-age school.” In the talk, I provide more evidence for this claim and its consequences for the professional development of teachers within TGfU.

I propose that the institutional context for sports coaching is quite different and swings around two axes of professional and participation coaches, and those who have an adequate level of education as a coach and those who draw primarily on their own experience as former players. Here the issue is about pedagogy, and the argument for retaining traditional practices that resemble molecularization have, in my view, no defense whatsoever on pedagogical grounds (see Kirk, 2010b). In the talk, I again elaborate on the evidence for this claim and consequences for coach professional development in TGfU.

I will argue, in summary, that it is not only test pilots who can fly TGfU. But “ordinary” teachers and coaches never will use TGfU in great numbers until we identify and then tackle the different root sources that impede its progress as a games pedagogy.

References


Using Technology to Evaluate Game Play for Beginners and Proficient Players That Encompasses Game-Play Evaluation

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Teaching games for understanding (TGfU) is a learner-centered approach involving problem solving, decision making, and tactical development (Bunker & Thorpe, 1982; Thorpe, Bunker, & Almond, 1986). This approach promotes skill development in a realistic and enjoyable context that has benefits for motivation and sports participation (Strean & Holt, 2000). A further benefit is that skill development progresses at a pace that is manageable for the learners (Pill, 2006). There are a number of variations of TGfU (Almond, 2015; Holt, Strean, & Bengoechea, 2002), but the general approach is recognized as a cycle of six main stages that address the game, game appreciation, tactical awareness, decision making, skill execution, and performance. The purpose of Holt et al.’s (2002) study was to consider the affective domain within TGfU, which had already incorporated the cognitive and psychomotor domains of learning. Research into TGfU has considered instructional environments and the tactical and technical development of learners (Memmert et al., 2015). However, Memmert et al. (2015) also recognized that the integration of state-of-the-art technology into game-play evaluation still needed to be described. Therefore, the purpose of the current presentation is to review feedback technologies that are relevant to TGfU and to discuss their relevance within the different feedback mechanisms utilized within TGfU.

Magill (1995) classified feedback in two broad classes: sensory and augmented feedback. Within TGfU, learners will receive sensory feedback through their participation in games. Augmented feedback is provided within coaching processes and includes knowledge of results and knowledge of performance. There are examples of augmented feedback used in the assessment of performers in TGfU such as the Game Performance Assessment Instrument (Mitchell, Oslin, & Griffin, 2003) and the Team Performance Assessment Procedure (Gréhaigne, Godbout, & Bouthier, 1997). The type of data recorded includes tallies of events as well as subjective judgements about quality of skill execution of skills. These techniques are the same as those used within the area of notational analysis (Hughes & Franks, 1997), which has now grown into performance analysis of sport and exploited advances in information technology (Liebermann, McClements, Katz, Franks, & Hughes, 2002).

TGfU is a learner-centered approach with the flexibility to address the needs of learners at differing stages of development in different game types who learn in different ways. Therefore, the use of feedback technology within TGfU must be optimal to allow for the benefits of sensory feedback through game play and augmented feedback including knowledge of performance, outcome statistics, and supporting video sequences. Kinematic motion analysis systems can be used to monitor technique development (Leser & Roemer, 2015). General-purpose game analysis systems can be tailored to analyze relevant aspects of games and therefore allow for interactive video sequence feedback as well as real-time feedback possibilities supported by wireless technology and portable devices (O’Donoghue, 2015). The cost, portability, and usability of technology are important factors in the selection of technology to use in TGfU. At elite levels of sport, ubiquitous computing, voice input, and special purpose game systems have the potential to support technique and tactical development (O’Donoghue, 2015).

Performance profiles are an important tool for identifying areas where learners need to improve (Almond, 2015). Profiles give content validity to performance assessments and are collections of performance indicators that together represent all important aspects of attacking and defending play.

Whatever technologies are used within TGfU, they must be appropriate for the learners, teachers, and training context, with motivational impact as well as summative and formative feedback (Wiemeyer & Mueller, 2015). The technologies that can enhance learning include virtual reality, multimedia, simulation, and animation (Wiemeyer & Mueller, 2015).

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Teaching Games for Understanding and the Psychology of Intuition

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One of the top research questions that have been identified in relation to teaching games for understanding (TGfU) pertains to possible contributions by scientific psychology. In principle, this comprises knowledge about basic psychological concepts, such as perception, anticipation, learning, memory, motivation, and more complex processes, such as problem solving, self-regulation, or group dynamics. The present keynote will focus on aspects of judgment and decision making and the role of intuition in these processes, respectively.

Expertise and creativity in decision making have been acknowledged as core factors that separate the best game performers from those who are behind. The psychology of judgments and decision making in sport and exercise has been omnipresent in many current debates in sport science disciplines, such as talent development and selection, but also in regard to refereeing, choices about where to host events, how to respond to doping or match fixing, and many more areas, such as physical education in general (e.g., Raab, 2007).

Due to the nature of most game sports, athletes’ decision making has to be carried out in a highly dynamic, time-pressured environment. Therefore, it is not surprising that their decision making has been frequently associated with certain attributes, such as automatic, implicit, affective, and nonanalytic, which many authors relate to the term intuition (cf. Evans & Stanovich, 2013).

So far, however, intuitive decision making in game sports has been mainly considered from the perspective of the so-called adaptive toolbox approach (Gigerenzer, Todd, & the ABC Research Group, 1999; Raab & Gigerenzer, 2015). According to this approach, experts learn to rely on fast and frugal heuristics in an adaptive way to make accurate decisions. For example, it has been proposed that experienced players use a “take-the-first” heuristic (i.e., when confronted with a tactical decision situation, such as where to pass the ball in handball, they tend to choose the first option that comes to mind, which is mostly better than any other option generated subsequently; Johnson & Raab, 2003). On the other hand, less skillful players commonly generate more options and in most cases do not pick any of the first options generated.

In contrast to the adaptive toolbox approach, so-called multiple-cue approaches to judgment and decision making generally highlight people’s ability to make decisions by assessing multiple features of the decision-making situation. According to these approaches, the ability to process multiple cues in a parallel fashion and to draw valid conclusions even under time pressure can be considered an important factor of a decision makers’ expertise. Consequently, the value of multiple-cue approaches for understanding expert performance in sport has been recognized as well (e.g., Araújo, Davids, & Hristovski, 2006; Plessner, Schweizer, Brand, & O’Hare, 2009).

Given the great variety of proposed processes that are termed intuitive in the domain of judgment and decision making (for an overview, see Plessner, Betsch, & Betsch, 2008), several authors have argued that this diversity should be acknowledged instead of focusing only on one process, such as single-cue heuristics, or generalizing across different approaches. For example, Betsch and Roth (in press) presented a categorization system for intuitive processes that cross-tabulates the size of the information sample and the centrality of used information. This system results in four feature combinations—describing four types of intuitive judgment and decision-making processes. All can bear specific benefits under certain circumstances. Consequently, Phillips, Fletcher, Marks, and Hine (2015) argued that educators should carefully consider both individual differences in the decision maker and the nature of the decision task when advising a certain decision style. This reasoning is in line with other psychological approaches to game sports that emphasize the fit between individual preferences and situational constructions (e.g., activated via instruction) as a basis for top performance, such as regulatory focus theory (Plessner, Unkelbach, Memmert, Baltes, & Kolb, 2009).

The present talk concludes with a discussion of the differentiation between several intuitive decision styles as a general framework for understanding the development of intuitive decision making in game sports and as a basis for its improvement (cf. Hogarth, 2001).
References


Capturing the Complexity of Team Synergies to Provide a Better Practice

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Performance of expert teams is distinguished from lower-skill team performance by achievement of high levels of task outcomes, with effective and adaptive interactions between team members. Team performance analysis has gained prominence in the last decade. One variant, notational analysis, has been used to objectively audit the behaviors of performers during different subphases of play and has provided additional information to practitioners to improve future sports performance. Recently, there have been criticisms of these methods that have argued the need for a sound theoretical rationale to explain performance behaviors rather than simply document outcomes (Vilar, Araújo, Davids, & Button, 2012).

In complex social neurobiological systems, self-organization is the fundamental principle acting to bring order among the parts (Davids, Button, Araújo, Renshaw, & Hristovski, 2006). Ecological dynamics analyses of team sports have attempted to explain how the interaction between players and information from the performance environment constrains the emergence of patterns of stability and variability and the transitions in organizational states of such systems—precisely what sport scientists and coaches need to understand in analysis of team game performance (Araújo, Silva, & Davids, 2015).

The emergent coordination patterns in team sports are channeled by the surrounding constraints, as they structure the state space of all possible configurations available to the team game as a complex system (Davids, Araújo, & Shuttleworth, 2005). The interaction between constraints of the performance environment and each individual’s characteristics allows opportunities for action to emerge (Araújo et al., 2015). For example, an opportunity to score a goal in football may emerge between the performer’s ability to shoot the ball (individual constraints) and the distance to the goal or to the goalkeeper (task constraints). In this way, successful performance in sport is grounded in the performer’s ability to attend to the relevant informational variables that are needed to regulate their decisions and actions (Hristovski, Davids, Araújo, & Button, 2006). By perceiving opportunities for others to act, performers make use of environmental information to coordinate their actions with others. This process enables players to act synergistically with respect to specific team task goals (Travassos, Araújo, Duarte, & McGarry, 2012). By means of tracked positional data, recent studies have started to reveal how players and teams continuously interact during competition. For example, Sampaio and Macias (2012) found specific expertise effects. They argued that because playing football demands that players constantly adjust their positions on the pitch, according to the game ebb and flow, a more effective team coordination was expressed by the fact that the most powerful variable in distinguishing pretest and posttest conditions was the distance of players from the team geometric center. As was expected, interplayer coordination in pretest seems to reflect individual affordances, and not shared affordances among team players. However, posttest values showed that players became more coordinated with increased expertise. The coordination patterns showed compensatory behavior within the team, an essential characteristic of a synergy (Riley, Richardson, Shockley, & Ramenzoni, 2011).

Specific constraints like the players’ individual characteristics, strategy, and coaching may impact the functional and goal-directed synergies formed by players during performance. These informational constraints shape shared affordances available for players, which are viewed as crucial for the assembly of synergies and support the reduction in the number of independent degrees of freedom and enable fast, regulating actions. Another feature of a synergy is the ability of one of its components (e.g., a player) to lead changes in others (Riley et al., 2011). Thus, the decisions and actions of the players forming a synergy should not be viewed as independent. Synergies’ properties can be used to inform the meaning of variables like team center, team dispersion, and the like. These team variables have revealed that effective teams tend to be tightly synchronized in their movements when they are successful. Developments in methods of analysis of expert team performance can benefit from a theoretical approach that situates and traces relevant team processes. Here we suggest ecological dynamics as an alternative to more conventional operational methods of performance.
analysis that merely document performance statistics. Then ecological dynamics can guide the design of representative practice tasks where the evolution of the synergistic properties of team performance could be monitored.

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**References**


Student Learning Outcome and Teachers’ Autonomy Support Toward Teaching Games for Understanding Through Adopting Accessible Technology and Alternative Sport Equipment: An Asian Experience

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In Hong Kong, physical education (PE) is one of the eight key learning areas of the Education Bureau (2013; Education Department, 2002). Accordingly, the PE curriculum and classes should be designed to motivate students to participate in physical activity (PA) regularly, and emphasize a student-centered constructivist approach. Nonetheless, the content-based, teacher-centered approach emphasizing skill learning and improvement is still used predominantly in most Hong Kong schools. Ha and her colleagues (Ha, Macdonald, & Pang, 2010; Ha, Wang, & Collins, 2014; Ha, Wong, Sum, & Chan, 2008; Wang & Ha, 2013) consistently observed that Hong Kong teachers are weak in terms of acknowledging or adopting the learner’s point of view. Moreover, even when teachers’ beliefs slanted toward a newer approach, these did not appear to translate into methods related to more student-centered learning approaches, such as teaching games for understanding (TGfU) in PE. Therefore, research evidence concerning the effectiveness of TGfU-based interventions (Butler & Griffin, 2010; Memmert et al., 2015) designed to enhance the competence of in-service teachers in nurturing the students’ positive learning experience in PE is lacking. To address this void in research, I designed and piloted a school-based intervention using TGfU, and also adopting accessible technology and alternative sport equipment.

According to tenets of self-determination theory (SDT; Ryan & Deci, 2002), students are more likely to engage and persist in activities that (a) are fun and enjoyable and/or (b) provide outcomes that are valued by the individual. Therefore, the intervention was designed with the aims of (a) facilitating the development of technical skills through available technology, (b) assessing the tactical knowledge transfer across games using alternative sport equipment, and (c) enhancing fun and enjoyment through game play and the provision of meaningful choices. Two classes of students (one boys’ class and one girls’ class) took part in the pilot study. Instead of using a traditional teacher-led format, students were shown videos of team games using iPads and were then asked to play these games. Alternative equipment (e.g., balls, frisbees) made of soft foam materials were also given as alternatives for their “real” counterparts. Students’ moderate-to-vigorous physical activity (MVPA) during the pilot study was measured using ActiGraph wGT3X-BT accelerometers. Students were also interviewed immediately after the end of the lesson to determine whether the TGfU-based games were considered interesting or enjoyable. The PE teachers of the two classes were also interviewed. They were asked to provide feedback and reflections after using a TGfU-based approach, and also to provide comments in terms of the feasibility of such teaching methods in Hong Kong schools. Results of the pilot suggested that the intervention did not negatively impact students’ MVPA. Students also reported that they enjoyed the format of the lesson. The teachers, however, noted potential gender differences in terms of the acceptance and support required.

The results of the pilot study suggested that TGfU-based teaching methods could be applied to Hong Kong schools and may increase students’ activity levels and enjoyment in PE. Nonetheless, a change toward a student-centered approach may provide challenges to both teachers and students, and therefore cultural adaptations may be required. Theory-driven professional development for in-service teachers should be applied. Vigorous experimental research designs, such as randomized controlled trials, should also be used to evaluate TGfU-based interventions in the future.

References


Understanding Games for Teaching—Reflections on Empirical Approaches Toward Game Instruction

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Physical education (PE) must include a lot of complex phenomena, such as game ability, fitness, or self-concept, which are indeed challenges for both instruction and scientific analyses. Either might become aggravated because in some countries, PE follows the idea of a physically educated person (i.e., the pedagogical aspiration to integrate qualification and personal development within PE—a didactical position that requires a concurrent consideration of both aspects in teaching and researching). This issue seems to apply in particular to team sports, because students need to be qualified to take part in the game and they need responsible personal and social behavior as well as an understanding and respect for differences among people to master the endeavors of competition and association.

In contrast to individual sport disciplines, a further dimension is added to individual learning or exercising: one’s own and an opposing team’s dimension that forms a framework for individual behavior—a fact that has been considered thoroughly in training science (Hohmann & Brack, 1983) but has been neglected to a certain extent within sport pedagogy. This leads to learning and teaching problems, because either individuals cannot please their needs and expectations of PE or teachers fail to consider such discontent in an adequate manner. As a consequence, instructional research must analyze game instruction to provide appropriate teaching tools for PE instructors, which in turn imposes requirements on instructional theory and its research methodology (Memmert et al., 2015). As a consequence, this lecture deals with reflections on methodological approaches toward games; thus, it focuses on several conference themes—in particular, teacher development and understanding games for learning.

Instructional theory and its research profile

Instructional theory represents the empirical branch of sport pedagogy and is contrasted to a normative orientated approach, describing educational aims on the basis of philosophical and educational aspects (Prohl, 2010). Within instructional theory, research on teaching in physical education (RT-PE) has become a fruitful branch of research focusing on the teaching and learning process by analyzing the “processes, social dynamics and outcomes (motor skill, attitude, knowledge and fitness) of physical education” (Silverman & Skonie, 1997, p. 301); this branch of research includes inquiry into the preactive (planning), active (execution), and post-active (reflection) phases of instruction (Silverman, 1991, p. 352). As a consequence, RT-PE works with different approaches from the social and behavioral sciences ranging from experimental quantitative studies to “pure” qualitative studies but still mainly follows an “either-or” strategy (e.g., Hemphill, Richards, Templin, & Blankenship, 2012; Marttinen, Novak, & Silverman, 2014).

This talk follows the idea that the aforementioned issues in PE can be understood at more profound levels with the use of mixed-methods approaches (Greene, 2015, p. 608). Nevertheless, a thorough observation of research in both sports science, in general, and RT-PE, in particular, only shows a gradual adoption of this paradigmatic discussion. The discussion also seems to take place in emerging subdisciplines of sports science rather than in its social and behavioral core disciplines such as sport pedagogy—a reverse development compared with other scientific fields (e.g., Tashakkori & Teddlie, 2003).

Outline of the presentation

In view of these facts, this presentation will deal with the potentials and limitations of mixed-methods research (MMR) in game instruction by building on an approach by Memmert and König (2007) that analyzed teaching-games-for-understanding programs at elementary schools from different perspectives in a multistrand study. Therefore, it first approaches research streams and methods of RT-PE by analyzing some milestone papers to illustrate the state of the art. Second, two examples of mixed-methods designs from the field of RT-PE are presented to show the added value of MMR for different epistemological interests of game instruction.
(König, 2016): Example 1 focuses RT-PE’s interest on the effects of specific syllabi and thus regularly uses experimental designs based on analysis of covariance approaches. However, this approach fails to address the interests, needs, and premises of both partners of interaction (i.e., teachers and students), which might add further complexity to the matter. Thus, this talk will show how experimental mixed-methods designs might enhance the results of monomethod approaches. Example 2 describes a second point of interest in RT-PE: students’ motor development, which requires an analysis of change over time by analyzing measurements of individuals’ data at different points of time via multilevel regression analysis. Nevertheless, it does not help to understand explanations “behind” and “between” the predictors—problems that might only be solved by using additional qualitative methods (Onwuegbuzie & Hitchcock, 2015, p. 289) giving answers to questions arising from quantitative results. Third, some key elements of MMR (e.g., timing, weighting, etc., Creswell, 2014) are examined with the aim of integrating this approach more fully into RT-PE. In a fourth step, this presentation will show how “understanding games for learner and cultural development” (Conference Theme 5) can be improved by explaining how different strands of research pursue the purpose of better teaching.

References
Building an Increased Evidence Base for Game-Centered Approaches in Professional Practice Settings

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Since the inception of the teaching-games-for-understanding model 35 years ago, there has been increased advocacy for game-centered approaches (GCAs) for the teaching of games within physical education and coaching academic programs worldwide (Harvey & Pill, 2016). Despite this increase, research evidence of its efficacy in physical education and coaching professional practice settings remains equivocal (Harvey & Pill, 2016). Consequently, in this presentation, I will investigate the ambivalent nature of GCA research and endeavor to explain the specific ways in which researchers can operationalize GCAs by addressing potential gaps in the GCA research literature. After providing a brief summary of the three recent reviews of GCAs (Harvey & Jarrett, 2014; Miller, 2015; Stolz & Pill, 2014) and the article “Top 10 Research Questions Related to Teaching Games for Understanding” (Memmert et al., 2015), I will overview the notion of evidence-based practice. Evidence-based practice is a foundational concept for any instruction or pedagogical model used to determine the efficacy of a program to enhance its utilization. Next, I will explore in more detail what evidence we need to know more about and will provide concrete and specific examples on how researchers may go about conducting research to provide a more robust evidence base and theoretical foundation for GCAs. For example, I will consider research methods and designs that can be used by researchers (and practitioners) to provide evidence for enhancing the efficacy of GCAs. In summary, the intention of this presentation is to not simply repeat messages in the three recent reviews of GCAs or the recent publication of Memmert et al. (2015), but provide ways for determining the efficacy of GCAs in professional practice settings and provide a stimulus for practitioners’ ongoing professional development.

References

Instructions in Sports From a Cognitive Information-Processing Perspective: Implications for Theory and Practice Within Teaching and Learning in Sport Games

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Within recent years, sport game learning and teaching has mainly been considered within the theoretical framework of nonlinear pedagogy, or more specifically, complexity thinking (e.g., Memmert et al., 2015). More traditional information-processing accounts of human behavior have become less popular within this field as they have been criticized for not adequately accounting for the complex dynamic nature of sport games. Within this talk, I draw on Ulric Neisser’s work (e.g., 1976), in which he advocated the combination of ecological approaches and information-processing approaches of human behavior. Neisser recognized that the goal of understanding and predicting human behavior in everyday contexts can only be achieved by pitting the conscious person against the deterministic situation (see also Mischel, 1997). In this respect, I will follow the call of Neisser by adopting dual-process theories of human behavior and will attempt to address one of the overarching themes of the conference of process theories in sports (in particular, the default-interventionist model; Furley, Schweizer, & Bertrams, 2015) and will argue that athletes’ behavior is guided by two qualitatively different modes of information processing: first, an autonomous/automatic mode in which the behavioral response of an athlete is triggered by the environmental stimulus configuration; and second, a controlled mode of behavior in which the individual deliberately controls behavior. I will review evidence from our lab showing that an athlete’s working memory plays an important role in this controlled mode of processing by controlling an athlete’s attentional focus and thereby influencing decision making (Furley & Memmert, 2012). In a series of studies, we provide evidence showing that the contents of working memory bias the allocation of attention in sport decision-making contexts, especially in more complex scenarios (Furley & Memmert, 2013). In a further series of studies, we show that verbal instructions from coaches will access the working memory of athletes and in turn influence their behavior. Importantly, certain instructions that were intended to facilitate the decision-making behavior of athletes had the ironic effect of actually harming their decision making as the instructions presumably led to an attentional narrowing effect causing open teammates to be overseen (Furley, Memmert, & Heller, 2010; Memmert & Furley, 2007). In this respect, tactical instructions can harm the creativity of game players as their attentional focus will narrow. This theorizing was confirmed in a 6-month training study by Memmert (2007) who showed that training in tactical decision making benefits from inducing a broad breadth of attention by giving fewer instructions and not rigidly practicing offensive routines.

Based on these research findings from our lab, I will describe a practical framework of how to teach tactical creativity (Memmert, 2015), which we have incorporated into our university’s curriculum for sports teachers and coaches. Within this practical framework, the “six Ds” (diversification, deliberate play, one-dimension games, deliberate coaching, deliberate motivation, and deliberate practice) will be proposed as a practical guide for assisting coaches and teachers in enhancing (creative) tactical behavior within team and racket sports.

References


Analyzing Complex Dynamical Systems: Artificial Neural Networks Contribute New Insight Concerning Optimal Athletic Techniques and Tactics

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A sports game with its players or a single athlete as a biological system might be seen (and therefore modeled) as a complex dynamical system (Memmert et al., 2015). It is quite difficult to discover cause-and-effect relations in complex dynamical systems. This difficulty applies to success and failure of technical and tactical behavior in sports-related games, too.

Current sports game researchers incorporate artificial neural networks (ANNs) to recognize, analyze, and evaluate group- and team-based tactics, as well as individual activities and interaction (Grunz, Memmert, & Perl, 2009; Perl, Grunz, & Memmert, 2013; Perl & Memmert, 2011). With ANNs, it is possible to distinguish inherent patterns within highly complex environments (statistical series; Perl, 2004), and ANN-based pattern recognition methods ultimately enable research of even the final mysteries in the functionality of tactical patterns; also, these methods can be successfully applied in the field of motor analysis.

Athletes, coaches, sports educators, and (movement) scientists strive to optimize athletic techniques: What is the optimal movement execution for the shot on goal in football, the basketball free-throw, or other athletic techniques? Thoughts like these demand an ideal technical model that all athletes should endeavor to master, as it promises comprehensive success.

Nevertheless, only a personalized technique, making advantageous use of the executing athlete’s constitution, motor skills, and psychological capacity, can ever be recognized as “optimal” in the best case; an optimal technique is therefore always individual. Certain biomechanical regularities do of course play a crucial role in the process; however, they must be applied and molded specifically to the constraints of the executing athlete. With his “constraints theory,” Newell (1986, 1991) explained the realization of a coordinated purposeful movement as a combination of “organismic,” “environmental,” and “task constraints,” where “organismic constraints” are the individual attributes of the executing athlete—genetic, constitutional, conditional, emotional, and intellectual.

It can thus be reasonable to discount the perfect use of mechanical laws in favor of personal viability, while deviating slightly from a certain optimal parameter such as reaching the highest possible point in the air at the moment of throwing a basketball free-throw (Schmidt, 2012).

Technical models are often incongruent even in professional literature (e.g., free-throw in basketball [Schmidt, 2010] or round-off [Büscher, 2014] and front handspring [Lingl, 2015] in gymnastics). They are based in large part on the argument of biomechanical laws, yet details often vary depending on the experience of successful coaches and athletes.

Most techniques in competitive sports must first and foremost be effective in a confrontation with an opponent and his or her techniques and tactics. Techniques therefore have to be situationally appropriate and remain adaptable to various “task” and “environmental constraints.” One cannot, however, avoid making these variations usable by the executing athlete above all else.

The process of analyzing the concrete individual execution of a technique should accordingly focus less on comparisons to the technical model and more on any remaining dysfunctionalities in the realized movement. This means that the goal is to find movement executions that are suited to and realizable by oneself.

How can modern procedures support the movement analysis in finding the best individual technical variation? Through the use of movement pattern recognition methods, it is possible to gain insight into the workings of human movement that would be unattainable with conventional statistical methods (e.g., Lamb, Bartlett, & Robins, 2011; Schmidt, 2012; Witte, Schobesberger, & Peham, 2009; Zart, 2012).

The process of movement pattern recognition via ANN—dynamically controlled networks (see Perl, 2004), in particular—can capture, identify, and group participants’ realized movement patterns (Baca & Kornfeind, 2012; Schmidt, 2012; Schmidt, Meseck, & Perl, 2015; Witte, Emmermacher, Langenbeck, & Perl, 2012). This process requires data, usually biomechanical
(e.g., kinematic) and representing the basic structure of movements. The analysis then allows us, among other things, to illustrate individual phases of movement, their variability and stability, as well as “action units” and “functional variability” (Schmidt, 2010).

The variation within a specific part of a full-body movement impacts the whole. To this effect, Handford (2006) showed that movements such as the overhand serve in volleyball are made up of so-called “action units,” which are destroyed in segmented practice as they no longer depict the adequate part.

These “action units” can be distributed individually throughout the entire kinematic chain of a full-body movement. There is a good case to believe that this also applies to compensatory variability. The analysis of sport-motoric movements must therefore refer to the entire kinematic chain (Schmidt, 2010; Schmidt, Memmert, & Perl, 2011; Schmidt et al., 2015).

References


Using Modification to Generate Emergent Performance (and Learning?) in Sports

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The emergent performance and learning of sports skills is usually a combination of hands-off coaching approaches such as indirect coach instruction and the skillful manipulation of game constraints. One method that can be used to purposefully create game conditions that lead to emergent tactical understanding and skill development is sports modification. In particular, modified junior sport programs, which purport to be easy to learn, engaging, and accessible have been a visible part of the sports landscape for a long time and are central to the participation strategies of many international sporting organizations.

To date, the optimal manner in which to modify or scale sports, be it the equipment used or the space in which the game is played, has largely relied on anecdote or expert comment (Memmert et al., 2015). Decisions such as what to scale, what not to scale, by how much, for what ages, and until what age are made arbitrarily, and the approach adopted continues to vary drastically between, and sometimes within, sports. For example, in Australia, children younger than the age of 10 years shoot at a 2.4-m-high goal in the sport of netball, while 11-year-olds shoot at a 3.05-m-high/adult-sized goal. However, the rationale for this 25% increase in height is unclear and is not calibrated to any commensurate physical development by 11-year-olds.

Surprisingly, there is relatively little evidence to substantiate the link between modified junior sport and a range of implied positive outcomes, including increased enjoyment and age-appropriate tactical and skill development (see Buszard, Reid, Masters, & Farrow, 2016, for a review). This presentation will review an emerging body of research that demonstrates the value of equipment scaling and its influence on technical and tactical skill development.

The sport of tennis is used to highlight a possible sequence of scaling events that ultimately may lead to more effective skill acquisition. First, lower-compression balls allow children to strike the ball with greater ease in better hitting locations (Buszard, Farrow, Reid, & Masters, 2014a; Kachel, Buszard, & Reid, 2014). In turn, children generate greater ball velocity while maintaining (or improving) hitting accuracy (Larson & Guggenheimer, 2013). Although scaling the racquet size (reducing length) is also useful and further enhances hitting performance, its influence is not as significant as that of ball compression.

When the scaled equipment constraints are integrated into practice and game play, enhanced skill-learning opportunities are afforded to the performer. For instance, a combination of low-compression balls and smaller court size increases the volume of practice that is able to be completed in a given time frame (Farrow & Reid, 2010). Additionally, more representative performance is observed during match-play conditions. For skilled children, low-compression balls relative to standard balls result in match play that more closely resembles a professional adult match (Kachel et al., 2014). Further, when the net height is lowered, it has a positive influence on match-play performance as children hit more shots with qualities representative of high-performance game play (Timmerman et al., 2015).

A range of perceptual-motor skills and psychological and biomechanical factors clearly interact when scaled equipment is used in an effort to optimize the learning environment and create emergent learning for the participants. A particularly interesting discussion point is that the cognitive processes underpinning learning by children in a modified setting may be different from those employed when using regulation equipment and task demands (Buszard, Farrow, Reid, & Masters, 2014b; Buszard et al., 2016).

References


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Game-Centered Approaches: Different Perspectives, Same Goals—Working Together for Learning

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Since the publication of the teaching games for understanding (TGfU) model in the early 1980s, there has been a clear evolution of the original model as well as the promotion of different versions and approaches based on analogous ideas. The clustering of these approaches has received different explanatory denominations (Memmert et al., 2015), such as game-based approaches, alternative models, TGfU approaches, constructivist approaches, tactical models, and probably the most widely accepted, game-centered approaches (GCAs).

Almond (2015) described the current situation as a wealth of ideas but expressed at the same time concern about that this number of quarters divides the community of practitioners and researchers, thereby preventing new thinking. To minimize the negative consequences and take advantage of the positive, we think that two actions should be done. Firstly, find a shared agreement about the essential features of GCAs, so that the search for an identity does not involve the loss of the essence. And secondly, review and analyze the foundations and history of the different GCAs, while extracting their strengths and main contributions, and in doing so, offer to teachers and coaches "a set of tools" in addition to (or rather than) whole approaches. This second action is the purpose of this work.

(1) Foundations: The simple and generic playful situation-oriented forms proposed in Ball School (Kröger & Roth, 2003; Memmert & Roth, 2007) are appropriate for the first experiences of very young children and build quite early the foundations for tactically complex categories like invasion games.

(2) Structure: The tactical game model (TGM; Mitchell, Oslin, & Griffin, 2003) offers a structured progression through levels and a clear relationship between skill and tactics. The invasion-game competence model (Tallir, Lenoir, Valcke, & Musch, 2007) also provides a progression based on chained basic game forms.

(3) Learning-game designing: TGfU (Bunker & Thorpe, 1982; Thorpe, Bunker, & Almond, 1986) and play practice (PP; Launder & Piltz, 2013) provide pedagogical principles for designing games that address specific tactical problems (TGfU, representation/exaggeration; PP, simplification/shaping), while game sense (GS; Den Duyn, 1997; Light, 2012) provides indications for the design of more open learning environments.

(4) Teaching in the game: The necessary modifications during the actual game, depending on their development and attention to diversity, are well addressed by the principles of focusing (PP) and adaptation (Hopper, 2011). Promoting learning through questioning is a central issue in GCAs and is especially addressed by GS and the tactical decision learning model (Grehaigne, Wallian, & Godbout, 2005) as they provide a component of social learning. The development of motivation as a source of learning can be achieved from the principle of enhancing (PP), which includes strategies like fantasy games. Also, creativity can be promoted by strategies such as those proposed by Memmert (2010) and by applying strategies used in student-designed games (Hastie, 2010).

Regarding the evaluation, as an essential component in the learning process, the TGM with the Game Performance Assessment Instrument is the most used assessment instrument, both in research and teaching.

(5) Context adaptation: The PP and especially GS have a significant presence in coaching that is not achieved by other approaches. In this sense, the intentional GS design for coaching is remarkable as it simplifies TGfU elements, so it is less structured and prescriptive and relies on the deeper content knowledge possessed by coaches (in comparison with teachers). In the same way that designing games depends on whom the games are targeted toward, Playsport, TopPlay, and Sense Game cards are good examples of materials that could be used by instructors with little experience in games teaching (e.g., volunteer parents).

(6) Expansion: Finally, in relation to the expansion of GCAs, we must highlight the rise of GCAs in Asia in the last decade, with the most remarkable example of the
rapid and extensive introduction of the game concept approach (GConA; McNeill, Fry, Wright, Tan, & Rossi, 2008) in Singapore. GConA is a good example of how research and training should influence education policy. The expansion and influence of the TGM is also an example that a good way to increase the use of a model is to provide simple and complete curricular materials that are research-based.

References


“Leveling the Playing Field” in Physical Education With Adaptation Games

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A problem that has plagued physical education teachers for years is how to get all students, even the resistant ones, involved in meaningful games and physical activity. The next generation of physical education teachers needs to transform games teaching to create games in which 21st-century learners want to engage, if games are to be a relevant aspect of the physical education curriculum. Almost three decades ago, an approach known as teaching games for understanding (TGfU) was conceptualized as an alternative way to teach games (for a review, see Memmert et al., 2015). Educators were concerned that children were not experiencing the thrill associated with games and that they and adults had little understanding of games (Almond, 2010). Thorpe, Bunker, and Almond (1986) proposed two ways to modify games that form a fundamental cornerstone to TGfU thinking—representation and exaggeration—to help students become better game players. In this presentation, I will share a new principle of game modification we call “modification by adaptation or adaptation games,” which adds another dimension to these pedagogical principles (Pagnano Richardson, Sheehy, & Hopper, 2013) and connects this work to complexity thinking (Davis & Sumara, 2006, 2010). As described Hopper, Sanford, and Clarke (2009), modification by adaptation connects to a concept in video game play that Gee (2003) calls “game-as-teacher.” In adaptation games, the outcome of the game leads to the game structure adapting to the player. The game is modified to increase the challenge to a successful player based on the outcome of the previous game (e.g., changes to space, scoring, rules conditioning play or number of players). The conditions of play are triggered as a result of a winning outcome to the game, so that the winner is faced with an increased challenge. Multiple game outcomes allow the game to adapt to the ability of the players. An example is provided by a volleyball-like game called “Space Adapt,” played in a quarter of a badminton court. After one student scores 2 points, the other student increases the opponent’s play area by changing the boundaries and increasing space by adding on a quadrant of the badminton court. The students play again. The student who does not win then increases the opponent’s play space or decreases their own space and then the students play again. Adaptation allows students even with disparities in skill to engage in meaningful yet unpredictable game play (Hopper, 2011). Preservice teachers noted that adaptation games served to equalize power among opponents and provided a catalyst for learning (Pagnano Richardson et al., 2013). They identified that the student who did not win had the power to make decisions about the constraints of the next game, which served to equalize the power dynamic between the winner and loser. Further, the decentralized control of game play was evident in the theme of “teacher takes a back seat,” whereby the teacher initially sets the broad constraints of the game, yet preservice teachers play the game independently and make decisions based on the interactions between the players involved. Pagnano Richardson et al. (2013) identified three qualities of a complex system: Adaptation, self-organizing, and emergence formed critical elements that allowed learning in games to occur in a nonlinear process. For this to happen in adaptation games, the conditions in the environment needed to offer enabling constraints that limited what the system could do to prevent it from being overwhelmed, but at the same time, it offered an openness to possibilities of which the complex system could take advantage. In adaptation games, the role of the teacher was to provide the enabling constraints (i.e., game designer) as guidelines for emergent engagement by students. Rather than being prescriptive, the enabling constraints oriented the learner to what might happen in the game, rather than what must happen (Davis & Sumara, 2010). Adaptation games created the opportunity for students to engage in and with each other in meaningful game play while matched to their own level of competency, where the flow of the game play engulfed the players. Physical educators should consider adopting a “game as teacher” approach if they value creating delightful games that engage learners of all abilities, backgrounds, and experience levels. To be an effective game designer, physical education teachers need to examine their own social positions, biases, and
experiences to better understand how to create equitable and engaging games for all students. Consider the following questions as you focus on game design for your students: What aspects of my social identity influence my conception of competition or a good game? How might my past experiences as an athlete who may have derived a sense of power or had been empowered from success in sport influence how I design games in physical education?

References


Symposium:
Developing a Conceptual Framework to Underpin the Practical Art of Making Games Accessible to Players

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Introduction: This symposium will be the third phase of an investigation into the complexities of translating a complex game into meaningful game forms that enable players to understand games, learn to love playing them, and become intelligent performers. There is a great deal of research in the field of teaching or coaching games, but there appears to be very little on the practical art of making games accessible to players. This gap needs to be addressed.

To support this work, our ongoing investigation strives to explore what a coherent conceptual framework to underpin the teaching/coaching of games could look like. It will address the problems that teachers and coaches experience in translating a complex game into meaningful units and finally how we can support teachers and coaches.

The aims of this symposium are: (a) to outline a conceptual framework that underpins the practical art of making games accessible to players, (b) to illustrate what it means in practice, and (c) to explore some issues associated with creating game forms.

Conceptual Framework for Understanding Digital Video Game Design and Its Relationship to Teaching Games for Understanding

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In recent years, the game-centered approach (GCA) arena for academic research has been well populated with evidence-based studies that enhance the theoretical underpinnings of teaching and coaching of games. Nevertheless, there has been limited attention paid to how GCA models such as teaching games for understanding (TGfU) can be merged with alternative fields of game studies, outside of physical education and sport, to make games accessible for young people.

In this symposium, we use principles of “good digital game design” (Gee, 2013) to propose a conceptual framework for understanding the practical design of games. We consider similarities between a teacher and coach and a digital game designer using the notion that “good game designers are practical theoreticians of learning” (Gee, 2013, p. 21). The symposium will acknowledge that the rationale for TGfU and rationale for digital video games are similar—to attract and sustain participation and performance through challenging and enjoyable practice.

The symposium will promote ways in which complex games can be learned and mastered through practical application of game design. The symposium will specifically interpret TGfU’s 4 pedagogical principles and will merge with Gee’s (2013) features of good game design, which are considered to enhance learning and performance. Further discussions will build upon Almond’s foreword in Butler and Griffin (2010) to use game design for developing a whole mind set for game sense, with a specific focus on how video game play can simulate the human mind and its learning capabilities in today’s digital age.

Translating Formal Game Into Manageable Game Forms: The Case of Volleyball

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Introduction: We address 2 main questions: how to develop better teachers and coaches and how to best bridge research findings and daily practice in real-life settings, therefore bringing about meaningful guidance for practitioners. Specifically, we will advance concrete proposals for transforming formal game into manageable game forms to instigate the players to truly love the game by discovering the remarkable combination of fun and competition. In this vein, we will engage from our own embedded experience as teachers, coaches, and researchers of volleyball.

Principles we stand for: First and foremost, we would like to advance the concept that, by definition, all pedagogy is nonlinear. Each coach/teacher, each athlete/student, each learning environment, and each team
represent a unique reality. Therefore, one-size-fits-all types of approaches are rendered to failure. From this starting point, we outline 5 basic principles in our approach: (a) Recognize that learning is an active concept. (b) Understand that each learning moment is distinctive and special, and therefore, coaches and teachers should make use of a manifold of different philosophies and methods instead of relying on preestablished recipes. This includes being faithful to each coach’s and teacher’s idiosyncrasies, as honesty and genuineness define who you are and remain paramount in any learning-related process. (c) In line with the previous points, appreciate that learning environments should focus on the student but also bring ecological task and environmental control to nuclear roles. (d) Amid such considerations, avoid a narrow practice supposedly based on tradition (even tradition is an evolving concept after all!) and replace it with a constant (re)analysis and permanent critical thinking, while fully embracing the present instead of relying on the past. And (e) finally, comprehend that the tactical and technical dimensions are hardly separable.

Making Sense of Handball

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Teaching games for understanding (TGfU) is a pedagogical model that has gained widespread popularity among teachers and coaches in recent years (Bunker & Thorpe, 1982; Thorpe & Bunker, 1989; Thorpe, Bunker, & Almond, 1984). Based on constructivist principles, TGfU implores practitioners to account for 3 fundamental principles in their game design: representation, modification, and exaggeration. In doing so, the puzzles presented by well-designed games can afford the learners opportunities to develop an understanding both of the game and within the game.

Nevertheless, Casey (2013) contended that the extent to which practitioners are able to operationalize games that embody the principles of TGfU is questionable. Further, Laudner (2001) likened TGfU in the hands of teachers to jumbo jets in the hands of test pilots; it is clear that much work is yet to be done to enable coaches and teachers to effectively use this model-based approach. Answering Casey’s (2013) call to aid teachers and coaches in making a conceptual shift in their practice, this presentation aims to provide some explicit mechanisms through which handball may be delivered—true to TGfU principles.

The presentation considers how we might make sense of handball and the need to do so (Richards & Collins, 2012). Further, the presentation proposes ways in which teachers and coaches might create the tactical problems, which are national governing body-stated principles of play (England Handball, 2015). Handball-specific examples of how these puzzles can be represented, exaggerated, and modified are suggested. In addition, we consider how this sits within a wider planning and reflective practice framework for coaching, where practice design is aligned with coach behavior, learner engagement, and outcomes (Muir, 2012).

The Thinking Behind a Conceptual Framework for Teaching/Coaching Games

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This presentation will be divided into 3 parts to illustrate the key principles underpinning the creation of a conceptual framework. In our analysis of current practice, we believe that there is a need to focus more precisely on what we want to achieve in the teaching and coaching of games. This symposium will address how we can generate a new sense of direction.

(1) Complex games can be translated into meaningful game forms to develop an understanding of the game and an understanding in the game leading to intelligent performance.

In recent times, the conceptualization of a complex game has been a neglected aspect of the representation process for teaching a game to beginners. There is also good evidence that similar neglect is taking place with experienced players. This neglect needs to be addressed, so examples will be provided.

(2) Coaches and teachers need to know how to integrate practices so that they can shape them in forms compatible with players’ needs. This requires an understanding of: (a) meaningful modification of game forms; (b) creation of enabling environments to support learning in game forms; (c) creation of developmentally appropriate game scenarios that simulate the realities of games; (d) recognition of learning factors (playful learning, meaningful learning, and learning load); (e) scaffolding the learning process and fading of support; and (f) developing an enabling attitude of the teacher/coach.
A new concept will be introduced that goes beyond the traditional perspective of teaching games for understanding in the form of skills and tactics that we are calling a game capability. A game capability is the integration of player attributes and the quality of their experiences in learning to play a game that enables players to “make sense of games” so that they can understand what they can do and have intelligent performances in a game.

Perspectives of Rugby Coaches in Understanding Teaching Games for Understanding

J. Lambden
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In this presentation, 3 problem scenarios will be explored. Coaches encounter major problems in translating a complex game into meaningful units that enable rugby players to learn the game and become intelligent performers. What is its relevance for beginners, experienced players, talented performers, and professional players? How do they address relevance? Concepts like the game-centered approach, modification principles, affordances, scaffolding, and cognitive load, to name just a few. In addition, at conferences, they hear about nonlinear pedagogy and complexity theory.

Grasping the key concepts underpinning teaching games for understanding (TGfU) has proved difficult for many coaches from a traditional background because they challenge their practices and require a great deal of rethinking and relearning. Most coaches gather an understanding of TGfU from 2nd-, 3rd-, and often 4th-hand accounts of what it means and how it can be applied. As a result, very different variants emerge with strange practices that have little connection with the original ideas.

The culture of games at a local level appears to frown upon developing a shared understanding of these ideas and then sharing with others what individual coaches have experimented with and want to develop. They are quite happy to pick and choose ideas from books or demonstrations and simply graft them into their repertoire. Reflection and taking stock appear to be rare.

Finally, my experiences of translating rugby into progressive game forms have generated a kind of “map and compass” of the terrain, and these experiences will be shared with delegates.

Symposium:
The Ecological Dynamics Approach to Sport Pedagogics and Tactical Analysis

Chairs: D. Araujo,1 K. Davids,2 and I. Renshaw3
1University of Lisbon, Portugal; 2Sheffield Hallam University, United Kingdom; 3Queensland University of Technology, Australia (daraujo@fmh.ulisboa.pt)

This symposium includes presentations focused on 2 levels of analysis: (a) sport pedagogy and (b) capturing tactical behaviors of players in games. These complementary levels of analysis are embraced by the same theoretical approach: ecological dynamics. Therefore, the performance and practice ecology and the dynamics of pedagogy and tactics are addressed in a principled and coherent framework to enhance understanding of how the methodology of training and practice can be improved. On tactics, Passos and Silva discuss how players’ actions create opportunities for others to achieve team goals; Travassos et al. show how the manipulation of a task constraint, such as the properties of goalposts in field invasion games, can dramatically shape the dynamics of match play. On coaching, Connor et al. compare the effectiveness of traditional versus constraint-led methodologies to develop the batting skills of talent-pathway cricketers during an 8-week off-season program. Moy identifies difficulties encountered by undergraduate trainee teachers on practicum when implementing a nonlinear pedagogy in schools. Renshaw and Clancy, following a similar path, discuss how nonlinear pedagogy can be implemented and help to evaluate teacher–environment interactions.

Implementing a Nonlinear Physical Education Pedagogy in an Australian Secondary School

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The multiple, less predictable learner responses that emerge as a consequence of the complex nature of learning within a nonlinear pedagogy (NLP) can present significant challenges for novice practitioners. The purpose of this study was to explore 2 physical education teacher education (PETE) students’ experiences associated with this learning process when implementing an NLP using the methodology of the constraints-led approach (CLA) with
physical education students in a school setting. Data were collected using participant and primary researcher written reflections and semistructured interviews. The results demonstrated major challenges facing PETE students when implementing an NLP. Participants experienced difficulty detecting the less predictable pupil responses that emerged from the game structures they created. They also had difficulty manipulating constraints to allow problem-solving behavior to emerge through the natural, exploratory learning processes underpinning the CLA. These study findings can be used to inform and improve the design and delivery of PETE programs in supporting students to effectively implement an NLP.

**Reflecting on Practice: An Exploration of NLP in Games Teaching**

I. Renshaw and J. Clancy

Despite the popularity of “alternative” pedagogical methodologies such as teaching games for understanding (TGfU) and the constraint-led approach (CLA) in academia, there is still limited take-up by practitioners (Almond, 2010). Additionally, when they do try to adopt new methodologies, there are question marks regarding the capability of teachers to faithfully adopt the key principles in their practice (Butler, 2014). One reason for this challenge may be a disconnect between learning about new methodologies in a sterile lecture theatre and delivering them in complex environments like schools. To address these challenges, it has been suggested that researchers and practitioners need to work closely together. One idea is for researchers to provide tools to support delivery in practice. One useful tool could be a lesson self-checklist based on the theoretical framework underpinning the methodology. To that end, this study aimed to examine the pedagogy of an experienced physical education teacher in an 8-week volleyball unit delivered to a Year 11 group. The lead researcher observed all sessions live or video-recorded and took field notes in real time. For each lesson, the teacher completed the Nonlinear Pedagogy Lesson Reflection Tool (Chow et al., 2015). Weekly postlesson meetings were held to review findings and plan upcoming sessions. Reflections revealed that the teacher based his learning design on the methodological principles of CLA and TGfU. Key findings centered on time as a constraint for learning, the use of reflective questioning and instructional constraints, the challenge of designing representative tasks, manipulating task constraints, promoting variability in learning, individualizing learning, and nonlinearity in progress. The collaborative review process provided a framework for evaluating the teacher–environment interaction and enabled enhanced delivery of nonlinear pedagogically based practice through CLA and TGfU.

**Evaluating a 12-Week Games-Based Training Program to Improve Cricket Batting Skill**

J. D. Connor, I. Renshaw, D. Farrow and B. Abernethy

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Although a constraints-led approach (CLA) to skill acquisition is different from teaching games for understanding (Renshaw et al., 2015), the theoretical underpinnings of CLA can be utilized when designing games-based training approaches. This study examined whether a games-based training design, underpinned by CLA, was more effective at developing cricket batting skill than a more traditional technically focused coaching approach.

Sixteen under-15 skilled cricket batters participated in a 12-week intervention study and were randomly allocated to a traditional or experimental training group. The experimental group participated in activities with manipulated rules, equipment, and outcome goals, while the traditional group focused on optimizing technical batting skill processes. Both groups completed two 2-hr sessions per week, bookended by a preintervention and post-intervention batting skills test. This test involved facing 18 balls delivered by bowlers, with the number of successful scoring shots, total runs scored, attacking strokes played, and quality of bat–ball contact recorded.

An analysis of variance was used to examine between- and within-group differences over time. The experimental group (CLA) demonstrated an increased number of successful scoring shots (3.88 vs. 6.63), and increased number of runs scored (11.63 vs. 20.7), and an improvement in the quality of bat–ball contact (1.26 vs. 1.52) after intervention, while there was no change in the number of attacking strokes played, and quality of bat–ball contact recorded.

These numbers were significantly greater than those for the traditional group, which revealed no changes in the number of successful scoring shots played (4.62 vs. 3.75),
the number of runs scored (10.25 vs. 10.00), the quality of bat–ball contact (1.26 vs. 1.29), or attacking strokes played (77.78% vs. 78.87%).

Skilled U15 players significantly improved facets of their batting using a games-based training approach, while a more traditional training approach did not lead to improvements. Training using a systematic approach to manipulating constraints is suggested to benefit the overall development of a batter.

**Manipulating Goal Posts Significantly Impacts Tactical Behaviors in Small-Sided Football Games**

B. Travassos,1,2 P. Silva,3,4 R. Duarte,5 L. Vilar,6 and P. T. Esteves2,7

1University of Beira Interior, Portugal; 2Research Centre in Sports Sciences, Health Sciences and Human Development, Portugal; 3FC Zenit, Russia; 4University of Porto, Portugal; 5University of Lisbon, Portugal; 6European University, Portugal; 7Guarda Polytechnic Institute, Portugal (bfrt@ubi.pt)

In team sports, goal target manipulation is 1 of the key task constraints promoted by coaches. However, a clear understanding of the effect of such manipulations on team-adaptive behaviors is needed. Here we synthesize how the number and size of goal targets and players’ ages impact collective measures of tactical behaviors in football. Tactical behaviors were measured by considering the spatial-temporal relations between players in effective contexts of performance. Results revealed that the manipulation of the number of goal targets (from 1 goal + goalkeeper to 3 minigoals) increased the distance between the geometrical center of each team and decreased the relative stretch index between teams. Interestingly, an increase in the number of goalposts positioned over the end line was associated with longer periods of time played in defensive sectors and lateral channels than when only 1 goal + goalkeeper was used. Also, lack of goalposts promoted higher variability in teams’ spatial distribution than when 2 lateral mini-goalposts or 1 goalpost + goalkeeper were used. Worthy of note is that players’ age modulated the effects of manipulating the number of goalposts used in practice. A significant interaction between number of goal targets and age was observed in the ratio between the width of attacking/defending teams. Performance of older players expressed a higher width ratio between teams when playing with a higher number of goal targets compared with the youngsters. Also, manipulation of goal target size disclosed a differential effect of regulation size in comparison with 7-a-side and 5-a-side goal sizes. Whereas official goal target size afforded a higher number of shots from different field locations, 7-a-side and 5-a-side goal target size induced a greater frequency of shots from central subareas of the field requiring a greater buildup of play to shoot at goal.

**Players’ Relative Position to Characterize the Affordances Landscape in Football**

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In football, just like in most team sports, one of the ball carrier’s tasks is to seek and seize opportunities to make the ball get closer to the opposing goal by means of in-depth (i.e., toward the end line of the opposing team) passes to a support player located “within” the opposing defense. And it is the players’ (e.g., teammates and opponents) dynamics, in the continuous adaptation to the behavior of others demanded in such competitive environments, that lead to such opportunities. In this study, we aim to describe the ball carrier landscape of in-depth passing affordances that emerge for each attacking phase. This landscape was built upon a geometric Figure (similar to a diamond shape), which is defined by the ball carrier, the passing target, and the 2 nearest defenders’ relative positions and is updated in a 1-Hz rate. For this purpose, the players and ball x and y coordinates were captured with an automatic video-tracking system. It was also hypothesized that the width of this diamond shape can point out in-depth passing opportunities with high success probability. Additionally, the integration of both defenders and ball estimated positions in the next second may lead to a more accurate indicator. Results identify pitch areas where the in-depth pass opportunities occur more often. It is by overlaying such pitch areas that the ball carrier in-depth pass affordances landscape is characterized.

**Symposium: Personality in Team Sport: A Coach and Athlete Perspective**

Chair: J. Kleinert
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Personality plays a substantial role in team sport, particularly when considering the perspectives of coaches and athletes and the overall coach–athlete
relationship. Given the wide range of personality factors, there are many psychological constructs and processes of relevance when considering the personality of coaches and athletes. In terms of the coach perspective, this workshop specifically addresses emotional intelligence and burnout, as both aspects are strongly related to the quality of coaching and are, therefore, relevant to the performance and well-being of team members. The theoretical link between the coach’s personality and team processes is identified in leadership and motivational processes. Additionally, recovery is recognized as a protective factor against the development of personality disorders. Finally, from the athletes’ perspective, it is important to discuss personality as an aspect of human development that is particularly relevant in youth team sport. All contributions in the present workshop demonstrate the need to find the optimal conditions under which personality development of both coaches and athletes in team sport is optimized.

**Personality Development in Team Sport Players**

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The adolescent years are the most important years for personality development. Young elite athletes have to solve the same developmental tasks (DTs) as nonathletes even though they spend a lot of time playing sports and also have to solve certain sports-related DTs in addition (Ohlert & Kleinert, 2014). Therefore, the aim of our study was to find out if this situation leads to a shortfall in certain DTs and furthermore to reduced well-being especially in adolescent team-sport players.

In total, 75 elite adolescent handball players and 134 soccer players participated in the survey together with 166 nonathletes. Participants were aged 16 to 19 years old; the majority of the participants were female (69%). They answered questions regarding the relevance of different DTs, their actual progression, satisfaction with their actual progression, and the World Health Organization Well-Being Index (WHO–5) measure for well-being.

Results showed that compared with the nonathletes, players reported a different relevance for some DTs, especially for the DTs of circle of friends and independence from parents. No significant differences between the 2 groups could be found in progression or satisfaction with progression. The stepwise multiple regression resulted in only 2 significant predictors for well-being in athletes: the satisfaction with progression in the DTs of to find oneself (β = .39, p = .001) and circle of friends (β = .35, p = .002). For nonathletes, the analysis revealed only satisfaction with progression in circle of friends (β = .24, p = .023) as a significant predictor. Implications from these findings are that, at least in this age group, elite players do not suffer from problems with DTs. However, if satisfaction with their own progression in certain DTs is low, well-being will also be reduced. Longitudinal studies will have to show what happens if players fail to achieve the DTs when reaching adulthood.

**Burnout, Stress, and Recovery in German Coaches**

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Coaches have to deal with emotional and physical stress that can influence their well-being and, in turn, potentially impact athletes’ performance (Mallett, 2010). To perform at their optimal level, coaches have to manage their own physical and emotional state using self-regulation strategies and personal recovery. A growing imbalance of stress and recovery of the coach could lead to emotional exhaustion, which is widely accepted as the key symptom of burnout (Frey, 2007; Raedeke, 2004). Thus, the aim of the current study was twofold: first, to examine the prevalence of burnout in German sport coaches; and second, to investigate the impact of stress and recovery on burnout.

Two hundred and thirty-three coaches of various sports and levels responded to an online survey. Burnout was measured by the coach-specific German adaptation of the Maslach Burnout Inventory (Altfeld & Kellmann, 2014). Recovery and stress were measured using the Recovery–Stress Questionnaire for Coaches (Kellmann, Kallus, & Altfeld, 2016).

The research results showed mean scores of 1.38 (SD = 0.79) for emotional exhaustion, suggesting low-to-medium levels of burnout. However, according to the standard values of Maslach and Jackson (1996), 12.9% of the coaches indicated high levels of emotional exhaustion. Overall stress (β = .29, p < .001), overall recovery (β = –.15, p < .05), coach-specific stress (β = .31, p < .001), and age (β = –.14, p < .05) demonstrated a significant impact on emotional exhaustion within multiple regression analysis.

Unlike previous research that focused on individual and situational factors, this study revealed the important role of
recovery and stress regarding emotional exhaustion. Thus, monitoring the recovery–stress balance of sport coaches during the course of a competitive season could help identify coaches’ burnout risk.

The Relationship Between Coaches’ Emotional Intelligence and Their Perception of Player Need Satisfaction

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Introduction: Leaders with higher emotional intelligence (EI) exhibit behaviors more congruent with group members’ feelings. Based on basic needs theory, a micro theory of self-determination theory (Deci & Ryan, 1985, 2000), this study aimed to test the hypothesis that coaches with higher EI are better able to accurately perceive their players’ need satisfaction levels than are coaches with lower EI.

Method: Coaches (N = 12; Mege = 30.17 ± 9.20 years; 75% male) and players (N = 127; Mege = 15.33 ± 1.35 years; 63% male) were recruited from German sports teams (basketball, 25%; handball, 25%; football, 41.7%; volleyball, 8.3%). Players completed questionnaires assessing their level of need satisfaction for a typical training session (Contextual Basic Need Satisfaction Scale), while coaches completed the same questionnaire from the perspective of their team, along with a measure of their EI (Trait Emotional Intelligence Questionnaire-Short Form). Coaches were median split into relatively high and relatively low groups for global EI and individual EI factors.

Results: Responses from relatively high-EI, emotionality, self-control, and sociability coaches, respectively, were significantly different (i.e., lower; p < .05) from players’ responses regarding players’ levels of relatedness satisfaction. Responses from relatively low emotionality coaches were significantly different (i.e., higher) from those of players regarding players’ levels of competence satisfaction, and vice versa. All coaches’ responses were significantly different (i.e., higher) from those of players regarding players’ levels of autonomy satisfaction. Coaches with relatively high EI scored players’ levels of relatedness satisfaction significantly lower than relatively low-EI coaches.

Discussion: Higher-EI coaches appear to underestimate their players’ levels of competence and relatedness. This finding could suggest that high-EI coaches are not satisfied with their current provision of needs support, thereby reflecting the higher motivation efficacy (i.e., the confidence to influence the psychological states and skills of athletes, a component of coaching efficacy) found in higher-EI coaches.

The Link Between Emotional Intelligence and Leadership in Soccer Coaches

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Social competences like emotional intelligence are essential for coaches’ leadership behavior (Laborde, Dosseville, & Allen, 2015). The present study examined the extent to which the emotional intelligence of soccer coaches is systematically associated with different components of leadership—for example, social support or democratic behavior. The sample of 198 soccer coaches from the lower leagues up to the first German League (all male, Mege = 39.41 years) completed an online questionnaire comprising the Trait Emotional Intelligence Questionnaire (TEIQue; Freudenthaler et al., 2008) and the Leadership Scale for Sports (LSS; Würth, Saborowski, & Allermann, 1999).

Analyses showed positive correlations between the LSS score (operationalized as social support, positive feedback, democratic or autocratic behavior) and the TEIQue global score (comprising well-being, emotionality, self-control, and social competence; r = .382, p < .001). The democratic behavior of coaches was positively linked to their age (r = .166, p = .021) and coaching experience (r = .174, p = .015). Age was also associated with self-control (r = .192, p < .001) and global LSS score (r = .149, p = .038).

The results show an empirical relationship between self-reported trait emotional intelligence and the way soccer coaches describe their leadership styles. Practical implications for coach education and “coach the coach” are discussed. Further research should combine self-evaluation of coaches and athletes’ descriptions of coaching behavior.

Symposium:
Translating TGfU Theory Into Practice: How Can We Support Teachers’ and Coaches’ Learning When Implementing TGfU?

Chair: K. A. Parry
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Despite the perceived benefits of game-based pedagogies such as teaching games for understanding (TGfU),
research has shown that their implementation in practice can be problematic, particularly because game-based pedagogy relies on the “craft of the teacher” (Butler & Griffin, 2005). Employing game-centered practices places great pedagogical and conceptual demands on the teacher/coach. The literature has revealed much about the dilemmas faced by teachers/coaches, along with the feelings of insecurity, apprehension, and confusion they experience when trying to implement game-based pedagogies such as TGfU. There is an evident “epistemological gap” (Light, 2008) or “cognitive dissonance” (Butler, 2005) between teachers’ and coaches’ understanding of game-based pedagogies and their actual professional practice. This gap is reflected in the struggle teachers and coaches experience in adopting game-based pedagogy when teaching games.

The literature recognizes that teachers and coaches need to be provided with effective support (Nash, 2009; Wang & Ha, 2012; Wright, McNeill, & Fry, 2009) and effective professional endorsement (Memmert et al., 2015) to develop the knowledge and skills to implement game-based pedagogies such as TGfU into practice. However, research has revealed little about how best to support teachers/coaches in developing the required knowledge and skills to effectively implement game-based pedagogies in their own practice. Furthermore, Memmert et al. (2015) argued that researchers have failed to provide teachers/coaches with an up-to-date picture of how their work can inform practice. As such, research into game-based pedagogies needs to be made more accessible for teachers/coaches. They need help translating the theory into practice and bridging this “epistemological gap” (Light, 2008).

In this symposium, we consider how TGfU-related approaches can be implemented with the goal of facilitating preservice and in-service teachers’ and coaches’ learning with the aim to teach and foster their professional development from novices to experienced practitioners.

**Supporting Teachers to Implement Game-Centered Approaches: Toward an Effective Model of Professional Development**

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Game-centered approaches (GCAs) have become increasingly popular among physical educators because of their potential to enhance educational outcomes. Yet the literature shows that implementing GCAs can be problematic. Research has shown the conceptual and pedagogical difficulties along with the feelings of insecurity, apprehension, and confusion experienced by teachers when trying to implement game-based pedagogy. Little has been revealed about how best to support teachers to explore what these approaches may look like in their own practice. The purpose of this research was to address this gap in the literature by examining the professional development (PD) required to support teachers in their implementation of game-based pedagogy. In doing so, this research proposes an effective model of PD to support the implementation of GCAs. To achieve this aim, this study was conducted using action research in 4 phases: needs assessment, planning, implementation, and evaluation. Multiple methods of data collection were employed across all phases of the research including interviews, focus groups, observations, and document analysis. Data were analyzed using triangulation, thematic coding, and constant comparison. Results revealed that limited teacher knowledge and the professional learning culture including the prioritization of time, teacher accountability, and student response impact teachers’ professional learning when implementing GCAs.

**Utilizing Real-Time GPS (Adidas MiCoach System V2.0) to Enhance Soccer Coaches’ Ability to Reflect in Action When Engaging in a GCA**

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The growth and advancement of technology during the last decade has transformed the way we communicate and interact and has the potential to change the way we learn (Narayan & Herrington, 2014). This change is apparent in professional sport where the use of global positioning system (GPS) monitoring tools has increased significantly during the last 5 years. Current research has largely focused on outputs such as physical load and the impact of specific coaching practices and games (small-sided games) on the physical demands of players involved (Ric et al., 2016). To the authors’ knowledge, no studies have specifically examined the impact of innovative technologies on the coaches’ behavior and pedagogical approaches. The purpose of this research was to examine the impact of real-time GPS and physical data (Adidas MiCoach V2.0) on a coach’s game-centered approach (GCA) sessions. The case study followed 4 coaches of an English Premier League Football Club academy for 24 weeks. A range of data collection methods was employed,
Using a Heutagogical Approach to Develop an Undergraduate GCA Module: Developing GCA V2

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Learning and education are still widely regarded as a pedagogic relationship between the teacher and the learner with the teacher or coach owning the learning process and deciding what the learner should learn (Hase & Kenyon, 2001). Learning is still entrenched in these traditional pedagogical principles and, as such, fails to recognize the potential impact and affordances that current and future technology can have on learning. As such, researchers have proposed that there is a need to look beyond both pedagogy and andragogy. Heutagogy is the focus on self-directed learning by the learner (Hase, 2001). Such an approach goes beyond e-learning and embraces self-directed study through the use of technology and where learning is socially constructed and decontextualized (Moravec, 2008). This presentation will explore the impact of a game-centered approach (GCA) undergraduate module designed using heutagogical principles and framework. A grounded theory approach design was utilized for this study. Thirty-four final-year undergraduate students participated in the study. Data were captured using the following approaches: GCA coaching sessions were captured before, during, and after the 12-week study using a body camera (Go-Pro V4). These sessions largely consisted of coached invasion games. In addition, commentaries captured via the use of a mobile social media coach analysis website (www.coachlogic.com) and session plans were collected throughout the 12 weeks. A variety of systematic coding analysis was utilized to analyze the data captured throughout the study. A key factor in the students’ learning was the accessibility of technology (body cameras, Go-Pro V4, and mobile coding software) and the enhanced learning experience they gained from engaging with these technologies. In addition, the students reported deeper and more “deliberate practice” of self-reflection.

Implementing Game-Centered Approaches: An Alternative Vision for Coach Education

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Operationalizing game-centered approaches (GCAs) requires a host of knowledge, understanding, practices, strategies, coherent arguments, and critical thinking, all of which are conspicuously absent from utilitarian, technocratic, and idealized coach education and the rhetoric of coach development. Knowledge of GCA, even its applied principles, is insufficient, and implementation involves more than simply providing coaches with a “toolbox” of skills. Currently, guidance about GCA is compelling rhetoric and too idealized, as it provides prescriptive lists, principles, and decontextualized examples that do not engage with issues around learning. This presentation argues for an alternative vision of coach education specifically to develop the implementation of GCA. Such a vision addresses giving coaches an awareness of their own beliefs and assumptions about coaching, developing an understanding of learning, and addressing the social, cultural, and political complexities of coaching practice. Strategies discussed include: utilizing case history examples and stories from coaches illustrating the lived experiences of those who have attempted to change practice and culture; (correctly) modeling context-specific GCA in practice, with support in understanding differences between coaches’ existing practice, attempts at GCA, and authentic GCA through the use of scaffolding (Vygotsky, 1978), which enables the coach to recognize the distance between existing practice and understanding and practice when assisted by, or collaborating with, more experienced people; and creating opportunities for coaches to speak with others through partnerships and coalitions to create a critical mass within
Moving Forward in a Game-Centered Context: A New Stage in Games and Sports Education

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Game-centered approaches (GCAs) have been the focus of physical education teacher education (PETE) for the last 30 years. Research has demonstrated that if GCAs are used appropriately, educators have the capacity to enhance the learning, engagement, and motivation levels of learners in game environments. However, despite these apparent positive benefits, inconsistent uptake of GCAs as a teaching method has hindered pedagogical development in educational settings. There have been a number of suggested reasons for this hindrance, including the tradition of the more technical approach in games and sports, strong teacher and student resistance based on philosophical and practical beliefs, and difficulties in GCA implementation and use. However, when one views GCA issues from a different perspective—one based on the time needed to gain expertise in games and sports and the ability to transfer this learning into GCA practice—it could be argued that addressing these 2 areas could be central to the implementation of GCAs in educational settings.

This presentation outlines an approach developed and used by the author in PETE undergraduate games and sports courses and games and sports projects in educational settings. The approach posits that GCAs have already identified 3 key concepts of content knowledge that are transferable across ALL games and sports and adds communication and concentration as the 4th key concept. Developing a deep understanding of these concepts and how they interact together provides the opportunity to (a) address problematic issues related to developing expertise in games and sports in the time available and (b) give PETE undergraduates the capacity to transfer this understanding into creating significant experiences in games and sports contexts using the full range of teaching approaches.

Symposium German Handball Association (DHB)
Forum:
Session of the German Handball Association

Chairs: S. König1 and S. Greve2
1University of Education Weingarten, Germany; 2University of Hamburg, Germany (koenig@ph-weingarten.de)

Note: Only English abstracts included.

Teaching Games in Secondary Schools—TGfU or Something Else?

S. König
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Although there has been an intensive discussion on conceptions for teaching team sports in physical education (PE) for more than 40 years, it must be stated that the teaching games for understanding (TGfU) approach has both been scarcely adopted in German-speaking countries and hardly undergone empirical research there. This is problematic, particularly with reference to secondary schools, because this age group needs specific instructional settings. As a consequence, this presentation focuses on the issue described and aims to analyze the TGfU approach in PE for 11- to 16-year-old adolescents.

In a multistrand and quasiexperimential field, research effects of different teaching methods (TGfU, teacher centered approach, skill orientation) were evaluated in football, team handball, and volleyball (N = 244). The composition of the TGfU programs was realized on the basis of Mitchell et al. (2006). While quantitative effects were validated by means of expert rating and prevailing statistical procedures (analysis of covariance, generalized linear model), the qualitative strand focused on teachers’ assessments via guideline-based interviews and students’ attitudes with questionnaires.

Initial results showed effects for all methods, $F(2, 241) = 77.57, p < .001$, $\eta^2 = .247$, but the highest effect size was found for the TGfU group ($d = 0.51$). Additionally, this finding could also be verified for all TGfU subgroups. Further results based on hierarchical linear modeling pledge additional interesting findings regarding nested data structure, which will be explained by qualitative data analysis (Schoonenboom, 2016).
Introduction: Freiwurf Hamburg is an association of 7 handball teams within a league structure in which teams are formed of able and disabled players. The league endeavors to act inclusively in line with its mission statement: All participants are supposed to experience “freedom of movement” to take part in the game and to enjoy their time together. Players are therefore not seen as impaired, but as handball players with specific needs. This fundamental principle of inclusion is in line with the position required in the current sports education-based discussion. Here diversity is recognized and valued as a quality that enriches life (Tiemann, 2013).

Method: Based on the question of how participants perceive Freiwurf, a utilization-focused evaluation (Patton, 2008) of the project is being conducted momentarily. The 1st step in the ongoing process was to reconstruct stakeholder perspectives by interviewing able and disabled players, their parents, and their trainers and by interpreting these interviews using the methods of grounded theory (Corbin & Strauss, 2008).

In a 2nd step, a workshop with the participants of Freiwurf will be conducted in July 2016 where the results of the interviews will be addressed and discussed. Additionally, the next steps for the Freiwurf movement will be contrived.

Discussion: Intermediate results of the qualitative evaluation will be presented during the talk at the conference by tying data to a theoretical approach to inclusion. Additionally, I will provide insight into the specific use and significance of terms such as “attitude,” “performance,” and “behavior within the group” within the community of Freiwurf players.

Symposium: Democracy in Action Through Inventing Games

Chair: J. Butler
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This symposium reports on findings from a 3-year Social Sciences Humanities Research Council of Canada-funded research project involving 6 physical educators and approximately 90 8th-grade students and 90 4th-grade students. We investigated how Inventing Games (IG)—a physical education program where groups of students create their own games—might support the development of principles of ethical actions in students as they learn collaboratively. IG is an extension of the teaching games for understanding (TGfU) curriculum model, which moves physical education pedagogy further into democratized learning while sharing TGfU’s constructivist epistemology. This study moved our thinking about the value of IG further, as we examined cocreation and coactive engagement and considered the potential of the model to promote student understanding of democracy and ethical action. An emergent outcome of the research is the coining of the term “democracy in action” to describe these educational processes.

The team will first introduce the study and its context and then offer 5 sections that report findings on the processes, dynamics, and insights of students and teachers and, in particular, interactive structures as they arose during engagement in IG and democracy in action: (a) Sheppard reports on how teachers most effectively designed the learning environment for IG; (b) Berning gives insights on survey data from her 8th-grade students through both the inventing invasion games unit and the 2nd unit of soccer/basketball, with emphasis on knowledge and skill transfer; (c) Erin McGinley reports on a 9-step pedagogical process for helping teachers consider moments of aporia and/or difficulty in communications; (d) Steve McGinley reports on pedagogical changes noted by the teachers during the course of the 4-year process; (e) Finally, we conclude by asking presenters the following question: Who are you when you teach?
in IG. The 2nd year was organized around 3-day-long research sessions involving the exploration of unit planning combining IG with situated ethics. The 3rd year involved data collection as teachers taught units in IG and subsequent units in institutionalized games. Investigators observed and video-recorded 3 lessons by each teacher in both units, with the focus being on the students. During the IG unit, these lessons occurred during (a) game construction, (b) game showcasing, and (c) development of strategies in game play. During the institutionalized games unit following the IG units, the observations occurred at the beginning, middle, and end of the units. Following each of these lessons, the students were asked to consider their decisions and actions to reexamine the antecedents of their decision making. Surveys and interviews captured these responses to the IG and democracy-in-action processes. Students’ initial views of games were compared to whether or not they considered the IG teaching and learning environment and their expectations of the experiences changed and in what ways. Data gathered from classrooms were analyzed through member-checking procedures for students’ level of probing, depth of engagement, social skills in action, and collective productivity.

Democracy in Action Through Inventing Games: Teachers’ Views About Teaching and Learning

S. McGinley
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This presentation reports on changes in teachers’ educational beliefs in a series of 3 interviews over 4 years. The preliminary interview took place at the start of the research study in 2010. The 2nd interview occurred at the end of the 4-year research study in 2014. The final interview took place more recently in March 2016, 2 years after the research study.

As a means to examine teacher beliefs as a result of the Inventing Games (IG) initiative during the 4 years, teachers completed a Teaching Perspectives Inventory (TPI) at 6-month intervals. This inventory includes 45 questions online (Pratt, 2001, 2002). Initially, we used the TPI to construct baselines of the teachers’ beliefs and values about learning and teaching games. The TPI identified, through reflection and dialogue, teachers’ (a) biases in actions (how we teach), (b) intentions (what we are trying to accomplish), and (c) beliefs (why we consider them important or justified). The changes monitored through the 6 completed TPIs were discussed with each individual teacher during the 2nd interviews in 2014. Major changes in teaching perspectives and key points made by teachers are reported. The final interview, 2 years after the completion of the study, examines if any changes reported have been sustainable. The overall foci will be directed by the question, “Who are you when you teach?” This presentation includes fresh teacher perspectives on how democracy in action has changed their practice, how they have seen the learning process change, and how IG fits into their worldview as global citizens.

Democracy in Action Through Inventing Games: Exploring Moments of Aporia (or Communications Difficulties) as Opportunities for Learning

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During the course of 3 years, participating teachers worked closely to develop a 9-step pedagogical process in identifying, approaching, and reflecting on moments of “aporia” and difficulties in communications during an Inventing Games unit. Participating teachers discovered, “rather than seeing these moments of aporia as an educational failure, teachers who are focused upon emergent learning see them as opportunities for learning” (Butler, personal correspondence). By developing pedagogical content for decision making, participating teachers began to note changes in their own teaching practice. Rather than “reacting” to unexpected events, teachers were able to “respond,” and therefore, their role within the classroom shifted from facilitator to guide. A “shift” also occurred within their students, as they began to discuss games in the context of being “fair,” “fun,” “flowing,” “safe,” and “inclusive.” The teacher both explicitly and implicitly taught students democratic language to use to communicate when a student or group encounters difficulty or aporia. Collectively, both the teacher and students opened up possibilities for communication, and in turn, this communication allowed for higher-level thinking about the democratic processes that are present during game play. Teacher participants reflected deeply about their own pedagogy. Similar to the cliché “You are what you eat,” participating teachers began to reflect on the idea of “You are what you teach.” As educators, our pedagogy is as important as the curriculum we teach; how we approach learning impacts the most important people in our classroom, the learners.
As educators, we experience disruptions every day in our classrooms; whether we approach those disruptions is a choice. Yes, “teaching situated ethics makes many more demands on the teacher than running drills, refereeing dodgeball, or coaching. However, there are clear steps that can be applied when a group encounters a moment of aporia or difficulty” (Butler, personal correspondence).

Democracy in Action Through Inventing Games: Student Responses

A. Berning
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This contribution will follow a coeducational group of Grade 8 students in their learning throughout a 10-class Inventing Games (IG) unit and a 10-class soccer/Ultimate Frisbee unit, which both were part of the 3-year study on democracy in action through IG. Students were given questionnaires before and after each unit.

In the IG unit, students were asked to create a game that was fair and fun and flowed nicely. The 1st questionnaire inquired about what expectation they had in a games unit, what their general understanding of democratic decision making in a group was, and how it might apply in playing games in PE. The 2nd questionnaire asked similar questions immediately after the IG unit and further included questions about their game understanding and about how a game becomes fun, fair, and “flowing.”

The focus of the 2nd unit was to learn basic skills and strategies of the institutionalized sports of soccer and Ultimate Frisbee. Students had to review their games and develop and compare strategies as a team. While the questionnaires before and after this unit still inquired about democratic processes, they also included questions about students’ understanding of the games and how they were able to develop strategy and apply it to both games.

This presentation will show how different athletic abilities, gender, and interest levels as well as the IG unit influenced students’ understanding of teamwork and game play. For example, what was the high-level soccer player able to learn when working with students whose abilities and understanding were much lower than his? What was the experience of students who were not used to team sport and who were taught by a nonspecialist as they created a game with flow and strategy together with advanced and confident athletes?

Democracy in Action Through Inventing Games: Setting the Environment

J. Sheppard
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This section summarizes what the teachers found in their planning and teaching to be most helpful in setting up a learning environment for the Inventing Games (IG) unit. We found that IG units create classroom conditions that nurture self-determination by allowing students to make choices, demonstrate competency in a range of roles, and participate in supportive peer relationships. As students learned through fluid, dynamic game play, they became engaged and activated by its intrinsic delights. Such things as effort, improvement, and mastery were perceived as natural outcomes of creative play, rather than chores to be dutifully accomplished. We also noted that students needed to be able to communicate effectively to make shared decisions in the IG process. Developing a new game requires trial and error: Students must be patient with both themselves and others as they learn to communicate and negotiate. Open dialogue and an emotionally safe environment became crucial. One teacher found it helpful to link to a unit on adventure-type activities where students had to solve problems through group decisions. These skills then transferred easily to IG. Modifications to rules and equipment created a can-do environment in which learners believed that they could achieve their desired outcomes. Self-efficacious students such as these recover quickly from setbacks; they are also more motivated and more likely to challenge themselves. As they work with and observe others, they develop tolerance for difference, sensitivity, and empathy. When they invent games, students take ownership and become self-regulating as they make up and test their own rules and evaluate their effectiveness. They make choices and discover how they work out.

Symposium: The Game Performance Assessment Instrument: Twenty Years and Counting!

Chair: S. Mitchell
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This symposium describes the Game Performance Assessment Instrument (GPAI) and its use as a research
tool and live observation instrument. The GPAI is an authentic form of game performance assessment because it: (a) provides a more complete definition of game performance than traditional assessments in games; (b) gives credit for ALL facets of performance, which benefits the lower-skilled performer; (c) is flexible in that teachers, coaches, and/or researchers can select the components of performance to assess; and (d) assesses selected components and performance criteria based on what has been taught.

Presentations will include: (a) examples of how the GPAI has been implemented as a coaching language for faster performance assessments and players’ adjustment in practices and matches; (b) the use of technology in collecting GPAI data and subsequent data analysis and reflection; (c) the use of GPAI components to foster a deeper analysis of game performance in the Game Performance Evaluation Tool (García-López, González, Gutiérrez, & Serra, 2014), which is focused on the assessment of tactical awareness (the ability to identify problems that arise while a game is in progress and to select the skills necessary to solve these problems; Mitchell, Griffin, & Oslin, 1994); and (d) the use of GPAI components to develop game performance rubrics, which are based on facets of the GPAI. Their aim is twofold: to offer teachers a basis for teaching content in physical education and sport and for providing feedback to learners and to offer teachers a means of formally and formatively assessing students’ progress in becoming more skillful players throughout the learning process.

A final presentation will include (e) a focus on 3 summary areas of GPAI utility: (1) assessment perspective, (2) strategies for using the GPAI process, and (3) the benefits of the GPAI process in relation to student learning.

**Introduction to the GPAI**

S. Mitchell  
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This presentation will introduce the Game Performance Assessment Instrument (GPAI) and describe the transition of its use from a research tool to a live observation instrument. First, differences between the GPAI and traditional forms of game performance assessment are explained. Second, components of the GPAI are defined in terms of their observable characteristics. Third, the transition of the GPAI from a research tool to a live observation instrument is described. The GPAI was originally developed as a research tool for studies investigating the impact of teaching-games-for-understanding instruction in invasion and net/wall games (Oslin, Mitchell, & Griffin, 1998). However, over time, many teachers began to use it for live assessment of game performance, thereby prompting a rethink on scoring systems due to the time limitations imposed by assessing under live conditions (i.e., not from video recording). Examples of different GPAI scoring systems are provided, specifically a tally scoring system and a rubric-based scoring system. To conclude this introduction to the GPAI, the instrument is explained as an authentic form of game performance assessment because: (a) The GPAI provides a more complete definition of game performance than traditional assessments in games; (b) the range of GPAI categories enables teachers to give credit for all facets of performance, which is to the benefit of the lower-skilled performer; (c) the GPAI is flexible in that teachers, coaches, and/or researchers can select the components of performance to assess; and (d) teachers can assess the selected components and performance criteria based on what has been taught.

**Enhancing Performance Using the GPAI as a Coaching Language in Practice and Matches Administration**

A. De Souza  
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The Game Performance Assessment Instrument (GPAI) approach was developed to assess individual game performance and serve as feedback to the performer after performance had already happened. This approach has kept the performer out of the immediate assessment and creative process. The GPAI has been demonstrated to be able to encompass the game and the performer as a whole and creates opportunities for the performer to learn about efficiency after the games have ended. In competitive sports settings, the most efficient players and the most efficient teams have shown to be the ones who can adjust to game needs and create offensive and defensive solutions during play and not after play, before the coaches have to ask for time-outs and not after. These actions keep the game unpredictable, when the players create. This presentation will share how the GPAI has been implemented as a coaching language for faster
performance assessments by the players and players’ adjustment in practices and matches. The GPAI language has helped players to become more aware of the effectiveness of their on-and-off-the-ball, tactical, and strategic choices in the game, and it has provided them with opportunities to become more creative and independent, while developing their game intelligence and performance efficacy. The game components of the GPAI are used in coaching language in practice to bring awareness to the players of what can create game efficacy. Players are encouraged to look into specific game components depending on what type of goals are being trained in practices and what strategies and tactics are being followed or created in matches. The content of the GPAI coaching language is guided by “frequency questions and goal statements” regarding frequency and efficiency of on-and-off-the-ball skill execution and tactical goals.

Reflecting on Student Learning: Using the iPad to Collect GPAI Data

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Most students look forward to “playing the game” in physical education. It is often the students’ desire to play the game that allows the game to be a site for meaningful learning when games are appropriately modified (Mitchell, Oslin, & Griffin, 2013). Thus, it is important to document student learning in the context of game play. Preservice teachers, however, often struggle to document and understand the impact of their instruction on student learning. A program in the College of Education and Allied Studies at Bridgewater State University requires students to purchase an iPad. Teacher candidates now have access to app-based technologies (e.g., Dartfish Easy Tag and Videotagger) and handheld digital recording for collection of Game Performance Assessment Instrument (GPAI) data. Teacher candidates learn to use the technology in their methods classes. Data were collected as part of an upper-level methods course, which includes classroom-based instruction and fieldwork in an urban high school. Participants were 16 teacher candidates, each coteaching 8 to 12 high school students in a 4-day minigames unit of instruction (water polo, volleyball, or badminton). The unit was focused on 1 tactical problem. Teacher candidates developed the criteria for the GPAI with the assistance of their professor and created the tool on their iPads. Teacher candidates were required to collect baseline GPAI data on the 1st day of instruction, to share the data with students on subsequent days, and to collect final GPAI data. With the use of an iPad and a teaching partner, teacher candidates are able to collect GPAI data and calculate selected indexes with ease throughout the unit. The process of collecting, analyzing, and sharing data with students allowed teacher candidates to better focus on student learning as they engaged in modified game play.

Development of GPAI Components Through GPET

Game Context Adaptation

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Decision-making can be assessed at 2 levels. The 1st level involves “what is done,” and the 2nd level evaluates “what should be done” in a particular game context or situation (Gutiérrez, González, García-López, & Mitchell, 2011). According to Grehaigne, Godbout, and Bouthier (1997), tactical-context adaptation provides information relative to the tactical process involved in the assessment of performance in team sports, while previous game performance evaluation tools have only assessed the tactical product. With regard to this 2nd level of analysis, development of the Game Performance Assessment Instrument (GPAI; Oslin, Mitchell, & Griffin, 1998) components is proposed. This deeper analysis of the GPAI is a contribution of the Game Performance Evaluation Tool (GPET; García-López, González, Gutiérrez, & Serra, 2014). The GPET is focused on the assessment of tactical awareness and the ability to identify problems and make the appropriate decisions to solve these problems (Mitchell, Griffin, & Oslin, 1994, p. 21). In doing so, a situated view to the basic tactical problems with regard to attacking (maintaining possession of the ball, penetrating the defense, and achieving the objective) is adopted. Game-centered approaches (GCAs) to games teaching, and especially the tactical games model (TGM; Mitchell, Oslin, & Griffin, 2003), develop their lessons from an overarching tactical problem. For this reason, the evaluation of game performance depending on the tactical problems, as it is proposed in this work, promotes the alignment between assessment and learning when applying GCAs (especially TGM).
Formally and Formatively Assessing Students Using Game Performance Rubrics

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Although there are numerous practitioner-orientated journal articles and books showcasing different modes of assessment in games (i.e., Game Performance Assessment Instrument, team-sport assessment procedure), the use of these modes by both researchers and practitioners is limited (Harvey & Jarrett, 2014). Some of the reasons for this limited use may be due to the instruments’ practical utility, ability to assess technical and tactical skills both on and off the ball, and the practitioners’ knowledge and ability to read and interpret results to ensure they are adequately being embedded into the teaching and learning cycle. Consequently, the aim of this presentation is to outline the initial stages in the development and validation of a range of game performance rubrics, which have been designed through the amendment and extension of concepts from the Game Performance Assessment Instrument. Brewer and Jones’s (2002) 5-step validation process was used as a guiding framework for this development process. During the presentation, information pertaining to instrument development will be outlined (e.g., literature review, amending an existing instrument, content and face validity, and observer reliability). The eventual aim of these rubrics is to offer practitioners: (a) a basis for teaching content in physical education and sport and providing feedback to learners, and (b) a means of formally and formatively assessing students’ progress in becoming more skillful players throughout the learning process.

GPAI Applications: Critical Responses and Possibilities

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In responding to the 5 presentations on the Game Performance Assessment Instrument (GPAI) approaches, the respondent will focus on 3 areas: (a) assessment perspective, (b) strategies for using the GPAI process, and (c) the benefits of the GPAI process in relation to student learning.

In relation to assessment, consideration will be given to how the GPAI offers assessments “of/for/as” learning opportunities (Earl, 2003) to enable authentic insights into how students’ off-the-ball movements enable effective game performance. This aspect of the response will focus on how well the GPAI approaches create the foundation for more engaged play and skill development.

In relation to teaching strategies, the GPAI offers a way to enable students, both children and student teachers, to see how players interact with the demands of the game and facilitates a form of game literacy in the moment and over time (Mandigo & Holt, 2004). The aspect of this response will consider how the GPAI process enables the teaching-games-for-understanding approach to be more effectively realized for a range of skill abilities and understandings.

In relation to learning, the GPAI process creates the possibility for developing strong perception-action couplings in relation to the rules, opponents, and peers’ actions (Hopper, 2011; Tan, Chow, & Davids, 2012) and between student off-the-ball movements and skill selection/execution (Mitchell, Griffith, & Olsen, 2006). The key benefit of the GPAI is that it captures the prerequisites that lead to the dynamics of game play—the emergent moments that create exciting player interactions. Such patterns of play can often be missed with a focus on game-play outcomes or skill tests. The aspect of this response will focus on how the elements of the GPAI assessment processes presented allow students to see more, do more, and visualize more effectively how they can engage in and create more worthwhile game plays.

Symposium: Complexity and the Design of Learning Systems in TGfU

Chair: A. Ovens
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In this symposium, we examine the value that working with complexity has to the teaching and coaching of games. Each of the 4 presentations provide different insights into how teachers, coaches, and researchers are working with complexity to better understand how young people learn and perform in physical activity settings. We begin with an introduction to the concept of complexity and outline some of the implications for the design of learning systems. The next 2 presentations discuss the implications that complexity has for embodied learning and working with young people in modern, highly mediated settings. Overall, the symposium aims to interrupt our traditional understandings of what it means to know, learn, and teach and focuses instead on how new understandings from theories of complexity can help
practitioners enhance their teaching, coaching, and research practices.

**Tactical Disturbances: Exploring the Complexity of Tactical Learning in Basketball**

V. Minjares  
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This presentation explores the learning experiences of members of a secondary school boys’ basketball team in Auckland, New Zealand. In particular, it takes interest in how male adolescent team members experience the tactical and strategic aspects of sport learning and decision making amid the intersecting sociomaterial contexts of their everyday lives. Drawing on a relational ontology and the theoretical framework of complexity, this study recognizes the embodied, extended, embedded, and enacted nature of cognition in sport. Participant ethnographic data have been collected across a range of training, competition, school, and team settings, including not only the focal team of interest but outside participation settings as well. This nested case study traces over time the tactical challenges faced within and across sport settings, embodied sense making in play, contextualized approaches to tactical learning and development, and how features of the school-sport ecosystem constrain and afford such processes. The findings help explain sport-based learning, curriculum, and decision making as complex processes that unfold over time from interactions of the sociomaterial context. Studying tactical learning experiences has relevance for human development through sport, particularly the intersection of cognition, learning, team sports, and the academic mission of educational institutions.

**Embodied Learning: A Simplified Pedagogical Complexity**

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This research uses a complexity thinking framework to examine teachers’ beliefs in embodied learning and the implications for modern pedagogies.

By problematizing the ethnographic accounts by New Zealand-based teachers with philosophical and scientific theories, the presentation will elaborate on the following 3 claims: (a) Teachers exhibit an innate sense of embodiment and desire to provide opportunities for students to learn through their "bodies"; (b) teachers have insufficient knowledge of the mechanics and philosophies behind embodied learning to be able to use it effectively in their pedagogies; and (c) embodied learning must play an essential role in modern education.

**Making Sense of Complexity and Its Implications for Teaching and Coaching**

R. Pucheggar  
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This presentation provides an overview of the concept of complexity and its implications for how teachers and coaches might design activities for student learning. In the past 2 decades, increased attention has been paid to the complexity of educational phenomena. The orthodox approach tends to explain education as a linear process capable of being understood at the level of its independent and constituent parts. Complexity provides ways of understanding that embrace uncertainty, nonlinearity, and the inevitable “messiness” that is inherent in game settings. The presentation will argue that for coaches and teachers, complexity provides a way of viewing the connectedness inherent in playing games and accommodates the influence of feedback loops and enabling constraints, the ability of participants to self-organize, and the nested nature of related systems. The presentation concludes by suggesting that teachers and coaches have to tap into the generative potential of complexity thinking to design teaching and coaching systems that foster the types of learning and performance outcomes conducive to quality learning.

**The Complexity Turn in Sport and Physical Education: Reflecting on an Emerging Field**

A. Ovens  
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In this presentation, I bring together some of the threads implicit in the previous presentations and consider how these enact a particular way of theorizing educational phenomena. In acknowledging that there has been an increased interest in the idea of “complexity theory,” the
main suggestion underpinning this presentation is that one does not have to “talk complexity theory” to research and discuss complex matters in teaching and coaching. Rather, attention is brought to understanding how complexity can inform the design of learning systems that enable young people to play games with skill and pleasure.

**Symposium:**
**Learners as Complex Systems: Basic Moves, Modification-by-Adaptation, and Social Coordinated Mimicry**

Chair: T. Hopper
University of Victoria, Canada
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The purpose of this symposium is to explain the connection in our work in curriculum development, motor learning, and sport pedagogy to a common interest in complexity theory. The session will focus on early-years physical education; however, insights will inform the application of teaching games for understanding at all levels of school and community sport programs. United by a common interest in the emergent nature of learning within simple, focused, modified games, we will focus on embodied learning. In this way, cognition is not a representation of an independently existing world, but rather, it is a “bringing forth” of a world through processes of learner engagement, adaptation, and self-organization around a common attractor/intent. Key for creating common attractor states for learners is the idea of modification by “adaptation” where the outcome of a game encounter is to increase the challenge to a successful player. The symposium will offer 3 phases: (a) outline of an early-years physical education curriculum approach called “Basic Moves,” which centers on a recursive process of learning through adaptive, creative, and technical tasks to set the broad context for teaching physical education; (b) explanation of the role of social coordinated mimicry in student learning with a focus on how groups of dyads and triads can be designed to maximize the mimicry of stable skill patterns between players with different abilities; (c) practical exploration, using a simple net/wall game designed so that the outcome of a game encounter results in an increase in the challenge to a successful player. This process then initiates the next game encounter between the 2 players in a recursive process of playing, adapting, and then playing again (Hopper, 2011). Through observation, we will explore how this engagement results in social coordinated mimicry as the more competent player is forced to play at the optimum level of their ability to cope with the less competent player’s game structure advantage.

**Application of Social Coordinated Mimicry: Net/Wall Example**

T. Hopper¹ and J. Rhoades²
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Demonstrating a practical exploration of learning to play net/wall games, this part of the symposium will show how a simple throw catch game can be used to create the conditions for learning to emerge through social coordinated mimicry (Chartrand & Bargh, 1999; Richardson, Marsh, Isenhower, Goodman, & Schmidt, 2007). Social coordinated mimicry implies that there is a higher degree of coordination for conditions in which pairs are visually coupled. We suggest that where 2 players’ physical interactions are coupled with the intent of a modified game, it is more likely that a social coordinated mimicry to more stable efficient movement patterns increases. It is our premise that in game play, novice players can unconsciously draw on more stable efficient movement patterns from competent opponents when both players are adapting to constraints that allow similar potentials for success (Hopper, 2012).

Framed by complexity thinking, this practical will demonstrate how a diverse pairing of players (1 competent, the other novice) will be combined in a series of task constraints that are cooperative, creative, adaptive, and technical in relation to a modified-by-adaptation game. The key idea in the tasks will be creating common attractor states for players in relation to efficient off-the-ball movements to select and execute sending skills. The modification-by-“adaptation” game will be designed so that the outcome of a game encounter results in an increase in the challenge to a successful player. This process then initiates the next game encounter between the 2 players in a recursive process of playing, adapting, and then playing again (Hopper, 2011). Through observation, we will explore how this engagement results in social coordinated mimicry as the more competent player is forced to play at the optimum level of their ability to cope with the less competent player’s game structure advantage.
**Social Coordinated Mimicry: Theoretical Applications of Current Research**

J. Rhoades¹ and T. Hopper²
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Studies have repeatedly demonstrated that socially connected dyads will tend to mimic psychomotor behaviors. Essentially, paired participants who have visual contact will mimic each other’s movements (Nagasaka, Chao, Natoya, & Fujii, 2013). Additionally, it has been found that social rapport and competence have influence on this socially based mimicry (Chartrand & Bargh, 1999). These findings support certain notions of complexity theory—specifically, ideas of constraints-based adaptations. For instance, examining students as complex adaptive systems (Hristovski, Davids, Araujo, & Passos, 2011), whose behaviors adapt to task, learner, or environmental constraints (Williams & Hodges, 2005), it becomes apparent that every student within the learning environment represents a component of the environmental constraint. Thus, there hypothetically should be an observable influence between dyadically and triadically paired students, regardless of the pairing motivation. Specifically, each time a student learns a new behavior, it changes the learning environment for every other student and thus should create adaptive pressure for each of the other students. This adaptive pressure could be a reason for the identification of socially coordinated mimicry between dyadically paired individuals.

Applications of these findings for physical education or coaching might provide unique instructional strategies. Specifically, understanding the directionality of mimicry—that is, who mimics and who is mimicked—may provide instructional designers with a method by which to engage students who have traditionally been nonengaged. Further, classroom pairing or practice strategies to take advantage of socially coordinated mimicry could allow for a greater degree of individual skill development.

**Complexity Thinking and Early Childhood Physical Education**

M. Jess and N. Carse
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This presentation discusses how complexity thinking and ecological perspective have been used to inform the design of an early childhood physical education framework. In the presentation, we discuss how key complexity principles have helped with the creation of conditions to design flexible learning tasks that support the coexistence of outcomes highlighting both predictability and unpredictability and also similarity and diversity. Accordingly, we present an early childhood physical education framework composed of 2 interrelated components: core learning and applications. Employing examples from Early Moves (Jess & MacIntyre, 2009) and Basic Moves (Jess, Dewar, & Fraser, 2004), we consider how core learning concentrates on learning experiences that accommodate the complex interaction of children’s holistic learning to integrate the efficient, adaptable, and creative attributes needed for successful participation in early-years games and other physical activity applications. Concurrently, we also consider how the early childhood framework posits the need for a pedagogical approach that supports this complex learning process by actively acknowledging children’s different starting points, the recursive elaboration process involved, and the many potential connections within, across, and beyond the physical education setting. The presentation concludes by highlighting how this complex vision of early childhood physical education should not be viewed as a set of “building blocks” or “fundamentals,” but as a move toward the design and delivery of learning experiences that seek to scaffold the nonlinear nature of children’s core learning. In addition, leading to the next presentation, we acknowledge the interactive nature of children’s learning by highlighting how teachers can create adaptive constraints in which diversity is used as an asset to benefit social coordinated mimicry as a feature of children’s learning.

**Symposium:**


Chairs: M. Raab and L. Musculus
German Sport University, Germany
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Recently, teaching games for understanding (TGfU) proponents asked 10 questions, and we will focus specifically on the 4th: How can complexity thinking be utilized to shape day-to-day physical education and coaching practices?
We compare in this session current approaches of teaching decision making and invited experts on the simple heuristic approach (Musculus), the ball-school approach (Lopes), the ecological dynamics approach (Araujo), and TGfU approaches (Harvey) for a critical evaluation of the limits and prospects of each approach. First, focusing on elite youth soccer players, the development of decision making testing the take-the-first heuristic will be presented, and conclusions for an age-related decision-making training will be drawn (Musculus et al.). Second, based on a ball-school approach, the effect of explicit, implicit, and sequential practice on decision making and skill execution in young basketball novices will be examined (Lopes et al.). Third, a training program for soccer to promote collective tactical behavior will be presented from an ecological dynamics approach (Araujo & Silva). Finally, current research on decision making in sport will be critically discussed from a TGfU perspective, and ideas on how the “interpersonal” aspects of decision making can be fostered using several pedagogical strategies, skills, and knowledge will be provided (Harvey et al.). In conclusion, we will discuss for which situation or person involved a particular learning mechanism should be beneficial and how it can be trained (Raab and Musculus as discussants).

The Effect of Top-Down and Bottom-Up Processes in the Development of Game Performance in Basketball

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The number of models of teaching sports games has been growing recently. The models can lie more toward the explicit dimension of learning (e.g., teaching games for understanding) and would refer to the top-down process or lie more toward the implicit learning pole (e.g., ball school) while emphasizing the bottom-up process. However, it is not clear how these learning processes should be applied on the road to learning games. This field-based study investigated the effect of explicit, implicit, and sequential learning (implicit–explicit) processes in the development of game performance of basketball beginners when technical and tactical training are combined. The participants were 70 novices in basketball, aged 9 to 12 years old. The experimental groups followed 3 different methods of training: (a) explicit practice for the development of declarative knowledge, (b) implicit practice for the development of procedural knowledge, (c) sequential practice (implicit first and then explicit), and (d) a control group that participated only in the measurements. All intervention groups trained for a period of 5 consecutive days, which amounted to a total duration of 25 hr. A pretest and a posttest in the form of a 3 × 3 game measured, through the Game Performance Assessment Instrument, the accuracy of the decision making and skill execution. The results show a significant effect of groups on the decision-making test, $F(3, 66) = 4.72, p = .005, \eta^2 = .18$, and skill execution test, $F(3, 66) = 5.17, p = .003, \eta^2 = .19$. A post-hoc analysis shows that the sequential group ($p < .05$) and the explicit group ($p < .05$) were more accurate than the control group on the decision-making test. In the skill execution test, the sequential group ($p < .01$) and the implicit group ($p < .05$) outperformed the control group. It seems that explicit instruction is necessary to improve accuracy of decision making, while to enhance the skill acquisition is more important for the accumulation of procedural knowledge in the early stages of learning.

Training of Team Decisional Behavior in Football From an Ecological Dynamics Approach

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Ecological dynamics has developed a 3-stage model of learning to explain to practitioners how to deal with different perceptual-motor learning rates. These stages are nested together—not sequentially where 1 comes before the other, but as concurrent processes of exploration and reinforcement (Renshaw et al., 2015). The stages include: (a) search, exploring system degrees of freedom to achieve a task goal; (b) discover, exploring task solutions and strengthening them; and (c) exploit, exploiting perceptual-motor degrees of freedom. In this talk, we extend this model to address team behavior (Silva et al., 2016). An ecological dynamics approach advocates that intrateam synchronization for decisional behavior to solve match problems is governed by locally created information, which specifies shared affordances responsible for synergy formation. To verify this claim, we evaluated coordination tendencies in 2 newly formed teams of recreational players during association football
practice games, weekly, for 15 weeks (13 matches). We investigated practice effects on 2 central features of synergies—dimensional compression and reciprocal compensation—here captured through near in-phase modes of coordination and time delays between coupled players during forward and backward movements on the field while attacking and defending. The results verified that synergies were formed and dissolved rapidly as a result of the dynamic creation of informational properties, perceived as shared affordances among performers. Practicing once a week led to improvements in the readjustment delays between copositioning team members and enabled faster regulation of coordinated team actions.

A Holistic Approach to Decision Making in Games and Sport

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Traditionally, research into decision making in sport has predominantly been conducted from a cognitivist perspective centered on elucidating the differences between “experts” and “novices” using experimental designs in laboratory settings. Light (2008) recently critiqued such an approach to the study of decision making as it reflects a “dualism” between mind and body and a mechanical view of learning that reduces learning a skill to a number of individual small parts. This view of learning fails to take into account the creative, dynamic, and unpredictable manner in which the mind works and the unpredictable and chaotic nature of team sports. In this way, cognitivist, deterministic approaches are unable to adequately account for the participants’ “lived experiences” of decision making from within an ecologically valid game context. What is more, developments in this research have been hampered by the fact that many researchers see decision making as tacit and innate and not amenable to teaching and/or coaching. Consequently, research needs to move beyond simply examining the “intrapersonal” (within the body) aspects of decision making to the “interpersonal” (outside of the body) aspects of decision making, which are also crucial to learning and developing a holistic, embodied understanding of team games within physical education and youth sport.

The aims of this presentation are to: (a) examine and critique the current research on decision making in sport and offer an alternative theoretical perspective; and (b) suggest ways that physical education teachers and youth sports practitioners can develop the “interpersonal” aspects of decision making through using an array of pedagogical strategies, skills, and knowledge.

This pedagogical understanding forms a basis from which practitioners can help performers grasp a more nuanced and holistic understanding of the “interpersonal” nature of tactics with respect to “time to action.” The presentation will conclude by overviewing how “field-based” phenomenological research methodologies may be utilized to study the “interpersonal” aspects of decision making.

Monitoring the Development of Elite Youth Soccer Players’ Decision Making: Implications for Age-Related Decision-Making Training From a Simple Heuristic Approach

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In sport, quick decision making is of high importance. For adults, strategies like the take-the-first heuristic (TTF) differentiate between expertise levels. So far, research has rarely focused on how youth athletes develop or are trained regarding their decision-making skills. This longitudinal study (t1–t4, 6-month intervals), therefore, examines how decision making develops to draw implications for age-related, cognitively oriented decision-making training. Using a temporal occlusion paradigm in a within-subjects design, 97 players aged 6 to 13 years old (“under 8” [U8]–“under 14” [U14] teams) generated options with and without time pressure by marking them on a touchpad and make a decision for their personal best option. Results of t1 indicate that players generate fewer options with time pressure in comparison with the number of options without time pressure, $F(1, 95) = 8.513$, $p = .004$, partial $\eta^2 = .08$. The 1st option is selected to be the best, according to TTF, more frequently in the time pressure condition, $\chi^2(1) = 11.60$, $p = .001$. Furthermore, youth players’ dynamic inconsistencies, meaning the mismatch between the 1st intuitive and final choice, are apparent in 22% of the decisions made with and 29% of the decisions made without time pressure. Regarding age-related changes,
decision-making process variables show, by trend, a curvilinear relation to the different-aged U8 to U14 teams. Compared with adults, age-related differences became apparent regarding dynamic inconsistency rates, which indicate that decision-making processes are indeed influenced by developmental changes. To identify sensitive phases for cognitively oriented decision-making training, age-related changes of the decision-making process will be discussed while taking additional study results (t2, February 2016) into account. From a simple heuristics approach, implications for an age-related decision-making training for players, coaches, and clubs will be discussed accordingly.

Symposium:
Dynamic Match Analysis

Chair: H. Folgado
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Recent technological development has enabled researchers to gather data from different performance scenarios while considering players positioning and action events within a specific time frame. This technology varies from global positioning systems to radio frequency devices and computer vision tracking, to name the most common, and aims to collect players’ time motion data and enable the dynamical analysis of performance. Team sports—and in particular, invasion games—present a complex dynamic by nature based on the interaction between 2 opposing sides trying to outperform 1 another. During match and training situations, players’ actions are coupled to their performance context at different interaction levels. As expected, ball, teammates’, and opponents’ positioning play an important role in this interaction process. But other factors, such as final score, teams’ development level, and players’ expertise, seem to affect the match dynamics.

In this symposium, we will focus on how different constraints affect invasion games dynamics during both match and training situations. This relation will be established while underpinning the importance of these effects to game teaching and performance optimization. Regarding the match, different performance indicators based on spatial-temporal relations between players and teams will be presented to reveal the interaction processes that form the crucial component of game analysis. Considering the training, this symposium will address the relationship of small-sided games with full-sized matches and will present how players’ dynamical interaction affects different performance indicators.

Small-Sided Games: An Optimal Training Tool to Represent Tactical Match Demands in Elite-Standard Youth Soccer Players?

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Small-sided games are an often-used training tool in soccer practices. They have proven to provide a simultaneous physical, technical, and tactical training stimulus for soccer players. Small-sided games replicate the tactical character of a match, but in a simplified format with reductions in number of players and pitch size. Like full-sized matches, players have to interact with team members and opponents to succeed in their task: score a goal or try to keep the opponent from scoring. However, whether teams show similar tactical behavior in small-sided games as in full-sized matches is largely unknown.

Previous research has shown that the pitch size is a major influence on the tactical performance of players during small-sided games. These findings demonstrate the importance of the effect of field dimensions on players’ behavior on the pitch. It is also suggested that the dimensions of the full-sized match should be adopted in small-sided games. That is, the individual area of a player in a full-sized match (i.e., 320 m²) should also be applied in small-sided games.

To identify the effect of these pitch dimensions on the tactical representativeness, a series of small-sided games was played with a different number of players and with an individual playing area of 320 m². Tactical team variables were calculated from positional data collected (local position measurement system) of an elite-standard youth soccer team during 5-v-5, 7-v-7, 9-v-9, and 11-v-11 games in training sessions and 2 full-sized matches. Results of the tactical team performance and interaction patterns provide tools for the soccer coach to design small-sided games in training sessions to match the specific aspects of tactical behavior of full-sized matches.
Real-Time Quantification of Dangerousity in Soccer Using Spatiotemporal Tracking Data

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This study describes an approach to quantify attacking and defending performance in soccer. Our method calculates a quantitative representation for the probability of scoring a goal for each moment a player has individual ball possession—we call this quantity “dangerousity.” The algorithm takes the positional information of players and the ball and uses the 4 dangerousity components of zone, control, pressure, and density. The indicator of performance quantifies the count and quality of dangerous situations of a team in a given time span, whereas dominance represents the performance difference of 2 teams.

Our evaluations are based on matches ($N = 64$) of the German Bundesliga during the 2014–2015 season. The statistical correlation between the winning probability (calculated from betting odds) and the performance indicators of goal difference ($r = .55$), shot difference ($r = .58$), passing accuracy difference ($r = .56$), duels won ($r = .24$), and ball possession ($r = .71$) shows that dominance ($r = .82$) has a greater potential to explain team performance compared with standard indicators. We use these metrics to analyze single game actions, describe the effect of interventions or main events in matches, and characterize the efficiency of teams in the course of a season.

Spatial-Temporal Patterns of Play Constrain the Success of Defensive Actions in Association Football

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In team sports, tactical behavior emerges according to the interdependent spatial-temporal relations of players and teams. In this study, we investigate the spatial-temporal relations between players and teams that constrain successful emergent actions of the defensive team. We compared sequences of play in which a pass performed “in between defensive lines” was or was not intercepted. The analysis implied the measurement of interpersonal distances between players and teams. Ninety-one sequences of play from 3 matches of a professional Premier League team (2010–2011 season) were classified as intercepted (IP; $N = 26$) and nonintercepted (NIP; $N = 65$) passes. Two-dimensional player trajectories (ProZone3®, Prozone Holding Ltd, Leeds, United Kingdom) with a frequency of 10 Hz were considered for analysis. At the team level, IP revealed higher values than NIP on distances between geometrical centers of teams and the width ratio between teams. Higher values of width in attacking teams were observed for IP compared with NIP. In contrast, lower values of width for the defending team were registered for IP with to NIP. At the local level, the analysis of the distances between defending and attacking players revealed lower distances between the ball carrier, ball receiver, and immediate defenders for IP compared with NIP. In contrast, select variables were observed to be higher for IP compared with NIP. These findings highlight the importance of using positional data to support coaches’ knowledge and intervention. Through the identification of tactical profiles of play of certain groups of players or the team in general, it will be possible to determine with better precision the vulnerabilities or the potential of the team in different game moments. Foremost, these data also revealed clear implications for training design once coaches can improve the players’ attunement to the most relevant information sources in this specific game scenario.

Changes in Offensive Tactical Performance Among Under-13 Basketball Players During 4 Months of Training

T. J. Leonardi,1,2,3 A. L. A. Soares,1 D. V. C. Brasil,1 M. C. Boscariol,1 C. E. Goncalves,4 H. M. Carvalho,1 and R. R. Paes1
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Game performance development is the focus of the teaching–learning process in team sports where tactical
decisions are key factors for success. In the present study, we examined changes of on-the-ball tactical performance in under-13 basketball players during a 4-month training period. A total of 15 players (female, \( N = 7 \); male, \( N = 8 \)) aged 12.6 ± 0.7 years participated in the study. Chronological age, stature, and body mass were considered. A standardized 3-v-3 condition (half-court, 10 min duration) was observed from August 2015 to December 2015. The team-sport assessment procedure (TSAP) proposed by Gréhaigne, Godbout, and Bouthier (1997) was used to assess players’ on-the-ball tactical performance. The rate of somatic growth during the 4-month period of training was 1.51 cm (90 % CI [0.98, 2.05]) and 1.44 kg (90 % CI [0.41, 2.47]) for stature and body mass, respectively. The magnitude of body size changes was moderate at best. The TSAP offensive performance index had an increase of 39.4% (90% CI [17.6, 65.3]) on average, and the effect size was large (\( d = 0.97 \), 90% CI [0.47, 1.47]). However, a somewhat large within-players variability was observed (29%; 90% CI [21.4, 46.0]). No differences were observed by gender. The increase in the TSAP index showed that the test was sensible for the on-the-ball tactical performance assessment of female and male under-13 basketball players, and it proved to be a useful tool for teachers and coaches.

**Symposium:**

**Sustained Collaborative Adventures in TGfU: Communities of Practice**

Chairs: H. Bohler¹ and D. Sheehy²

¹Westfield State University, United States; ²Bridgewater State University, United States  
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In this symposium, presenters will explore and share how particular communities of practice (CoP) are organizing to develop a shared knowledge and support system for learning and promoting teaching games for understanding. CoP refers to “any collectivity or group who together contribute to shared or public practices in a particular sphere of life” (Kirk & Macdonald, 1998, p. 380).

Wenger (2007) underlined 3 CoP elements: (a) Members share a domain of interest; (b) members actively pursue that interest; and (c) through sustained interaction, members develop a shared practice. This session will be valuable for those interested in promoting, establishing, and engaging in collaborative practices within a sustained, supportive environment.

**Game Curriculum Based on Legitimate Peripheral Participation**

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Most teachers implement a modified game based on an official competitive sport when using teaching games for understanding. Games are shaped in various ways, including modification of the number of players, the court size, the rules, and the type of equipment used. These modifications are used to mirror and facilitate tactical problems evident in sport. Many teachers struggle to use modification for shaping games to be effective in transforming student tactical awareness for game play. This approach can be considered to be a top-down approach, which focuses on the sport style. This presentation will offer 1 strategy that has been conceived for learning to teach games that does not focus on knowledge of the official sport, but rather tactical awareness by experiencing game play. The presenter suggests that the art of learning to teach tactical awareness is in the community of practice of preservice teachers (PTs) during participation. The presenter will share how learning can be situated and decomposed into stages and initiation rituals. Players participate in the game fully using a step-by-step curriculum map based on common tactics of the type of games, the competitive task, and goal. A new game curriculum based on legitimate peripheral participation at one Japanese university will be shared. Also, the presenter will introduce the professional development that incorporated this same framework with in-service teachers to develop their professions with PTs.

**Teaching Life Skills Through TGfU Game Play: International Collaboration of CoPs**

J. Sheppard  
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(joanna.sheppard@ufv.ca)

The Champions for Health Promoting Schools Program is dedicated to improving the life chances of children and their families in Antigua, West Indies. Through health and physical education initiatives, the Champions
Peer Mentoring: On the Move to Legitimate Peripheral Participation

D. Sheehy¹ and H. Bohler²
¹Bridgewater State University, United States; ²Westfield State University, United States (deborah.sheehy@bridgew.edu)

The purpose of this presentation is to describe how peer mentoring has been used at 2 universities to support preservice teacher (PT) development, not only in teaching games for understanding (TGfU) pedagogy, but in the profession. In the peer mentoring process, upper-level PTs are invited to “co-teach” with the professor in a sophomore-level premethods game course. In the games courses, TGfU is the model learned about and practiced. Upper-level PTs are invited to be peer mentors based on their interest to learn and develop their knowledge in TGfU. Often, these upper-level PTs need/want a semester of further experience and teaching practice prior to their final practicum to develop confidence and deepen pedagogical content knowledge. At each university, peer mentors take on some of the following roles and responsibilities with the professor: planning, teaching 1 to 2 model lessons, offering feedback on peer teachers, supporting lower-level students by answering questions related to planning and teaching, reflecting with the professor on student progress and use of TGfU, and establishing interrater reliability with Game Performance Assessment Instrument assessments on lower-level PTs’ performances. Peer mentors can be used as a tool to facilitate access to lower-level PTs’ needs and concerns, drawing them both closer to legitimate peripheral participation. By involving peer mentors, a reciprocal value among professors, peer mentors, and PTs can be created and acts to support PT development toward the domain, the community, and the practice.

Reflecting Back and Looking Forward: A TGfU Graduate Cohort

K. Pagnano Richardson
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The purpose of this session is to share the conceptualization and implementation of a teaching games for understanding (TGfU) graduate cohort at 1 university. The presenter will discuss features of this program, reflect on how this cohort served as a vehicle for a community of practice among educators in the state, and provide insights for possible future directions. In the summer of 2014, Bridgewater State University admitted its 1st cohort of students into the Master’s of Science in Physical Education, TGfU concentration. The program was designed to have a powerful face-to-face component to develop a community of practice and allowed graduate students to develop a deep understanding of the theoretical, philosophical, and practical dimensions of a constructivist approach to teaching and learning in physical education. Through engagement with the current literature in education, reflection on their own practice, and engagement in the research process, students explored the impact of applying student-centered approaches on teaching and learning in K–12 physical education. The 2014–2016 cohort began with 5 physical education teachers who had completed an initial licensure program in physical education, TGfU concentration. The program was designed to have a powerful face-to-face component to develop a community of practice and allowed graduate students to develop a deep understanding of the theoretical, philosophical, and practical dimensions of a constructivist approach to teaching and learning in physical education. The 2014–2016 cohort began with 5 physical education teachers who had completed an initial licensure program in physical education, TGfU concentration. 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The 2016–2018 cohort is projected to be 8 students. Some of the lessons learned include the impact of peer-to-peer support, the benefits and challenges of integrating noncohort students in classes with the cohort, the challenge of recruiting and retaining students, and the financial strains of completing a program in 2 years. For the 2016–2018 cohort, the next steps include changing the admission criteria and process, rethinking the curriculum to better support research proposal design,
Symposium:
Implicit Motor Learning: Applying Research Evidence to Real-World Contexts

Chair: D. G. Slade
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Applying Implicit Teaching Methods Using a Teaching-Games-for-Understanding Model of Learning for Improving Performance in the Overarm Throw in a Physical Education Context

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Finding a practical application of the theoretical construct of implicit learning in school physical education lessons is challenging. According to van der Kamp, Duivenvoorden, Kok, and van Hilvoorde (2015), the model of teaching games for understanding (TGfU) may provide an appropriate dual-task implicit learning environment when teachers undertake motor skill instruction for large groups.

The authors explored van der Kamp et al.’s (2015) hypothesis by applying implicit teaching methods using the TGfU model for improving performance in the overarm throw. One hundred students (48 boys and 52 girls) enrolled in Years 7 and 8 at a lower North Island school in New Zealand volunteered for the study. Four classes were randomly assigned to a treatment group or a control group that consisted of 50 students per group (24 boys and 26 girls). The mean ages of both groups were nearly identical (11.5 ± 0.6 years for treatment and 11.5 ± 0.5 years for control). Through a quantitative quasieperimental, field-based design, every student performed pretesting and posttesting of the distance throw, accuracy throw (AT), and choice reaction-time throw.

The control group continued with its assigned physical education program, while the treatment group participated in 6 TGfU lessons that in structure and equipment facilitated the employment of an overarm throw over variable distances, involving choice decision making and when scoring points, throwing at targets identical to those in the AT. The lessons culminated in a sport education-styled final tournament.

In 6 lessons, no student sought feedback on the overarm throwing technique, suggesting the TGfU context achieved an implicit-learning dual-task environment. Issues of team games versus equal technique engagement opportunities remain unresolved.

The posttest did not reveal any significant differences between the treatment and control groups. The treatment group also undertook a postprogram questionnaire that indicated very high levels of enjoyment and satisfaction with the teaching experience.

Errorless Learning: An Implicit Approach Applied to Fundamental Movement Skills

C. M. Capio, J. M. Poolton, K. F. Eguia, and R. S. W. Masters
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Errorless learning is one paradigm of implicit motor learning and has been suggested to be suitable for the promotion of fundamental movement skills (FMS) proficiency in children of varying abilities. By reducing the number of practice errors early in learning, stable movement performance is achieved in the face of concurrent tasks that may be competing for cognitive resources. Errorless learning has been used to train the FMS of overhand throwing within the context of physical education (PE), leading to improved performance that was stable in the presence of secondary cognitive tasks (Capio et al., 2013a). The fact that skills were unaffected by secondary cognitive tasks not only supports the implicit nature of the approach, but also justifies the application in children with cognitive limitations (i.e., intellectual disability).

The errorless learning approach generated similar stable improvements in movement performance among children with intellectual disability (Capio et al., 2013b). In this current study, errorless learning was further applied by targeting other object control skills (strike, dribble, throw, catch, kick) among children with intellectual disability (N = 20; M_age = 8.7 ± 0.8 years). Those allocated to training attended 8 weekly group practice sessions; the control group had an 8-week waiting period. Components of the Test of Gross
Motor Development-2 were used to evaluate movement proficiency at pretest and posttest.

Repeated-measures multivariate analysis of variance on pretest–posttest skill scores showed significant interactions, $F(13, 6) = 13.43, p < .001$. There were no group differences at pretest, whereas the training group displayed higher scores than the control group at posttest. This study supports the viability of errorless learning in FMS training of children during PE. It contributes to the growing evidence suggesting that errorless learning will likely promote skills acquisition with relatively less dependence on cognitive resources. Consequently, it promotes the availability of cognitive resources when dealing with changing constraints in children’s play environments. Other implicit paradigms may be explored in future research.

**Implicit Motor Skill Learning in Groups and How Teaching Games for Understanding May Contribute**

J. Duivenvoorden,1 W. Walinga,2 and J. van der Kamp3

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We discuss the differences between explicit and implicit motor skill learning. With implicit learning, there is no conscious control of movement execution, resulting in a strongly reduced accrual of declarative knowledge. This implies—we argue—that a teacher or coach intending to induce implicit learning needs to actively intervene to prevent learners from building declarative knowledge. Most of these interventions (e.g., dual tasking, errorless and analogy learning) have been validated in laboratory contexts with only the interaction between experimenter and a single participant learner; yet, in physical education and sports, motor skill learning is often taught in groups. The group dynamics raise important theoretical and empirical issues regarding the validity and applicability of implicit motor skill learning in physical education and sports that research has barely addressed.

We suggest ways to adapt laboratory-validated implicit learning interventions. In particular, we propose teaching games for understanding (TGfU) as a potential method for inducing implicit motor skill learning in groups; TGfU interventions may serve to attract attention away from motor skill performance, not unlike the dual-tasking intervention in laboratory paradigms.

In this respect, we draw attention to the necessity of empirically verifying this proposal and provide guidelines for doing so.

**The Effect of Rule Modification on Strokes in Tennis Matches: Induction of Offensive Play by Using the One-Trap Rule**

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This study investigated the effects of manipulating the number of contacts in tennis matches to understand the effects of rule modification to induce offensive play. Sixteen male tennis players with more than 3 years of tennis experience participated in this study. Each paired participant played tennis singles matches in normal- and modified-rule conditions. We used the one-trap rule that permits players to contact the ball twice per stroke. Players firstly play the ball in their own court and subsequently hit the balls after the bounce. Performance during the matches was evaluated in regards to winner (the shot that the opponent could not touch) rates and player/ball positions. Previous research has shown that hitting in the front position has offensive advantages. Because we assumed that players can adjust hitting positions by one trap, hitting position distribution was calculated using a 2-dimensional direct linear transformation method, which is a digitization method from recorded images. In addition, the shortest distance from the flying direction of the ball to the position of the opponent when hitting (Dshortest) was calculated, because time allowance made by the one-trap condition can make players hit a ball far away from the opponent. Results showed that the winner rate in the one-trap condition was significantly higher than that in the normal condition, $t(22) = 4.00, p < .05$. Averaged hitting position was approximately 12 m behind the net in the anterior-posterior direction in the normal condition and approximately 4 m behind in the one-trap condition. In a rally, Dshortest in the one-trap condition was significantly longer than that in the normal condition, $t(22) = 2.81, p < .05$. These results suggest that the rule modification can induce offensive play by providing players with more preparation time for a stroke and by moving the hitting position forward in the court. In future research, we will examine
learning effects of one-trap rule practice and investigate merits and demerits of the rule modification in detail.

Symposium: Developing Young Talent Toward Elite Performers

Chairs: A. Güllich, K. Davids, D. Farrow, and D. Memmert

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This workshop addresses the development of young talents toward outstanding senior athletes. Performance progresses—in part—as a response to the sport and physical activities in which developing athletes engage. We envisage sport activities through childhood and adolescence that facilitate the long-term development of accomplished competitive performance. Four short presentations review extant research with regard to different, but related, aspects of how coaches should design and shape practice and play.

(1) Senior world-class athletes’ developmental participation histories differ from those of the national level in greater volumes of variable sport activities, in different sports and peer-led nonorganized play, and in later specialization. Observations suggest that the interaction of specific practice with earlier variable, nonspecific experiences benefits the potential for long-term development of excellence.

(2) An ecological dynamics perspective is discussed for integrating the macro- and micro-structure of skill acquisition and talent development. Players and teams are conceptualized as complex adaptive systems where coordination tendencies emerge from the interaction between varying task and environmental constraints and players’ intentions, perceptions, and actions. The implications for the designing of practice and learning environments promoting adaptive and situationally functional skills challenge many conventions of traditional practice.

(3) Representative task designs in practice seek to reflect the behavioral demands experienced in competition. Systematic assessment of practice and performance reveals prevalent decontextualization of traditional practice methods from performance demands in competition. Research demonstrates the particular significance of temporal pressure as a critical component of representativeness in practice.

(4) Finally, studies highlighting the critical role of tactical creativity for top performance in team sports are reviewed. The presentation discusses the accuracy of different creativity tests. It then develops the “tactical creativity approach” and works out implications for the designing of practice and play in talent development.

The Macro-Structure of Developmental Participation Histories of World-Class Players

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Performance progresses—in part—as a response to the sport activities in which players engage. Macro-structural pathway models discussed in the literature (e.g., deliberate practice, early specialization, or early diversification frameworks) differ primarily in: (a) the intensity and exclusivity of early sport-specific practice/training and (b) variable experiences in various sports and nonorganized play. The presentation reviews retrospective studies comparing juvenile participation histories of senior world-class versus national-class players and a 2-year prospective quasiexperiment comparing youth elite soccer players exhibiting higher versus lower match-play performance progress.

Senior world-class players consistently reported comparable or even less organized sport-specific youth practice/training compared with national-class players but more practice/training in different sports and later specialization (in soccer, also more nonorganized play; Rees et al., 2016). In longitudinal analysis, greater performance progress correlated with more nonorganized soccer play and organized practice/training in other sports, but not more organized sport-specific practice/training. Variable nonspecific experiences elicited lagged effects in interaction with specific practice/training. Participation in different game sports was overrepresented (compared with other types of sports) in all studies, but the practiced types of sports did not differentiate success.

The presentation reflects these macro-structural findings from outstanding players’ participation histories against different approaches hypothesized in the literature to explain the mechanisms of specialized practice/training or of variable experiences (e.g., specificity of practice, deliberate practice, “monotonic benefit assumption,”
specific transfer of common elements between related sports, augmentation of the potential for subsequent long-term skill perfection, facilitation of intrinsic motivation and prolonged engagement, sustainability through cost-reducing and risk-buffering individual investment patterns, and functional matching through multiple sampling). It is concluded that future longitudinal studies may combine macro- and micro-structural perspectives while considering interactive and delayed effects of combined activities and recording their perceptual-motor, motivational, and psychosocial attributes more sophisticatedly.

From the Micro-Structure of Practice to the Macro-Structure of Talent Development: Pedagogues as Designers

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To optimize time and effort involved in training and practice to reach elite levels of performance, pedagogues need a theoretical model of “the learner” and the learning process to guide planning and organization of work with athletes. Ecological dynamics is a theoretical framework for understanding the design of learning environments in sport, inviting a reconsideration of traditional pedagogical practice in sport, and conceptualizing athletes and sports teams as complex adaptive systems (Araújo & Davids, 2011a).

Key ideas from ecological psychology and dynamical systems theory propose that coordination tendencies, within and between individual athletes, emerge as a function of interacting constraints on their intertwined intentions, perceptions, and actions. Emergent coordination tendencies in individuals and teams are continuously regulated by information for perceiving and acting on affordances or possibilities for action (Gibson, 1979). Affordances are utilized in organism–environment relations (after Gibson, 1979; see also van Dijk, Withagen, & Bongers, 2015), which in sport environments form the basis of skill acquisition (Araújo & Davids, 2011b) and can be continually developed and enhanced by attending to the micro-structure of practice (Davids, 2015).

This presentation outlines examples from research on perception and action in sport to illustrate the importance of designing representative practice task constraints that simulate (aspects of) the competitive performance environment to promote adaptations of an athlete to specific competitive environments. The more specific the information designed into practice tasks, the greater the specificity of transfer. Less specific informational constraints could also lead to learning, but through more general transfer processes. These distinctions in the micro-structure of practice, between specific and general transfer, have implications for time and effort needed for athlete talent development.

Closing the Gap Between Practice and Performance to Maximize Talent Development

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The concepts of representativeness (Brunswik, 1956) or specificity (Henry, 1968) in the fields of psychology and skill acquisition are clearly not new. When translated into the sports setting, these concepts have been contextualized as the extent to which the practice prescribed reflects the behavioral demands typically experienced in competition (Davids, Araújo, Vilar, Renshaw, & Pinder, 2013). Whichever theoretical perspective is adopted, it is argued that the closer the fit between the practice demands and performance, the more effective the skill learning. This argument has become a well-established mantra of talent development used by scientists and coaches alike. However, systematic observation of coaching practice often reveals a poor application of what is theorized, with practice often highly decontextualized from the performance demands (Barris, Farrow, & Davids, 2013; Ford, Yates, & Williams, 2010; Partington & Cushion, 2013). While there is a myriad of potential reasons for this situation, the focus of this presentation will center on how the systematic assessment of practice and performance can improve this situation by providing coaches with a clear picture of the disconnect and providing them with the necessary information to close the gap. Data will be presented from a range of high-performance sports settings including Australian football, tennis, and aquatic sports to illustrate the utility of such an approach. These data suggest that the constraint of temporal pressure is particularly influential in the overall representativeness of practice and provides coaches with a useful starting point to develop more effective talent development environments for their athletes.
Fostering Young Talents: The Case of Tactical Creativity

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The statements of the German national coach and World Cup winner of 2014 Jogi Löw substantiated the particular importance of tactical creativity in soccer: “Creativity and playful class should be the new German virtues.” First, empirical evidence from the World Cup in 2010 and 2014 demonstrated that as actions took place closer to the goal, they were evaluated as more creative. The objective of this talk is to give an overview of the literature on tactical creativity in team sports. After defining and exposing the relevance of tactical creativity in team sports, the advantages and disadvantages of different tests (video tests, game test situations) that measure tactical creativity will be compared to each other. The main focus of the talk lies in sport activities, coaching, and training environments to foster tactical creativity in youth sports. Here, I will introduce the tactical creativity approach (TCA; Memmert, 2015) for team sports, which is based on extensive research and can be seen as the basis for the development of tactical creativity. The TCA distinguishes between a micro-level (process) and a macro-level (content). The former points toward the mechanism and psychological processes in the respective training situation (micro-rules) that lead to the generation of creative ideas, and the latter points toward the organizable environmental training conditions that can be steered by teachers and coaches (macro-rules). The TCA focuses on 7 methodological principles that foster tactical creativity in team sports. All of these principles (1-dimension games, diversification, deliberate practice, deliberate play, deliberate coaching, deliberate memory, and deliberate motivation) are discussed on the basis of an empirical background. This talk is enclosed by potential directions for future research with a link to other research topics.

Symposium: An 18-Month Case Study of a Game-Centered Approach Coach Education and Development Program Within a Professional Rugby Club

Chair: L. Almond
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Learning and education are still widely regarded as a pedagogic relationship between the teacher and the learner with the teacher owning the learning process and deciding what the learner should learn (Hase & Kenyon, 2001). This belief is nowhere more prevalent than in coach education. Paralyzed by financial gains and quality assurance concerns, coach education programs are still largely certified, steplike processes, that do not reflect contextualized learning. Stodter and Cushion (2016) suggested that 1 major flaw in current formal coach education courses is that the learning experienced does not truly reflect the coach’s learning journey when acquiring new knowledge. Moreover, Cushion and Nelson (2013) argued the learning that takes place on these courses does not reflect the dynamic and cultural demands placed on the coach when they return to their natural setting.

Butler (2005) and Light (2008) have identified that an “epistemological” gap exists between game-centered approach (GCA) theory and practice (2005). Almond (2010) has proposed that teaching games for understanding (TGfU) has been accepted more openly within academia than it has with teachers and coaches. Cultural, political, contextual, individual, and operational themes have been identified in the literature as to possible reasons for this occurrence. Memmert et al. (2015) suggested that academia has a responsibility to not only share their findings through the traditional avenues, but to also provide coaches with current knowledge and understanding of GCAs to develop their pedagogical practice.

In this symposium, we will discuss a connection made through the TGfU website, a research collaboration between a university (St. Mary’s, London, England) and a professional sports club (Leinster Rugby Football Club) that resulted in an 18-month-long GCA coach education study. The symposium will consider how the study aimed to address the current conceptual, cultural, and operational challenges with adopting and implementing a GCA approach.

Measuring the Impact of an 18-Month GCA Coach Education and Development Program Within 1 Professional Rugby Club

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Harvey and Jarrett (2014) suggested that physical education teachers’ training around a game-centered approach (GCA) is largely limited in time and resources. Furthermore, studies that have examined the implementation of a pedagogical change from a GCA perspective have also had limited time during the intervention or professional development process (6–8 weeks). To the authors’ knowledge, this study is the first of its kind to examine the impact of an 18-month coach education and development program within a GCA context, that focuses on both the pedagogical and philosophical transition of both a professional sports club and its coaches. This presentation identifies the impact the study has had from an organization and coach perspective. As the study was embedded within a grounded theoretical approach, a constant comparative method was used, which meant that coding occurred throughout the study. Analysis of the data collected has initially highlighted 3 main findings of the case study. These findings suggest that the 18-month coach education and development program had redefined the coaches “understanding” of games, reshaped their personal and the organization’s coaching philosophy, and reconceptualized coach learning and development within the organization. The presentation will present the future developments of this GCA coach education and development program for the coming year while identifying the methodological issues that such a study presents. Finally, the authors propose that a rethink is required around the development and education of coaches and organizations within the context of GCAs. This rethink should include the deconstruction of learning hierarchies to enable professional sports clubs to become “learning organizations” (Senge, 1993) to successfully embrace a GCA as part of their organizational and coaching culture and identity.

A Case Study Examining an 18-Month-Long Game-Centered Approach Coach Education and Development Program—The Professional Rugby Club’s Perspective

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Research has identified that professional development opportunities are most successful when integrated into the workplace (Armour, 2010). Stodter and Cushion (2016) highlighted the fact that a coach’s learning in a rigid coach education program is often misaligned with the realities of coaching within their own organization. Taking this misalignment 1 step further, it can be argued that not only do current coach education program outcomes conflict with the complex realities of coaching, but they may also contradict and misalign with the organizational culture where the coaches work. To be able to constructively align (Biggs, 2003) the philosophical and pedagogical stance of a professional sports organization with their coaches and coach education program represents a substantial and significant challenge. Within this in mind, implementing pedagogical change at an organization level has received little or no attention from the academic world within the field of game-centered approaches. This study analyzed the process that a professional rugby club went through when engaged with the 18-month coach education and development program from an organization and coach development perspective. The methodology was based on a grounded theoretical

An Autoethnographic Study of 1 Coach’s Experience of Engaging With an 18-Month Game-Centered Approach Coach Education and Development Program

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Current research on coach education that focuses on implementing pedagogical change, specifically related to a game-centered approach (GCA), has so far been limited within the field. The studies that have examined this process have largely focused on physical education teachers or preservice teachers (Hopper, 2009; O’Leary, 2014) and have been limited in their duration. At present, we are unable to locate any studies that have examined coaches undertaking a similar shift in pedagogical practice using such a methodology. The coach concerned had limited coaching experience, although he had played for a rugby club. A range of data collection methods were adopted for this autoethnographic study. Session plans, diary entries, postsession reflections, and semistructured interviews were collected throughout the duration of the study. Concurrent verbalization was also encouraged throughout the recording of their GCA coaching sessions. Initial results of this study have highlighted the pedagogical, cultural, political, and emotional struggle the coach went through while implementing a GCA pedagogical approach. The coach also identified the approaches used to positively overcome these struggles.
approach. The participants in the study consisted of 1 coach development manager, 1 rugby manager, and 5 coach development officers. Data collection methods included semistructured interviews, field notes, observations, and memoing. The findings highlighted the cultural, political, social, and pedagogical challenges, at both a macro-level and micro-level, that exist when a professional rugby club attempts to shift its pedagogical practice across philosophical and pedagogical boundaries. Furthermore, the study identified the organizational values, behaviors, and practices that enabled the organization and coaches to embrace and fully adopt the change in pedagogical philosophy and practice.

A Case Study Examining an 18-Month-Long Game-Centered Approach Coach Education and Development Program—The Researcher’s Perspective

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Research has consistently highlighted the challenges, limitations, and benefits when attempting to implement a change in pedagogical practice to a more game-centered approach (GCA; Roberts, 2011). This study aimed to fill the knowledge and applied practice gaps that exist within GCA research (Jarrett & Harvey, 2013; Memmert et al., 2015). The methodology was based on a grounded theoretical approach. Purposive sampling was used to ensure a group of experimented coaches were included in the study. The participants in the study were 5 coach development officers (CDOs) and 12 community coaches (CCs). Four CDOs and 8 CCs completed the study. Their coaching roles within the organization varied from coach developers to grassroots coaches, and their coaching experience ranged from 1 year to 15 years. The bespoke GCA coach education program was developed from a needs analysis of the coaches within the organizations. This program consisted of thematic workshops, seminars, virtual learning activities, practical sessions, observations, peer coaching and co-coaching, and the establishment of a community of practice within a GCA context. In addition, a process of mentoring was established between the CDOs and CCs. Data collection methods included the completion of session plans before, during, and after the study. Recordings of coaching sessions before, during, and after the study were captured using Go-Pro (V4) body cameras. Semistructured interviews, field notes, observations, and recall techniques were also implemented during coaching practice. The findings suggest the positive impact a bespoke GCA coach education program can have on both the philosophical beliefs and pedagogical practice of coaches engaging in the program. The presentation will also explore the researcher’s itinerary from project design to implementation and will present the concept of “expert novice” coach educator and researcher.

Symposium: BIG Data in Sport Games

Chair: D. Link
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The technological innovations of recent years—in particular, advances in the field of position tracking—lead to enormous amounts of data. This presents new challenges including questions such as (a) how coaches and athletes can best exploit the possibilities to analyze game tactics and manage training processes, (b) how media companies can use this information to offer better and more innovative match coverage products, and (c) how new scientific insights into the nature of sporting phenomena in general and the factors that influence performance can be gained. The key for this answering these questions lies in using intelligent algorithms to derive complex performance indicators from the raw data that add real value when it comes to game analysis. There has been increased activity in this area in recent years driven by companies and the scientific community. Competing information providers are incorporating advanced methods of analysis into their software tools, and an increasing number of publications in the academic sphere have reported success in detecting tactical structures in raw data. This symposium presents the current state of research, reflects on achievements and limitations of existing technologies, and looks at the innovations that are shaping the future.

DFL Innovation Program Powering Match Analysis With Smart Data

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Access to match data has dramatically improved within the last few years. Event data (e.g., corners and shots on
goal) exist in almost all sports, and in football down to the amateur level. In addition, all major leagues in football collect positional data (“tracking data”), which can be seen in different media outputs, such as TV graphics, data-driven second-screen apps, or live sports centers. Increasing effort has been made in international elite football to give meaning to these data for match and performance analysis. Due to the complex technical and information technology-related challenges as well as the continual change and evolution of technical-tactical aspects, this task remains a challenge. This talk will provide some insights about match analysis in the Bundesliga and the role of the German Football League (DFL). One major objective is to foster technology and bring innovation to the game. Therefore, a DFL innovation program was put in place in 2015 to bridge the needs of practitioners and expertise from universities and research institutes. In the 1st round of the DFL’s innovation program, 3 scientific projects were funded. The rationale behind that program and a short overview about the projects will be presented. The key objective of the DFL program was to develop innovative key performance indicators for football by using and refining positional data—to obtain relevant and interesting “next generation” statistics.

Defensive Compactness as a Performance Indicator for Game Annotation

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Manually extracting important scenes from a whole game can be a challenging task for soccer analysts. Therefore, we developed a team performance indicator for defensive compactness in soccer to allow for automatic scene annotation using video-tracking data.

Defensive scenes were annotated if they were longer than 10 s. Two seconds of changes in ball possession were ignored. For rating the compactness, a Random Forrest classifier was trained on 17 different features computed from tracking data. The training was based on 96 scenes (from 5 games) annotated by different expert raters. The feature computation and classification were done every 0.5 s. The feature set contained simple features like maximum distances between players, as well as more elaborated features developed together with domain experts (e.g., coaches). A final team performance indicator for every scene in percent was computed using the temporal mean of the classification labels. This rating was expressed in 4 different scores per scene (total scene, start, end, and midpoint of the scene).

Classification results for a 10-fold cross-validation showed precision and recall rates of 86% for a 3-class problem using all features. The 3 class labels were low, medium, and high compactness. Rates of 96% were achieved if only 2 labels (low and high) were used (including all features) and dropped to a recognition rate of 84% if only 2 features were used. A validation using an unknown game showed an agreement of 59% between computed and rater-generated labels. The agreement increased to 97%, if only the confusion between low and high compactness was considered.

Evaluations show satisfying classification results, especially for the 2-class problem. Rating 3 parts per scene proved to be useful for finding crucial scenes. The developed assessment for compactness seems to also be suitable for large-scale analyses.

A Real-Time System for Availability Detection

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Availability is treated as 1 of the factors of success in football. In this lecture, an automated method is derived to evaluate the availability of players. First, a motion model of the players is theoretically justified on biomechanics. This model provides the time in which a player can reach any point on the football field from his starting position and present speed. Based on this information, a model for the probability of success of ground and high passes is built. The model for the probability of success of ground passes had been validated against the opinion of an expert team.

In the next step, practical performance analysis is performed on a large sample of games from the 2014–2015 season from the First German Bundesliga. The model is used to determine the availability and support of individual players in specific playing positions over multiple games.

As a future outlook, the model is used to evaluate possible sequences of passes with different passing options at each stage using algorithms from graph theory, while delivering several tactical performance indexes. Finally, the practical impact of this approach to game analysis and scouting of a professional football team using modern software tools for big data will be discussed.
An Approach to Tactical Performance Optimization in a Big Data World

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The amount of data collected from an individual player during a football match has increased significantly in recent years, following technological evolution in positional tracking. However, given the short time that separates competitions, the common analysis of these data focuses on the magnitude of actions of each player, while considering either technical or physical performance. This focus leads to a considerable amount of information not being taken into account in performance optimization, particularly while considering a sequence of different matches of the same team. In this presentation, we will present a tactical performance indicator that considers players’ overall positioning and their level of coordination during the match. This performance indicator will be applied in different time scales, with a particular focus on possible practical applications.

The Use of Self-Organizing Maps to Assess Tactical Training Effectiveness in Team Handball

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In sports game analysis, researchers primarily focused on players’ behavior during competitions. However, there is a lack of research regarding the assessment of transfer of tactical measures from training into competition. Therefore, this study aimed to assess the outcome of a tactical training intervention by a self-organizing map (SOM).

Offensive action sequences were determined from 12 official handball youth national team games in 2012. Each of the annotated action sequences contain position data from the last 5 passes prior to the shot and the shot itself (Schrapf & Tilp, 2013). Commercial software (neurosolution®) was used to cluster the action sequences into 27 tactical patterns by means of an SOM. A male handball team (17 ± 0.5 years) trained the most commonly occurring patterns for 6 weeks, 6 times a week for 60 min to 75 min against a 6:0 defense system. Following this training period, the team played a test game advised to use the trained target patterns as often as possible, while defenders were instructed to apply the 6:0 defense system. Subsequently, the position data of the offensive action sequences were tested with the SOM to analyze the assignment to the target patterns.

From 43 successfully played offensive action sequences in the test game, the SOM assigned 25 sequences (58%) to the target patterns. The remaining 18 sequences (42%) were associated with other patterns. The mean distance between the positions of the target patterns and the related pathways was less than 0.50 m, indicating a good accordance.

The application of an SOM appears to be an adequate method to recognize trained tactical patterns during competition. Offensive patterns classified during competition resembled the target patterns with high accuracy. Combined with automated tracking, the method could provide valuable feedback for coaches regarding the accuracy of the implementation of tactical trainings.

Symposium:
Learning to Teach TGfU: Pedagogical Ventures With Preservice Teachers

Chairs: H. Bohler1 and D. Sheehy2
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In this symposium, presenters will explore preservice teachers’ (PTs) learning of constructivist teaching and teaching games for understanding. Presenters will share some of their individual work with PTs at their own institutions, how learning is situated, and general outcomes of work with PTs. Sharing in this session will include PT work products and ideas for engaging PTs’ understanding of pedagogical approaches to teaching games.

Incorporating the TGfU Framework Into PETE

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The purpose of this presentation is to share a physical education teacher education 6-stage model for learning...
to teach within a teaching games for understanding (TGfU) framework. This presentation focuses on preservice teachers’ experiences with, knowledge of, and learning to teach using a TGfU model and a constructivist framework. The 6-stage engagement cycle is similar to the TGfU learning process itself and includes: (a) appreciation for teaching a concept, then transferring the knowledge to a discussion of the tasks; (b) experiencing a professor-taught model to gain strategic awareness and to consider what TGfU is and why TGfU is used; (c) engaging in a discussion seminar to reflect on understandings, share diverse ideas, and uncover the benefits of implementing TGfU; (d) development of a lesson plan within a group, based on current understanding of the model; (e) implementation of the lesson plans through peer teaching; and finally (f) a video assessment where preservice teachers watch and reflect on their own teaching and promote their understanding to teach the game using TGfU.

Changing the ‘Course’ of Games Teaching

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This presentation will offer a description of 2 courses that were developed and integrated into the curriculum at 1 university to support preservice teachers’ (PTs) learning of teaching games for understanding (TGfU). Additionally, PTs’ learning and perceptions of their experiences will be shared. Theory and practice of field-run-score and invasion games and theory and practice of net/wall and target games were designed as 3-credit, semester-long premethods courses. In each course, PTs use lessons, content, and pedagogy from the Mitchell, Griffin, and Oslin (2013) text, as well as the Rovegno and Bandhauer text (2013). PTs engage in an in-depth study of game content, tactics, constructivist pedagogy, as well as questioning, feedback, and assessment techniques. Each PT also peer-teaches multiple 30-min lessons. In-class debrief sessions with peers and individual debriefs with the professor are an important reflective aspect of the course. PTs in the 2nd cohort of implementation engaged in focus-group interviews with a TGfU expert from another university. PTs also completed a brief questionnaire. These data, along with student work products, were used to examine what students learned from the course and the perceptions of their experiences. Institutional review board approval was obtained. PTs were not required to participate in the study and were graded solely on course objectives. Constant comparison of the data revealed that PTs appreciated opportunities to practice teaching alone and with a partner. Multiple teaching episodes, participation in peers’ lessons, and observing others enhanced their understanding and application of TGfU. Reflecting after teaching helped them to recognize opportunities for improving, maintaining, and enhancing positive teaching behaviors. Novel content and complex tactical problems often elicited more desirable teaching behaviors. Few PTs demonstrated fragile and fluctuating understandings of TGfU when they mirrored direct instruction pedagogies used in the corequisite courses, thereby disabling the integrity of the model.

Concept-Mapping the Way to TGfU Pedagogy

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The purpose of this presentation is to share how a concept map assignment is used in 1 university games course to assess how preservice teachers (PTs) are growing to understand teaching games for understanding as a pedagogical approach. Concept maps are a unique and graphic means of sharing how a topic is understood. They can be used to organize and represent knowledge of a subject, as well as depict relationships among and between concepts. In this presentation, directions for the assignment will be shared, along with samples of PTs’ concept-mapping products. Based on the concept maps shown, the presenter will engage attendees in a discussion of the PTs’ knowledge structures in relationship to course content. Using concept mapping affords PTs creativity and allows students to express the depth of their learning in relation to their prior knowledge and experiences. This metacognitive process allows students to dig deeper and explore and question what they know. In addition, sharing the maps with their peers allows them to see multiple representations and interpretations of the content, while broadening their view of the information that they may not access otherwise. Concept-mapping tools allow the professor to see strengths, weaknesses, and misconceptions in knowledge structures. Concept mapping can be a valuable tool for PT education to assess and support PTs’ learning.
Suspended Disbelief and How It Works: Interacting With Avatars

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The purpose of this presentation is to describe the virtual-reality video simulation called Mursion and techniques used to engage preservice teachers while teaching a teaching games for understanding (TGfU) lesson. Suspended disbelief was the technique used that temporarily fooled preservice teachers’ senses into believing the virtual environment was reality. Thus, the technique allowed preservice teachers to practice pedagogical skills and make mistakes in a safe environment that did not place real students at risk (Kane & Staiger, 2012). A 2nd purpose of the session is to instigate discussion and questions about further use of this technology and how it is used as a means for TGfU with preservice teachers.
Decision Making and Task Constraints

Exploring the Quiet Eye Phenomenon in Basketball Game Situations

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The duration of the final fixation before movement initiation—a phenomenon labeled quiet eye (QE)—has been found to explain differences in motor expertise and performance of aiming tasks (Vickers, 2007). However, whether the same effect occurs in complex, on-field game situations remains unresolved. Consequently, this study examined intermediately (N = 10) and highly skilled (N = 7) basketball players’ QE behavior (onset, offset, and duration) as a function of performance (6 hits/misses) in undefended free-throw and defended small-sided game situations (counterbalanced order). It was predicted that differences in QE duration (Vickers, 2007) and QE offset (de Oliviera, Oudejans, & Beek, 2008) would occur as a function of expertise and performance, not depending on game situation. The players’ actions were recorded with GoPro video cameras (25 Hz) and Applied Science Laboratories mobile eye-tracking systems (25 Hz) and were analyzed using mixed-factorial analyses of variance. Results revealed earlier QE onsets and longer QE durations in undefended versus defended small-sided game situations (counterbalanced order). Independent of game situation performance, differences were found for QE offset, F(1, 15) = 4.83, p < .05, ηp² = .24, with later QE offsets for hits than for misses. Likewise, for QE duration, a main effect for performance, F(1, 15) = 11.99, p < .01, ηp² = .44, but also a significant Performance × Expertise interaction, F(1, 15) = 5.13, p < .05, ηp² = .26, were revealed. Only the highly skilled players showed longer QE durations in hits versus misses (p < .05). Finally, the 2 groups did not differ in their QE behavior (all p > .39). In summary, the study replicates positive QE effects for defended small-sided game situations but challenges the suggested mechanism in movement parametrization as the QE offset clearly exceeded movement execution. However, these findings might be explained in terms of attentional mechanisms.

Anticipation of Beach Volleyball Attacks: A Comparison of Natural Versus Animated Virtual-Reality Scenes

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Defending beach volleyball attacks requires good anticipation skills due to the highly time-constrained situations (Vansteenkiste et al., 2014). For examining the underlying mechanisms of these skills, using virtual reality is a promising approach because specific variations of players’ movements can be manipulated (e.g., the run-up of the attacker) to evaluate important cues for anticipating attacks. As a 1st step, animated virtual-reality scenes were created from natural beach volleyball attacking sequences by manually animating players’ movements in Autodesk 3dsMax. Four conditions of attacking scenes were created: animated occluded, animated not-occluded, natural occluded, and natural not-occluded. In occluded trials, videos were occluded 5 video frames (167 ms) before ball-hand contact of the attacker. Participants were instructed to decide as accurately as possible (accuracy in %) in occluded trials and to respond as fast as possible (response time in milliseconds) in nonoccluded trials. Eighty-two sport science students were tested in 120 trials with the same 30 mother trials in each condition (counterbalanced order). Videos were back-projected on a large screen, and participants responded using a 3-button response system (WiiMote). After the study, participants evaluated the animated scenes with a questionnaire. Response accuracy was analyzed with paired t tests. Performance was lower for animated scenes compared with natural scenes (55.3 % vs. 64.4 %), t(81) = 7.06, p < .01, d = 0.71, and participants responded later in animated compared with natural scenes (−170 ms vs. −237 ms before ball-hand contact), t(81) = 7.46, p < .01, d = 0.32. Lower accuracies in animated scenes imply that visual cues were less helpful for anticipation. Questionnaire data revealed that the dynamics of a shot negatively affected anticipation in animated scenes and that rather late cues were used for decisions, which could explain the later responses. Future virtual-reality applications should especially focus on the animation of relevant visual cues and the dynamics of the attack.
Development and Position Data-Related Application of a Stochastic Model for Trajectory Simulation of a Nonspinning Volleyball

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Background/Purpose: Modeling the knuckling effect in volleyball aerodynamics is essential for representing and analyzing erratic motion in a competition-related task. Based on net crossings of constant height (cf. Lithio & Webb, 2006), this study investigated the impact of position data on uncertainty quantification in numerical ball flight trajectories evaluation.

Method: The addition of Langevin forces for drag and lift to measured mean values taken from Asai et al. (2010) covers parameter uncertainty modeling in Newton’s 2nd law, while taking into consideration only 1 low-frequency component with magnitude as proposed by Wei, Lin, and Liu (1988) and phase angle as a random variable. To simplify output uncertainty modeling, an analysis of \( \sigma_{[LP]} \times \), the variance of landing points, based on Wiener-Askey polynomial chaos expansion using Legendre polynomials, is carried out. Calculated ratios of Sobol’s indexes (17.8 ± 3.8, Q\_0.05 = 11.5) for a wide range of initial values of velocity (11.1 – 23.6 ms\(^{-1}\)) and elevation angle (10\(^{\circ}\) – 21\(^{\circ}\)) indicate a dominant effect driven by drag-force fluctuations and enable a reduction in the number of random variables. Furthermore, using lift coefficient-induced dimension reduction results in neglect of the lateral direction of flight (cf. Goff & Carré, 2009) corresponding to a moderate relative error in \( \sigma_{[LP]} \times \) (3.4 ± 1.7%). Methods chosen for a subsequent characterization of flitting flights include time-averaging 99% confidence interval lengths for magnitude of position vector as well as Gauss-Legendre integration for calculation of \( \sigma_{[LP]} \times \). Additionally, a calibration of results based on recalculation assuming a speed-independent drag coefficient is used.

Analysis/Results: Overall, numerical simulations reveal a predominant occurrence of effective volleyball knuckleballs for the low-value range of initial conditions and a smooth decrease to higher values.

Conclusions: Optimizing tactics in float-serving play and volleyball engineering outline potential fields of application. Moreover, model application without uncertainty quantification may include sensitivity analysis-based investigation of perceptual trajectory illusion (McBeath, 1990).

Fitness Level of Young Female Competitive Basketball Players

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Introduction: Physiological testing of team-sport athletes is a fundamental element for designing training and for tracking each athlete’s and team’s development. To evaluate the athletic status of young elite female basketball players, several anthropometric and physiological tests were conducted.

Methods: Seventy young female basketball players (\( M_{age} = 14.7 \pm 1.2 \) years) were tested for height, body weight, body fat, vertical jump, standing long jump (SLJ), chest pass (CP), and the Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo IR 1).

Results: The female basketball players were 171 ± 7.3 cm tall, weighed 61.8 ± 8.8 kg with a body fat of 16.9 ± 5.15%. For the different vertical jumps, the highest height was measured in the counter movement jump (CMJ) with arm swing (31.1 ± 4.86 cm). The mean jump heights were 27.14 ± 3.97 cm for the CMJ, 25.62 ± 3.89 cm for the squat jumps, and 158 ± 60 cm for the SLJ. The distance for the CP was 9.82 ± 1.01 cm. The mean distance covered during the Yo-Yo IR 1 was 1,465.8 ± 464.7 m (estimated peak oxygen consumption = 48.60 ± 4.02 mL/kg/min).

Discussion: Compared with results of previously published studies, the adolescent players were smaller and less heavy but showed a similar CMJ jump height. Furthermore, the endurance level was lower than in previously published studies (58.8 ± 6.85 mL/kg/min). Therefore, basketball-specific training interventions are needed to improve the fitness level of young female basketball players specifically.

Current Trends in Performance Analysis

Exploring Scientific Learning Outcomes of a 12-Session Unit of Rugby Using the Rugby Attack Assessment Instrument (RAAI): A Micro-Level Analysis

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Our aim is to report the learning outcomes of a 12-session rugby unit using a micro-level analysis. Results were
obtained from the Index of Performance (IP) using the Rugby Attack Assessment Instrument (RAAI; Llobet-Marti et al., 2016). We applied the integrated technique-tactical model (López-Ros & Castejón, 2005) to improve tactical (and technical) behaviors in simple offensive game situations (e.g., 2 v 1, 3 v 2, 3 v 3, 5 v 5). Participants were 10 male novice players of a club (aged 17–19 years, with 4 months of experience). We report these results and describe the changes observed related to the evolution of the action frequencies of the IP during the course of the learning process with 4 assessment times: initial assessment, 2 formative assessments, and a final assessment. The RAAI assesses a 5-v-5 rugby situation for 10 min. The IP is a team score that summarizes favorable and unfavorable actions, either simple or combined. Results are described as collective measures of all members of each team in relation to these actions. Although IP results did not reveal significant improvement, results at the micro-level showed an increase in the combined favorable actions frequency (CFAF), like the actions of (a) drawing a defender and passing the ball to a teammate in a 2-v-1 situation, and (b) involving a player who is stopped by a defender but is able to pass the ball to a teammate who can keep advancing (weighted CFAF of Team A = 68, 38, 39, 87; weighted CFAF of Team B = 46, 83, 13, 131). By the end of the unit, both teams broke the defense fewer times and increased handling errors with no loss of possession. In conclusion, although the small sample size prevented significant results, players showed an increase in the execution of some tactical actions linked to the learning objectives.

**Video-Based Tactics Training in Youth Tennis**

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Problem: Training sessions of young talented tennis players frequently focus on technical and physical aspects of player development, while tactical training is neglected and there is hardly any coupling of match behavior and training. Video is mostly used for technical feedback, but recording and analyzing video clips from youth players’ matches to improve tactical skills is frequently taken as too demanding in practice. The advent of digital video made it possible to introduce game analyses in training and preparation of matches (Lames & Hansen, 2001). Several studies addressed methodological issues (e.g., the use of qualitative methods for video-based game analysis; Dreckmann et al., 2009). This study aimed to assess the effects of video-based tactics training with 10- to 14-year-old tennis players.

Methods: A field experiment with 24 players, divided into a control and experiment group, was conducted. The experimental group participated in a 12-week program where 2 weekly training sessions were devoted to video-based tactics training. Two types of variables were assessed in a pre-experiment and post-experiment test. First, players’ ability in interpreting tactical behavior was measured using a specifically developed video-based tactics test. Second, players’ tactical behavior in official matches was video-analyzed and assessed by experts (> 85 rallies per player per test).

Results: The ability to interpret tactical behavior improved significantly in the experiment group after the 12-week program, while no significant changes were recorded in the control group (F = 22.133, p < .001, η2 = .502). Comparably, results showed a significant difference between the groups for the improvement of tactical behavior in matches (e.g., for service; F = 18.165, p < .001, η2 = .452).

Discussion: The experiment demonstrated that video-based tactics training benefits the ability to interpret tactical behavior and match behavior of 10- to 14-year-old tennis players. Therefore, video-based tactics training is a recommended training method for the development of young tennis players.

**Validation and Reliability of a Game Performance Evaluation Tool for the Offensive Behavior of Players in Iranian Soccer Schools**

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The interaction between tactical knowledge and consciousness makes it difficult to measure the knowledge and understanding of a game. However, Gutierrez et al. (2011) designed a game performance evaluation tool (GPET) that is an observational system for notational analysis of the tactical decisions of a soccer player. The purpose of this study was to validate the GPET in Iranian soccer schools. Forty-eight experienced (at least 3 years of experience in a national league) and inexperienced soccer school under-11 (10 years, ± 0.9), under-14 (13 years, ± 1.02), and under-18 (16 years, ± 1.3; all groups include 8 experienced and 8 inexperienced players) players were asked to play 6 small-sided soccer games 3 v 3 with...
a goalkeeper on a 25-m × 35-m pitch. The games were recorded with a digital camera at a height of 5 m from the pitch and were then coded by the GPET. After consulting with 6 physical education experts and coaches to rate and revise some behavioral descriptions, the Content Validity Index tool was found to be 0.99 in offensive behaviors of players on and off the ball in all 3 age groups. To investigate intraobserver reliability, the videos of the mentioned games were randomly selected and the observations of 2 observers were compared at an interval of 2 weeks. The results of tactically appropriate behaviors such as ball possession, attacking the opponent’s goal, and scoring were positively correlated with each other (r = .81, .88, .97, respectively). To evaluate interobserver reliability, the coding of 2 trained observers of the videos was compared. The results showed a high agreement between observers in tactical and technical variables (kappa = .72). The GPET benefits soccer coaches in evaluating learners’ offensive behavior performance in on- and off-the-ball situations, according to the tactical situation at the present moment.

Reliability and Validity of New Shooting Accuracy Measurement System (SAMS) Software

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The aim of this study was to investigate the reliability and validity of new shooting accuracy measurement software (SAMS). Thirty-two male collegian soccer players performed 3 inner-side kicks to the transparent goal construction. A high-speed camera was placed at the back of the construction to determine where the ball made contact on the construction. Recorded video results were assessed by the SAMS and Kinovea software. To investigate test–retest reliability, the new software examined 3 kicking results twice. Also to investigate validity, kicking accuracy results obtained by the new software were compared to results provided by the Kinovea software program. Reliability of the new software was examined using concordance correlation coefficient (CCC). The Deming regression method was used to determine validity of the SAMS. After determining the compatibility in a Bland-Altman plot graphic, the Deming regression method was applied to determine systematic bias (constant and proportional error). Test–retest reproducibility of the new software was excellent, with the CCC for distance to target being .99, .99, and .99, respectively, for 3 kicks. For validity, constant error (0.44 – 1.27) and proportional error (0.97 – 0.98) were very low for distance to target. Also, constant error (−1.16 to −2.51) and proportional error (1.00 – 1.01) were very low for angular degree of the ball to target. Because of including a confidence interval of “0” for constant error and “1” for proportional error, it is not seen as a systematic bias.

In conclusion, the new software (SAMS) represents a valid, reliable, and time-effective instrument to measure the accuracy of shooting to target.

This study has been supported by the Afyon Kocatepe University Scientific Research Projects Commission (Project No. 16.KARIYER.02).

Small-Sided Team Games

Comparison of Small-Sided Game Training Versus Regular Basketball Training in Physical and Technical Skills in Basketball

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Aim: Challenges in sport sciences and coaching are not exclusively focused on clarifying the complex structures of performance and their associated parameters. The aim of this study was to compare the effects of 2 training methods based on small-sided games (SSG) and regular basketball training (RBT) on physical and technical skills of male junior basketball players.

Methods: Twenty-eight players participated in a pretesting session, 8-week intervention period, and posttesting session. Presessions and postsessions involved assessments of aerobic fitness, repeated sprint ability (RSA), agility, upper- and lower-body power, shooting, and passing skills.

Results: The main results showed that both training methods resulted in similar improvements in aerobic capacity. However, RSA was unchanged after both training methods. In addition, compared with RBT, SSG resulted in greater improvements in agility, shooting skills, and upper-body power.

Conclusion: These results suggest that SSG should be prioritized in physical conditioning of junior basketball players during the preseason; however, when RSA is targeted, more specific training is necessary. The results of this study suggest that if coaches of basketball players want to achieve greater physical and technical skills, they should organize half-court SSG games.
Does the Use of Futsal Balls Enhance the Quality of Play in School Football?

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Despite being one of the most popular sports in the world, football is also one of the most difficult games to teach in physical education, with reasons—among others—lying in the widely different experience of learners and the difficulty of running and simultaneously controlling the ball with the foot. In Germany, school football is usually taught indoors, resulting in the ball bouncing a lot more than it does on a grass field and thus making it even more difficult to control the ball, particularly for beginners. However, ball control is essential for any further actions such as passing, dribbling, or shooting. Therefore, the study’s objective was to evaluate the effects of utilizing low-bouncing futsal balls during physical education lessons in comparison with leather and indoor (felt) footballs. Technical skills and playing performance of 423 5th-grade pupils (197 female; $M_{age} = 10$ years, 11.5 months) were assessed in isolated trials (time taken to perform a certain task) as well as during 5-a-side matches (quantitative video analysis). The results indicate that utilizing futsal balls is associated with improvements in almost all areas of assessment. In particular, control of bouncing balls is significantly faster with futsal balls than with either leather or felt footballs. In play, using a futsal ball results not only in an increase in effective playtime and the number of ball contacts per player, but also in an improvement in the quality of offensive play (e.g., percentage of successful passes). Interestingly, we also found similar results in competitive high-level youth football players. In conjunction, these findings indicate that the quality of play can be greatly enhanced by using a futsal ball instead of a leather or felt football when playing or teaching football indoor with young people.

The Impact of Competition Mode and Coaching on the Amount of Actions in Youth Football

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A sufficient amount of movement supports healthy development for children. Therefore, it is important that competition and training are matched appropriately to children’s developmental stages. Horst Wein has constructed an alternative competition and training system in youth football called “FUNinio,” which is designed to provide a much higher amount of action than the current competition mode. The aim of this study is to compare the action density of “FUNinio” to that of the current competition mode under the influence of coaching.

We tested 16 children ($M_{age} = 9.9$ years) on an under-11 squad with a heterogeneous proficiency level. Data were collected on 2 different days with an identical structure: standardized warm-up (10 min) followed by 4 rounds of competition (10 min) with 4 recuperation phases (7 min) in between. Two rounds were coached, and 2 were not. On the 1st day, the children played the standard mode of “FUNinio,” and on the 2nd day, they played 7 v 7. The teams were put together based on the coaches’ judgments to be equal in performance. Everything was videotaped, and the footage was used to count different actions (shots, passes, ball contacts, goals). All 4 parameters were analyzed by a linear model with repeated measurement with the 2 factors of competition mode and coaching. There were significant ($p < .001$) effects of competition mode so that all 4 parameters (shots, passes, ball contacts, goals) were much higher in the “FUNinio” condition. There were no other significant effects. The results indicate that FUNinio provides a much higher amount of actions than the current competition mode.

The Impact of Competition Mode and Coaching on Physical Load in Youth Football

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A sufficient amount of movement supports healthy development for children. Therefore, it is important that competition and training are matched appropriately to children’s developmental stages. Horst Wein has constructed an alternative competition and training system in youth football called “FUNinio,” which is designed in accordance with the developmental characteristics (physical, psychological) of children. It claims to increase and level the inequality in physical load produced by the current system. This study tested the hypotheses
that “FUNinio” increases and levels children’s physical load in comparison with the current 7 v 7, independent of external coaching.

We tested 16 children ($M_{age} = 9.9$ years) with a heterogeneous proficiency level. Data were collected on 2 different days with an identical timetable: standardized warm-up (10 min) followed by 4 rounds of competition (10 min) with 4 recuperation phases (7 min) in between. Two rounds were coached, and 2 were not. On the 1st day, the children played the standard mode of “FUNinio,” and on the 2nd day, they played 7 v 7. The teams were put together based on the coaches’ judgment to be equal in performance. Data of physical load (number of steps, mean speed, heart rate) were collected via a pedometer, a global positioning-tracking system, and a heart rate belt, respectively. All parameters were analyzed by a linear model with repeated measurement with the 2 factors of competition mode and coaching. The effects for competition mode were significant ($p < .001$) so that all 3 variables (number of steps, mean speed, heart rate) were higher in the “FUNinio” condition. The only significant effect ($p < .001$) for coaching showed that active coaching increased mean speed. There were no significant interaction effects. The results show that “FUNinio” increases and levels the physical load in all 3 dimensions, but only mean speed could be influenced by coaching.

**The Integrated Technique-Tactical Model (IT-TM) in a 12-Session Unit of Rugby With Novice Players: Application and Overall Outcomes**

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In this communication, we describe the use of the integrated technique-tactical model (IT-TM; López-Ros & Castejón, 2005) in a 12-session unit of rugby union. Participants were 10 male novice club players aged 17 to 19 years old. The IT-TM is a game-centered approach that originated in Spain partially out of the influence of teaching games for understanding and the French tactical decision-learning model. This approach takes into account the integrated development of techniques and tactical behaviors using game situations. Our research is consistent with the practice-referenced approach (Kirk, 2005) because it reports a real coaching experience in a naturalistic setting with novice players. We show principles and tasks of the learning process and learning outcomes of the preassessment, formative, and summative assessment of players’ game performance using the Rugby Attack Assessment Instrument (RAAI; Llobet-Martí et al., 2016). The RAAI is based on coding the actions of the ball carrier and their tactical weights relative to their outcomes during a 5-v-5 game situation. The Index of Performance (IP) is a holistic team measure used for scoring purposes. Results of the IP on this macro-level show no significant linear trend for each team (A and B) at the 4 assessment times ($p = .504$ and .851, respectively).

**New Theoretical Directions for TGfU**

**Is It Possible to Unify Teaching Games for Understanding With Nonlinearity to Improve Creativity in Team Sports?**

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Introduction: Despite the excellent coverage of the connections between teaching games for understanding (TGfU) and nonlinear pedagogy (Tan, Chow, & Davids, 2012), the potential of integrating both approaches to boost the creative behavior in team sports still remains unexplored. Therefore, the aim of this study was to examine the effects of a nonlinear game-centered program in individual and collective game behavior in team sports.

Methods: Forty children, without previous experiences in sports, were allocated to control ($N = 18$, $M_{age} = 9.2 \pm 0.4$ years) and experimental ($N = 22$, $M_{age} = 9.5 \pm 0.7$ years) groups. Experimental children participated in a 5-month training program with 3 sessions per week (60 min each), involving the TGfU approach embodied in the nonlinear pedagogy principles. Individual and collective game behavior was assessed during a 3-a-side small-sided football game with a goalkeeper on a 10-m x 12-m pitch. The in-game individual exploratory behavior (attempts, fluency, and versatility) in ball possession was measured through a designed spreadsheet entitled “Creativity Behavior Assessment in Team Sports.” Furthermore, in-game collective behavior was measured through positional-derived variables, collected by a global positioning system, and processed with an approximate entropy technique to compute the amount of the players’ movement regularity.
Results and Discussion: The results suggest that the training program nurtures the players’ individual exploratory behavior through the attempts and versatility improvement in the game. Still, it promotes a high interplayer positional regularity (more repeatable movement patterns), indicating an intentional positional adjustment as a result of the players’ game perceptions and revealing a better understanding of the game. In fact, a nonlinear game-centered program provides freedom to experiment and produce a variety of novel motion configurations, which in turn gives children the opportunity to explore and adapt continuously. Moreover, it could be speculated that variability demands provided by both approaches lead to great effects in children’s capacity to adjust collective actions and unlock their creative potential.

*Developing Physical Education Teachers’ TGfU Content and Pedagogical Content Knowledge*

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Purpose: This presentation reports on a study that helps answer the question, “How can [teaching games for understanding (TGfU)]-related approaches be implemented in teacher or coach education with the goal of facilitating preservice and in-service teachers/coaches’ learning to teach (developing content knowledge [CK] and pedagogical content knowledge [PCK]) and thereby foster their professional development from novices to experienced practitioners?” (Memmert et al., 2015, p. 351).

Method: Fifty-nine Botswana Junior High School in-service physical education teachers were randomly assigned to 3 groups (experimental group 1 [EG1], experimental group 2 [EG2], and control). EG1 participants were exposed to a 3-day TGfU training workshop, which included lectures and practical sessions. EG2 participants also received the same TGfU training workshop together with onsite TGfU teacher-led planning discussions before and after each lesson (hybrid training). The control group received no TGfU training. A TGfU knowledge questionnaire was administered before and after workshop training to assess physical education teachers’ TGfU CK. To assess teachers’ TGfU PCK, a subset of 17 teachers was selected through stratified random sampling to have their pregames and postgames lessons recorded and coded using the System for Observing the Teaching of Games in Physical Education (SOTG–PE; Roberts & Fairclough, 2012). Groups were compared on teacher–learner interaction and lesson content component scores. Additional comparisons were made between pedagogical principles used and types of questions posed during lessons.

Results: Workshop training significantly improved physical education teachers’ TGfU CK scores between the control and experimental group, \( t(60) = 1.93, p = .06 \). Analysis using one-way analysis of variance and Kruskal Wallis tests on different component scores of the SOTG–PE revealed that both experimental groups significantly (\( p < .05 \)) improved their PCK components when compared with the control group. However, no significant difference in PCK was observed between experimental groups.

Conclusion: Though the traditional workshop facilitates TGfU learning by teachers, the hybrid training as a PD has a greater impact on the implementation of TGfU.

*TGfU, But Not as We Know It*

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During the last 30 years, traditional skill-based game-teaching models have gradually been supplemented by instruction under an inclusive banner of teaching games for understanding (TGfU). This approach focuses on developing tactical understanding through modified games and a philosophy that places the learner rather than the game at the center of instruction. We argue that because no 2 students learn or conceive knowledge in exactly the same way, teaching contexts require a more flexible approach to instruction, based on a methodological continuum of empirical to radical constructivism. Providing learners with sufficient opportunities to learn requires flexibility and a holistic experiential approach to teaching that is appropriate for the learner, activity, and context. We note that pedagogical practices associated with modifying or constraining games are much more than solution-based learning outcomes. They contribute to overcoming the movement competency barrier and assist teachers in facilitating “learning games through understanding.” We suggest that maintaining the art of teaching is not achieved by being ideologically bound to 1 methodology of instruction. Rather, it is the flexible nature of one’s (TGfU) philosophy and access to a variety of appropriate pedagogical models coupled with the ability to discern learners’ needs that are the keys to
providing sufficient opportunities for learning games. The presentation will highlight how this philosophical approach to TGfU can be transferred to physical education and coaching settings.

TGFU in Nature: The Czech Way

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The Czech educator Comenius (Jan Komenský, 1592–1670) wrote about outdoor experiences and games some 400 years ago. His work can be understood as a basis for the roots of experiential education and education in nature. Comenius believed in educating the whole person and linking the ideals of the Greek holistic philosophy of education, kalokagathia, involving educating the mind, body, and soul through experiences in nature using all the senses. He also believed in the use of games, play, and traveling in achieving educational outcomes, particularly for improving youth self-esteem and interpersonal relationships. While the English term outdoor education is accepted in Czech as výchova v přírodě, its translation as education in nature involves tourism activities defined as traveling for fun and playing games with the aim of learning about nature. The original form of turistika involved active movement on foot (i.e., walking, hiking).

By the end of the 19th century, due to British and German influence, there was also a rapid development of outdoor sports, especially rowing, water sports, skiing, and cycling, which further influenced the separation of sports from turistika activities, and newer types started to be formed—on bikes, canoes, skis. Turistika also involves other outdoor and cultural activities (e.g., local history, art, music). While some tourism definitions involve traveling away from local environments, turistika is culturally unique and specific to the Czech context and environment. The Department of Outdoor Sports and Outdoor Education has continued these traditions based at the Faculty of Physical Education and Sport at Charles University Prague since 1958. Their programs provide an integrated approach to physical education combining sports, games, and creative and touristic activities with group experiences in nature. The presentation will highlight how this holistic philosophical approach to teaching games for understanding in nature can be transferred to international outdoor settings.

Psychophysical Factors Affect Team-Sports Performance

Gibson, Yygotsky, and Bourdieu and Intentional Human Movement

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As a proponent of ecological and dynamical systems theorizing about intentional human movement, I recognize the need to juxtapose the direct perception approach of ecological psychology with the indirect perception approach of information processing to try to discredit the mind–body dichotomy, but I am concerned that in doing so, we could be unintentionally excluding other theories of how our mind contributes to intentional human movement. When we fail to recognize the contribution of mindful intentionality, we are in danger of moving from a preponderance of total mind-controlled information-processing theorizing to an interpretation of indirect perception that is “mindless.” This, in my view, is a limited explanation of direct perception, affordance theory, and ecological psychology, and so we need to demonstrate how the mind contributes as an internalized affordance. We could gain by considering, alongside Gibson’s theory of direct perception, Vygotsky’s theory of imagination and the role of play in developing what he referred to as sensorimotor imagination. We could also draw on Bourdieu’s social theory of the logic of practice to explain the impact of social affordances. So if we combined Gibson, Vygotsky, and Bourdieu, we could find that given the affordance of the situation and a holistically conceived imagination of possibilities, we have the social-constructed mind–body synergy as a total ecology of action that is necessary for intentional movement.

Individual Success and Personality of Professional Soccer Players: How Self-Report and Objective Performance Data Differ

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Introduction: The relationship between personality and success in team sports such as soccer has been discussed for years (Singer, 2004). Often, research has focused on team success (Cooper & Payne, 1972). At the personal
level, especially general criteria such as league or squad membership were examined (e.g., van Yperen, 2009; Zuber, Zibung, & Conzelmann, 2015), because individual career performance is difficult to operationalize. Alternatively, you could question the athletes themselves for a success rating. But do you gain reliable and valid data this way? How does personality of successful and less successful athletes differ, regarding operationalization (objective/subjective success)? This study is supposed to answer these questions.

Method: To receive objective data of success, we used the playing times in various competitions of 147 retired German soccer players (1st and 2nd league). For weighting and standardization of the competition levels, we asked 504 soccer supporters in a preliminary study. Personality was measured by the German version of the Business-Focused Inventory of Personality-6 Factors (Hossiep & Krüger, 2012). Items for self-reported success were added to the questionnaire.

Results: Objective and self-reported success have a moderately high correlation (r = .53). Regarding personality, athletes who attribute a high success to themselves show higher values in discipline, engagement, and emotional stability compared with subjectively less successful players.

Considering the objective data, successful athletes score lower in cooperation and social competence compared with less successful players. There are no differences in the other traits. Furthermore, personality explains at least 13.4% of success variance in soccer, independent of other characteristics (e.g., soccer skills).

Discussion: The results show a relationship between subjective and objective success data but also different personality profiles of successful athletes. Indeed, these findings should be considered in terms of success operationalization. In practice, decision makers could utilize these findings for team selection and training optimization. Moreover, researchers might focus on self-perception of success in further studies.

The Effects of Team Constitution on Tactical Behavior of Teams During 7-a-side Football in Small-Sided Games

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This study aimed to identify the effects of team formation on tactical behavior of teams during 7-a-side football small-sided games. Twenty-three semiprofessional football players participated in the study and were divided in 3 teams, based on their playing positions: Team 4:3:0

Pre-Event Competitive State Anxiety Fluctuations: Intensity, Direction, and Frequency Accounts Using the Time-to-Event Paradigm

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Background and Purpose: Examination of competitive anxiety responses as temporal events that unfold as time to competition moves closer has emerged as a topical area for research within the theoretical domain of sport psychology (Cerin, Szabo, Hunt, & Williams, 2000). However, very little is known about the pre-event patterning from a holistic perspective. The present study examined temporal responses associated with competitive anxiety and integrated dimensions of intensity, directional perceptions, and frequency of intrusions in athletes with respect to between-subjects variables across gender and skill level.

Methods: Elite table tennis athletes from the Ghanaian league (N = 90) completed the modified version of the Competitive State Anxiety Inventory-2 at 3 temporal phases (7 days, 2 days, and 1 hr) prior to a competitive fixture.

Results: Multivariate analysis of variance (Gender × Skill Level × Time to Event) with follow-up analyses revealed significant interactions for between-subjects factors on competitive state anxiety dimensions of intensity, direction, and frequency. Notably, elite (international) female athletes were less cognitively anxious, showed more facilitative interpretations toward somatic anxiety symptoms, and experienced less frequent somatic anxiety symptoms than their male counterparts. For time-to-event effects, intensity of cognitive anxiety fluctuated, increased progressively, and became more facilitative as competition neared. Debilitative somatic anxiety interpretations slightly improved with high self-confidence displays 1 hr before competition.

Conclusions: These findings suggest a more dynamic image of elite athletes’ precompetitive anxiety responses that require effective structure, content, and timing of psychological skills interventions, and perhaps, cultural differences might have influenced the outcomes.
(4 defenders and 3 midfielders); Team 4:1:2 (4 defenders, 1 midfielder, and 2 forwards); and Team 4:0:3 (4 midfielders and 3 forwards). Each team played against each other twice in randomized sequence in a 62-m × 50-m pitch for 5 min. Players’ trajectories were gathered using a nondifferential 5-Hz global positioning system and were used to compute the following variables: individual–distance from each player to both one’s own and the opponent’s team centroid (Dist CG and Dist OPP CG, respectively), individual area, and total distance covered; collective–team length, team width, and surface area. Approximate entropy was measured to identify the regularity pattern from the time series of each variable. Team 4:3:0 showed lower approximate entropy (ApEn) values in the individual area compared with Team 4:1:2 (very likely lower, Cohen’s $d = -0.88 \pm 0.63$) and Team 4:0:3 (likely lower, Cohen’s $d = -0.58 \pm 0.63$). Team 4:1:2 showed moderately higher ApEn values in the Dist CG in comparison with both Team 4:3:0 (likely higher, Cohen’s $d = 0.66 \pm 0.63$) and Team 4:0:3 (very likely higher, Cohen’s $d = 0.91 \pm 0.63$). On the other hand, Team 4:0:3 revealed lower ApEn in the Dist OPP CG in comparison with Team 4:3:0 (likely lower, Cohen’s $d = -0.77 \pm 0.63$) and Team 4:1:2 (very likely lower, Cohen’s $d = -0.99 \pm 0.63$). In conclusion, Team 4:3:0 revealed higher regularity on individual space occupation, while Team 4:1:2 seemed to mainly sustain their positioning decisions on teammates’ behavior. Conversely, Team 4:0:3 looked to be more fine-tuned with the opponent’s displacements. Overall, the teams’ constitutions present different emergent behaviors and should be taken into account during training tasks design.

The Influence of Handedness on Performance on the Different Playing Positions in Female Team Handball

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As part of the performance profile for team handball, handedness is frequently named. However, the topic of handedness in team handball is not sufficiently specified, because there still is a discrepancy between recommendations for training and empirical data. Left handers often play in the right-wing player position. If there are no left handers available, that position is often filled with young and tactically inexperienced players. To develop the full potential of players, a positioning according to handedness is appropriate. According to neuropsychological data concerning the use of hemispheres, differences between left- and right-handed players are to be expected, especially regarding reaction time and tactical skill (Noroozian et al., 2012).

The placement of players with different handedness in female German team handball was investigated in the present study. Further, the influence of handedness on certain handball-relevant performance factors was assessed. Finally, the selection mechanisms for left handers are surveyed and discussed. Six hundred fifty-four female players of the DHB (German Handball Association) were tested for handedness, constitution, technique, tactical ability, and physiological and psychological factors.

Results show that position-specific preferences regarding handedness (left handers on the right side of the court, right handers in center back, and both handers in the goal) are evident. In addition, the psychological variable of action versus state orientation differentiated between right- and left-handed players. No differences were evident for any of the tactical and reaction-time variables between left and right handers. Based on these findings, coaches could take into account more sensitive selection procedures considering left handers.

Team Tactics

Key Information From Complex Interaction Processes in Football

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Contemporary data acquisition techniques are able to provide data in enormous amounts. Even computer-based data analysis techniques seem to have problems detecting key information hidden in the data frequently. The problem can be clarified with an example from football: During a 90-min soccer game, video-based data-recording systems can produce (at least) 25 xy-position data of the 22 players as well as the ball per second, adding up to $90 \times 60 \times 25 \times (22 + 1) \times 2 = 6,210,000$ pieces of data per match. There is a tremendous variety of possible games, while most of the games have extremely different data representations. In contrast, the term “key information” is intended to reduce a whole game with all its complex activities and dynamics to just a handful of encoding numbers. In particular, key performance indicators (KPIs) like ball possession rates and pressure
intensity, in which coaches are interested, do not offer significant information if not embedded in the context of processes and playing dynamics—even more if such indicators are used to plan more successful tactical processes. For this reason, the analysis software SOCCER (Perl & Memmert, 2013) uses position data not only for calculating a long list of numerical indicators, but SOCCER analyzes patterns of attacking and defending activities, type and success of passes, as well as rates of space control in critical areas to measure the significance of KPIs in the context of playing processes. For example, pressure and number of bypassed players are indicators of passes and therefore do not make sense as mean values over a game, but only in the context of type and success of those passes. Space-control rates and ball-control frequencies as indicators of attacks do not count as much, if not correlating with each other and occurring in the opponent’s critical areas.

Kinematic and Tactical Analyses in Youth Soccer

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Introduction: While in professional soccer many statistics are given even in real time, only few studies in youth soccer exist to analyze tactical and physical performance. The aim of our explorative study was to describe and compare kinematics and tactical performance of boys and girls in a 9-a-side soccer match.

Methods: A soccer match between a female under-13 team and a male under-13 team was recorded with 2 video cameras and a high-frequency local position measurement system. Kinematic data like total distances and speed structure were analyzed. Speed zones were defined as referring to the maximum-occurring sprinting speed for boys and girls separately. Tactical performance was assessed by analyzing characteristics of ball possession periods.

Results: The average total distance covered during the 60-min match was not significantly different between boys (5,341 m) and girls (5,562 m; p > .05) and was divided into walking (34.2%), jogging (35.3%), running (13.5%), high-speed running (13.3%), and sprinting (2.4%). The playing time comprised 21 min of possession for the boys and 17 min for the girls, 16 min of stoppages, and 7 min of phases without control. Boys and girls passed 1.9 times per possession on average (p > .05).

Discussion: The physical load and speed structure were similar for boys and girls. The number of passes per possession was not different for boys and girls, but it was quite low in comparison with professionals (Hughes & Franks, 2005). Moreover, the duration of stoppages was shorter, and there were more phases without control in youth soccer than in professional soccer. More matches should be analyzed while focusing on different age groups, genders, and levels of players and to create recommendations for training in youth soccer.

Impact of the ‘Warm-Up Game’ on Tactical Awareness

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Introduction: Suzuki (2014) proposed a new idea in the introduction of teaching games for understanding (TGfU): the “warm-up game,” which is a large modified game for doing a warm-up and executing the skills. The purpose of this study was to clarify that the “warm-up game” had a strong impact on tactical awareness during the lesson.

Materials and Methods: A comparison was made between 2 classes that incorporated different forms of warming up (the “warm-up game” and skill practice). Data collection was done during 7 sessions scheduled from January 13, 2016, to February 8, 2016. Six randomly selected players per group served as participants and were investigated during a modified basketball game (4 v 4). Two researchers analyzed the games using the Game Performance Assessment Instrument (GPAI) separately. The focus of the analysis was on players’ tactical decision making. Two additional researchers implemented the fieldwork. One observed the game while teaching. Another observed the game while participating in the lesson.

Main Results: The GPAI analyses showed significant differences between the 2 classes. The “warm-up game” promoted students’ understanding of tactics. The results of the fieldwork were similar and showed that students in the “warm-up game” group appreciated the game framework and understood the tactical problem based on it. Therefore, students who played the game after
taking the warm-up game, promoted their decision-making competence. Hence, the “warm-up game” had a strong impact on tactical awareness.

Discussion and Conclusion: Based on the results of the present research, teachers are well advised to incorporate the “warm-up game” at the beginning of TGfU lessons instead of skill practice.

Emergence of Self-Organized Team Tactical Behaviors During a Preseason Football Game

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The aim of this study was to identify the soft-assembled hierarchical dynamics of team tactical behavior during football game competition. Twenty male professional football players on the same team participated in a preseason match. Positional data from the outfield players were collected using 5-Hz global positioning system units (SPI Pro, GPSports, Canberra, Australia). Twenty-nine categories were determined from 8 positional measures creating multivariate binary (Boolean) time-series matrices. A soft-assembled hierarchy model was applied by using 2 statistical analyses: a hierarchical principal components analysis and the calculation of dynamic overlap order parameter q. These analyses allowed for determining the hierarchical structure of the emergent tactical patterns and its dynamic properties. The sequential reduction of each set level of principal components (PCs) revealed 1 PC as the slowest collective variable forming the global basin of attraction of tactical patterns. The dynamic overlap showed the time scale on which the exploration of varied collective tactical behaviors saturates.

Differences Between Knockout and Group Matches: An Analysis of Tactical Behavior in Football During the FIFA World Cup 2014

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Introduction: An analysis of tournaments in sports games is often performed as a summary for all matches. However, there is reason to believe that teams behave differently depending on the tournament’s stage (Mackenzie & Cushion, 2013). This difference in behavior could lead to a different relation concerning tactical behavior because of a different structure of performance. Therefore, an analysis of the FIFA World Cup 2014 was conducted to examine differences in the structure of tactical behavior between knockout (ko) and group matches.

Methods: For the notational analysis, a football match was subdivided into different states. The attacking team had to solve successive states: (a) control the ball, (b) spatial progression, and (c) prepare a scoring opportunity leading to (d) the goal shot. The defense faced corresponding tasks beside the omnipresent task to win the ball. Based on the relative transitions between these states, 11 tactical metrics were calculated (Winter & Pfeiffer, 2015). Thirty-eight matches of the FIFA World Cup 2014 were analyzed. An explorative factor analysis (Varimax) was conducted subsequently for ko and group matches separately to analyze the relations between the metrics.

Results: Screeplots showed 4 factors for the ko matches as well as for the group matches. For the latter, the factors are transition after ball win (32.24%), offense and scoring (19.93%), transition after ball loss (17.86%), and defense (14.37 %) explaining 84.41% of the variance. The factors for the ko matches explain 86.56% of the variance and consist of transition in both ways (41.69%), offense (21.67%), defense (12.73%), and scoring (10.47%).

Discussion: Factor analysis showed that tactical metrics represent different dimensions depending on the stage of the tournament, indicating differences in the structure of performance. Therefore, future research should separate group matches and ko matches. In the final stage of the World Cup, success in scoring is less
dependent on other offensive behavior than in group matches.

Interaction Between Offensive and Defensive Behavior of Opposing Teams in Team Handball Analyzed by Artificial Neural Networks

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The analysis of game tactics is of high interest for researchers as well as for practitioners. However, the analysis of the interaction between teams is not well established. Therefore, the present study attempted to examine the interaction between offensive and defensive behavior of opposing teams in team handball.

Twelve games from the EURO-Men-18 Championship 2012 were analyzed with a custom-made analysis system (Rudelsdorfer et al., 2014). Position data from 723 action sequences were used to find typical patterns of offensive and defensive players by means of artificial neural networks (ANNs). Patterns were determined separately for offensive and defensive behavior. Subsequently, the most frequently occurring pattern combinations were analyzed with regard to their goal success and the distance between offensive and defensive players.

The training process of the ANNs led to 25 offensive and 13 defensive clusters. Out of all possible cluster combinations, 214 were realized within the analyzed games. Frequency analysis highlights 16 common combinations with a scoring rate of 30% to 90% and an average distance of the shooting player to the nearest defending player of 0.76 m to 2.07 m. No statistically significant relation between the cluster combinations, the scoring rate, and the distance between the shooting player and the nearest defending player was found. However, results revealed tendencies toward higher efficiency of some patterns. Moreover, odds ratio analysis revealed favorable defensive behavior.

Results indicate that ANNs are an adequate method to analyze the interaction between offensive and defensive behavior based on players’ positions. Although we could not detect significant differences between the different playing behaviors, odds ratio analysis demonstrated the advantage of specific defensive tactics against a specific offensive tactic.

TGfU in the Field

About Teaching Games in Brazil: National Scientific Production and the TGfU

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This project aimed to analyze the Brazilian physical education scientific production related to teaching collective sports and the teaching games for understanding (TGfU) presence in that scenario. For this reason, we have searched through Qualis Capes for national physical education journals of pronounced value. With these criteria, we defined 10 magazines to find articles regarding the target issue of research and found 516 documents, which will contribute to understand the national stage of research on teaching methods.

Sports education in Brazil is historically based on the traditional technique-centered perspective. Since the 1980s, the debate about the teaching process has motivated the proposition of different pedagogic perspectives. Nowadays, the Brazilian physical education professionals comprehend the importance of teaching about “how to play the game,” while discussing methodological and curricular aspects to organize the sports teaching. In this sense, we have looked for Brazilian universities and authors who contributed the most to this debate. We also intend to respond to what is being produced about TGfU in Brazil and what is discussed about this process. For now, the Movimento and Motriz journals, the most important periodic publications in Brazilian physical education, revealed 23 articles that discuss sports teaching. The university that contributed the most was Unicamp, with 8 articles. Bayer, Garganta, and Greco were the most quoted authors in the articles. The TGfU authors who appear more times are Tim Hopper, David Bunker, and Linda Griffin. There are differences in periodicity, quantity, and contents between the journals. The outcome of this project will allow researchers to analyze the Brazilian physical education system and its impact on the sports-teaching process, as well as aspects related to professional qualifications, teaching models adopted, knowledge of teaching methods, and the adoption of the TGfU method, which is not well disseminated across the country yet.
Application of Teaching Games for Understanding (TGfU) in Preschool Children Basketball Education

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The present work investigated the effects of a teaching games for understanding (TGfU) training among 5- to 6-year-old preschool children with respect to recognition, motor learning, emotions, and game performance in basketball. Ethical approval from the university’s ethics committee was sought, and subsequently, 20 children were recruited from a local kindergarten, including 10 boys and 10 girls, after parents provided informed consent. Participants underwent an 18-week TGfU-based training. Dependent variables were recognition performance, motor skill, emotional attitude, and game performance, and they were tested at pretraining and posttraining using observational methods and semi-structured interviews. All data were analyzed for significant differences using appropriate statistical tests with an alpha level set at \( p = .05 \). Results indicated that after TGfU basketball education: (a) Both males and female participants significantly improved in recognition performance, motor skills, emotional attitude, decision making, and game performance (all \( p < .05 \)); and (b) gender differences become only significant for game performance, decision making, and cooperation (\( p < .05 \)). The results, therefore, suggest that TGfU with preschool children approach is helpful in improving children’s overall abilities during basketball game performance and positively influences their emotional attitude toward the game. Furthermore, children enjoyed playing basketball and often would motivate family members to join the game. In summary, the present study proposes a new education method for Chinese preschool children for future reference by investigating TGfU-based 5- to 6-year-old preschool children’s basketball education.

Combining the Tactical Games Approach, Cooperative Learning, and the Sport Education Model for Elementary School Physical Education in Japan

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The tactical games (TG) approach and sport education (SE) model were introduced to Japan at the end of the 1990s through Japanese translations of Griffin et al. (1997) and Siedentop (1994). A number of Japanese physical educators attempted to put the models into physical education practice, but not all elementary school teachers used the models because of their lack of knowledge and experience.

Therefore, this research documents an attempt to familiarize general elementary school teachers with the teaching–learning process of the TG approach in combination with cooperative learning and the SE model.

The TG approach was designed as a modified game-centered lesson. That is, the teaching–learning process of lessons was organized as follows: skill practice, 1st-half game, questioning, team practice, 2nd-half game, and reflection. Cognitive learning of tactical awareness was emphasized through questioning and reflection. Cooperative learning was introduced by using a “sibling team system” strategy. This strategy entailed an alliance of 2 single teams, who then competed against the other teams. The same sibling teams worked cooperatively in team practice, and if one team played a game, the other team provided a referee or cheering supporters. In addition, if somebody was absent, a member of the sibling team served as a substitute. Features of the SE model were also applied to the lesson unit and were reinforced by the sibling team system. Formal games were played in each lesson and scores were recorded, with the climax being a tournament in the final lesson.

Six lesson units of ball games were taught by 6 different teachers and were observed and video-recorded at 3 elementary schools in Tokyo and Saitama. The study examined how the physical education lesson setup of the TG approach affected teachers’ lesson management and children’s game performance and affective states. Interviews with teachers were also conducted, and observational notes were taken.

Effects of Teaching Games for Understanding on Quantitative and Qualitative Indexes of Grade 3 Students’ Game Performance

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Growing research has demonstrated that game-centered approaches have been favored by physical education (PE) teachers as a means to increase all students’ competence at a physical and (meta)cognitive level. Utilizing the teaching games for understanding (TGfU) instructional model, the
aim of the present research was twofold: (a) to present the implementation of a game-centered intervention program within the context of Greek PE, and (b) to assess its impact on primary school students’ game performance and understanding. Four in-service PE teachers, trained in the use of TGfU, taught 16 45-min invasion-game units, and each were responsible for a different class of Grade 3 students from 2 separate schools (N = 91, approximately N = 23 per class). All teachers agreed on the content of all units so as to sequentially address the tactical problems of maintaining possession of the ball, creating space in attack, attacking the goal, and defending space. Each unit began with an initial game form, followed by observation and questioning by the teacher, and ended with a final game form of increased difficulty. At the end of every unit, teachers completed a structured reflective journal noting the students’ and lessons’ strengths and weaknesses. Using a single-participant design, 4 students per teacher (2 boys and 2 girls) were randomly selected from each class (N = 16). Changes in these students’ game performance from baseline to intervention were assessed within a modified 4-v-4 handball game (Game Performance Assessment Instrument; Oslin, Mitchell, & Griffin, 1998), while pedometers were used to record changes in their physical activity during game play. Qualitative data involving students’ verbal reports of game understanding were analyzed along with journal entries at the end of the program. Because the intervention is still in progress, results from the combinational analysis of the quantitative and qualitative data will be released during the conference.

A Systematic Review on Periodized Approaches to Teaching and Training: No Evidence Supporting Periodization

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Periodized approaches to teaching and training stand in contrast to well-established science, as we describe in our conceptual critique on periodization. In the present study, we conducted a systematic review on the topic to verify what research on the topic has been done. The search was conducted in late September of 2015 (Scopus, Scielo, PubMed, EBSCO + SportDISCUS, specifically selecting Academic Search Complete, CINAHL Plus with Full Text, MedicLatina, MEDLINE with Full Text, PsycINFO, and SPORTDiscus with Full Text; and Web of Science) and was repeated in the beginning of February 2016 to include more recent publications. Inclusion criteria resulted in a body of 195 papers, later reduced—by applying exclusion criteria—to 42 empirical papers and 5 nonempirical papers (i.e., systematic reviews and/or meta-analyses). Results show that all research on periodization has been mistaking periodization with variation. Furthermore, none of the empirical papers make any prediction concerning the timings, magnitudes, and/or directions of the adaptations, which is the original purpose of periodization. Tactical, technical, and psychological factors are largely ignored. Reporting of confounding variables such as nutrition, supplementation, and/or medication is absent or, when present, highly deficient. Reporting of data reliability is absent or incomplete in most cases. Effect sizes are properly reported in less than half of the sample. Data are analyzed with regard to central values and between-groups differences, whereas dispersion data and within-group variations are dismissed. Nonresponders are not considered. Finally, studies are usually short- to medium-term, while school years or seasons are long-term. The systematic reviews and meta-analyses provide no valid input as they have bypassed such problems and moved toward data comparison. Overall, there is no support in favor of using periodized approaches, as research on the topic is conceptually and methodologically flawed.

TGfU and Coaching

A Soccer Content Map Designed for Novice Teachers and Coaches

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As a physical education teacher educator and technical director for a small soccer club in the American Midwest, it presents a challenge to equip novice teachers and coaches with the content knowledge necessary to effectively teach soccer to children using games-based approaches. Instructors must initially comprehend the laws, tactics, and skills of the game as part of their common content knowledge and select the instructional tasks/experiences (specialized content knowledge [SCK]) that will facilitate performers’ acquisition of tactics and skills (Ward, 2009). The interplay of players learning tactics and skills in teaching games for understanding requires that teachers
have SCK to sequence and then interconnect gamelike tasks with increasing complexity. The purpose of this presentation is to present a content map (Ward, Lehwald, & Lee, 2015) for use by novice teachers and coaches to enable them to conceptualize, sequence, and explore the relational elements of soccer content to be learned by upper elementary-age children. Four offensive tactical principles (mobility/support, advancement, width, and depth/retaining possession) and 4 defensive principles (engagement/restraint, depth, contraction, and expansion) provide an overarching framework as players progress toward a 4-v-4 modified game (no goalkeepers)—the basic configuration representing 8 tactical principles of the adult game. A ground game is emphasized to simplify play, while specific learning tasks permit every player to contact the ball frequently to maximize time on task. Players are organized into similar-size groups (e.g., 4 students) that can be combined (e.g., 4 v 4) or divided promptly (e.g., 2 + 2 or 6 v 2) to avoid managerial disruptions during game-task transitions involving players and field space. In various learning activities, numerical overload conditions (e.g., 4 v 2) are employed to facilitate off-the-ball movement on offense, and degrees of defensive pressure (passive, active, competitive) are also applied. The proposed content map provides a useful tool for beginning teachers and coaches.

**Understanding the Taiwan Judo Referee Decision Support System**

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This case study is aimed to understand how an information system supports decision making of Judo referees and the possibility for developing a sustainable domestic Judo judgment support system in Taiwan. The growing popularity of Judo competitions and the ubiquitous use of instant replay decision support systems (DSSs) in those events have brought increasing pressure on the referees in making convincing decisions. Further, requirements of expertise in balancing the agile rhythm of the game and the scrutiny of the rendered decisions remain constant. In this presentation, we conducted interviews with a Judo referee who participated in major Taiwan Judo competition events to collect qualitative and quantitative data and compile lessons learned. To conclude, the advantages of the DSS are threefold: (a) DSS helps the organizer to reduce erroneous scoring; (b) DSS helps the referee to make the best possible decision by means of replaying the missed motion; and (c) DSS improves timing control.

In the future, we hope that the Judo competition system could not only be generating data for balloting and weighting athletes before the game as is its present usage, but that it will also provide integrated information about the competition results, as well as real-time analytical technical data to help athletes or coaches react responsively during the game.

**Comparative TGfU Junior Hockey Coaching Analysis: Effect of TGfU in Game Play, Knowledge, Cardiovascular Fitness, and Coaches’ Reflection in Malaysia and India**

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Teaching games for understanding (TGfU) in a coaching context seems to be untested among Asian hockey-playing countries in contrast to the skill drills technical (SDT) approach. Therefore, this quasiexperimental pretest–posttest control-group study design examined the effect TGfU had on Malaysian and Indian junior hockey players in ball control, while supporting player roles in 5-v-5 game play, as well as declarative and procedural knowledge and cardiovascular fitness performances. Furthermore, a qualitative approach was employed to elicit coaches’ (N = 4) reflections on implementing TGfU. The sample of 60 players randomly selected from both countries involved in this study were assigned equally (N = 15 players) to the TGfU groups and the control group (N = 15) that predominantly utilized SDT training. The study utilized the following methodologies: the Game Performance Assessment Instrument, multiple-choice tests, bleep test, and reflection journals to collect coaches’ reflections. Findings indicated that TGfU was significantly more effective compared with SDT among Malaysian and Indian players in ball control in 5-v-5 game play and fitness levels. Results showed that Malaysian players improved significantly using TGfU regarding supporting players compared with the Indians. As for procedural hockey knowledge, no significant difference between the TGfU and SDT approach was evident among Malaysian and Indian players. However, for declarative knowledge, significant improvements for the Indian players via TGfU were evident. In general, the current results support the TGfU model in enhancing both game play and cardiovascular
fitness; however, coaches expressed a need for better education regarding the TGfU approach.

**TGfU Transitions: Teacher Education to Teaching Practice in 3 Countries**

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The primary purpose of this study was to determine the extent to which physical education teachers implement teaching games for understanding (TGfU) practices in the manner in which they were taught and the extent to which the same teachers modified their TGfU practice dependent on their context. A secondary purpose was to determine the extent to which similar practices were used by teachers prepared to teach using TGfU in different countries. Participants in the study were 9 physical education teachers, including 3 in Ohio, 3 in British Columbia, Canada, and 3 in New South Wales, Australia. These teachers ranged in experience from 2 to 16 years of teaching. Data sources included semistructured individual interviews, field notes from direct observations of TGfU lessons, and examination of TGfU teacher preparation materials related to TGfU. Interviews were audio-taped and transcribed verbatim, and member checking was employed to ensure data authenticity. A direct observation protocol was developed from the TGfU “benchmarks for action” identified by Butler (2014).

Data were analyzed by a process of constant comparison (Glaser & Strauss, 1967) using open and axial coding, with several themes emerging. Emergent themes included: (a) Teachers maintained faithfulness to their TGfU preparation; (b) declared knowledge was consistent with TGfU practices; (c) teachers used game-based and question-driven teaching; (d) teachers combined curriculum models, and especially constraints-based modifications were used when necessary; (e) small-group practice and game play were common among all teachers; and (f) all teachers emphasized transfer among games.

The findings are discussed with reference to the implications for TGfU teacher education, as well as similarities between TGfU preservice teacher education in the 3 countries and the extent to which different approaches are “different paths up the same mountain” (Mitchell, 2005). The findings indicate many similarities among TGfU implementation across the 3 countries, and teacher educators can do more to emphasize the affordance of student input into game design.

**Connecting With Diverse Communities: Athlete-Centered Coaching, TGfU, and Sport as a Vehicle for Social Communities**

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Although sporting research has tended to focus on performance and processes of globalization, sport can also be a powerful vehicle for promoting health, education, social development, and peace and for reducing conflict (Butler, 2008). The aims of this study were to explore the potential and value of sport as a vehicle for developing relationships to enhance social outcomes in underprivileged communities.

Case-study methodology was adopted to explore how sport can be used by a religious organization in the Philippines to enhance the organization’s ability to effectively engage and build relationships within the communities they serve.

This 5-year project involved academics from New Zealand visiting the Philippines on an annual basis and implementing sports education programs underpinned by a holistic athlete-centered coaching philosophy. Principles drawn from a teaching games for understanding (TGfU) approach were used to develop future teachers’ understanding of how the coaching of sport can create environments for learners that are fun, inclusive, and developmental.

The objective of the project was to create a fully self-sustaining educational program to be delivered by graduates from the Marist Asia-Pacific Center in Manila. For the majority of these graduates, this experience has been their very 1st engagement with sport at any level. Focus-group interviews revealed that the experience, for many, has been “transformative” and “inspirational.”

This study directly addresses 1 of the 10 identified key TGfU research questions identified in a recent article by Memmert et al. (2015): Can the TGfU approach be considered a helpful model across different cultures?

**Effects of Korfball Teaching Games for Understanding in Chinese College Students: A Randomized Study**

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Objective: The objective of this study was to test the effectiveness of the teaching games for understanding (TGfU) model; a 12-week korfball teaching practice was used.

Methods: A TGfU group was compared to a technique approach group and a control group. In this randomized study, 99 college students were enrolled in the experiment (33 participants in each group). The technique method focused primarily on skill instruction where the skill taught initially was incorporated into a game at the end of each lesson. The TGfU approach emphasized developing tactical awareness and decision making in small-game situations. One physical educator (the assistant coach of the China team) taught field korfball using these approaches for 12 weeks (1 80-min lesson each week). The control group did not receive any field korfball instruction. Pretests (in the 6th week) and posttests (during the 12th week) were administered for korfball knowledge, skill, and game performance. Separate analyses of variance or analyses of covariance were conducted to examine group differences for cognitive and skill outcomes.

Results: The TGfU group (16.25 ± 3.71) scored significantly higher on passing decision making than did the technique (12.26 ± 2.79) and control groups (8.17 ± 3.84) during posttest game play (p < .01). The TGfU group (20.50 ± 4.65) scored significantly higher than the control group (17.16 ± 4.29) for declarative and procedural knowledge (p < .01). The TGfU group (19.88 ± 5.13) scored significantly higher on control and passing execution than did the other groups (16.27 ± 5.96; 12.32 ± 6.38) during posttest game plays (p < .01). For korfball skill, there were no significant differences among the 3 groups for accuracy (p > .05), but the technique group (15.25 ± 6.25) recorded faster than the control group (11.85 ± 2.66) on the posttest (p < .05).

Conclusion: This randomized study indicates that the TGfU approach provides a more viable way of teaching strategic decision making for korfball players. In particular, effective decision making is important for the successful execution of skills among korfball players. The authors suggest further exploring the efficient use of the TGfU approach in the field of korfball teaching.

TGfU and Psychosocial Factors

Psychosocial Development Through a Teaching Games for Understanding Approach to Coaching

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Although it is well documented that youth sport participation may provide young athletes with psychosocial development and transferable life skills (Turnnidge, Cote, & Hancock, 2014), such positive youth development (PYD; Fraser-Thomas, Cote, & Deakin, 2005) outcomes have yet to be rigorously investigated as a potential outcome of a teaching games for understanding (TGfU) coaching approach. As TGfU has become increasingly popular, an extensive literature review has led investigators to posit that the approach may facilitate PYD outcomes including: perceived competence, confidence, coach–athlete connectedness, peer connectedness, character, and intrinsic motivation. The present study will offer an important addition to the literature by examining the impact of a season-long (10-week) TGfU sport experience on PYD outcomes of youth soccer players. Three youth soccer teams (2 male and 1 female) ranging in age from 9 to 12 years will be the participants in this study. The soccer teams typically play an 8-game season over 2 months (April–May). Each team will undertake 2 practice sessions per week for approximately 1.25 hr beginning 2 weeks prior to the season. The teams will be taught using a TGfU approach by an experienced coach who has worked extensively with this instructional model for a 25-year period and who has taught and coached soccer in elementary and secondary schools as well as higher education settings. To examine potential changes in the aforementioned PYD outcomes, a repeated-measures one-way multivariate analysis of variance will be used to compare baseline measures taken at the beginning of the season with a postseason assessment. The current study will attempt to add to the body of literature on games-based instruction by providing an empirical investigation into TGfU as a vehicle for promoting psychosocial youth development.

A Review on the Effect of Small-Sided and Modified Games in Sport Teaching and Coaching: Informing TGfU Pedagogy

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In tactical models (Metzler, 2011) for games and sport teaching, such as teaching games for understanding (TGfU; Bunker & Thorpe, 1982), learning is game-based (Webb, Pearson, & Forest, 2006). For many, this means not just that students are first placed in game play, but that playing of small-sided games (SSGs) is analogous to TGfU, as structured learning experiences through minigames and SSGs are at the “heart” of the model.
It has been reported that teachers see tactical models like the Game Sense approach as playing SSGs or modified games (Breed & Spittle, 2011). In TGfU, it has been suggested that lessons focus on SSGs as “principles of play” (Liu Yuk-Kwong, 2010) as the 6-step model moves first from the tactical-conceptual to technical skill development, or from “why” to “how” (Stolz & Pill, 2014) and that game competence is specifically fostered through SSGs (Jepson, 2012). SSGs are, therefore, commonly presented as a core pedagogical feature of tactical models (Stolz & Pill, 2014). This presentation considers the evidence base for SSGs as a pedagogical device in games and sport teaching through a qualitative systematic review of the literature. This review involved identification of relevant published evidence via a search of academic research collections, such as Google Scholar and PubMed, for data-driven research where SSGs were the focus of the study. Data analysis proceeded by first tabulation of the studies to summarize the data and then systematic coding and analysis. The analysis reveals that SSGs have been shown to be at least as effective in technical, tactical, and physiological training as the drill-practice and drill-conditioning style in sport coaching contexts, but the evidence of technical or tactical efficacy in achievement of skill-learning outcomes using SSGs in a tactical model in physical education is less clear.

**Exploring Mixed-Reality Simulation Using TGfU**

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Virtual-reality simulation is taking center stage as a next-generation environment for teacher professional learning and allows preservice teachers to practice pedagogical skills in a safe environment that does not place real students at risk (Kane & Staiger, 2012). Though few studies have been conducted to measure teaching performance, such as type and pacing of feedback (Brandenburg, Donehower, & Rabuck, 2014), to date, no known studies have investigated the pedagogical aspects of teaching using constructivist principles in physical education. The purpose of this study was to understand physical education preservice teachers and faculty experiences using the virtual rehearsal method in the Mursion simulator. Participants were 2 physical education teacher education (PETE) faculty and 23 preservice teachers enrolled in physical education methods courses. Grant funding allowed PETE faculty at 1 university to use the computer-simulated, immersive, mixed-reality classroom in which their preservice teachers interacted with avatars that were scripted to portray typically developing 7th-grade students. Preservice teachers co-taught 3 teaching-games-for-understanding lessons, and 6 hr of teaching experiences were completed—specifically, 4 hr of simulation experiences. Data collection included video recordings of simulation experiences, semistructured interviews, lesson plans, lesson reflections, and debriefs. Data were analyzed qualitatively. Preliminary findings suggest that preservice teachers engaged “in the moment” with the avatars due to suspended disbelief, were challenged by the off-task behavior of student avatars, and struggled to find proactive positive strategies. The simulations provided opportunities for the preservice teachers to experience a range of off-task behaviors from a diverse set of student avatars who have unique backgrounds, interests, and needs. The faculty members were afforded an accelerated view of individual preservice teachers’ skills of making connections to students and of being able to manage off-task behavior while creating a positive learning environment.

**Refereeing**

**Decision Making in Football Officiating: An Interview Study With Top-Level Referees**

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Introduction: Officials take a vital role in almost every competition-oriented game sport. For this reason, an interesting area of research has emerged in recent years with respect to sport officiating. However, the majority of football-related studies can be characterized as pursuing a “from-theory-to-practice” strategy. Therefore, the present project focused on the reconstruction of subjective theories of elite football referees and on the identification of problems in the practice of top-level football officiating.

Methods: Semistructured interviews were conducted to collect data from 23 European elite referees, either from the Union of European Football Associations’ elite group (n = 19) or 1st group (n = 4). With the average length of 19.4 min (SD = 5.4 min, range = 10.5 min–39.2 min), all interviews were transcribed verbatim and analyzed independently by 2 coders to generate a category framework that was necessary for further processing based on the qualitative content analysis.
Results: From the interview material, the data analysis resulted in 91 raw-data themes that were grouped into 22 lower-order themes and further structured into 7 higher-order themes—namely: (a) descriptive, (b) characteristics of a good elite referee, (c) difficulties, (d) prematch preparation, (e) communication through headset, (f) decision making, and (g) decision-making training.

Discussion: The vast researched area of visual capabilities and perception enhancement in refereeing is also recognized by the interviewees as highly relevant. A clear need for further research, however, could be revealed for an optimization of the following topics: the prematch preparation; the evaluation of supporting technical devices; the development of innovative training tools for improving decision-making quality; the optimization of communication within the referee team, particularly through the headset; and the evaluation of supporting training methods like mental practice. Hence, for sport scientists with a special interest in applied work, these topics can be recommended for conducting further research.

**Evaluation of Innovative Technologies That Support Referees in Game Sports**

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More and more sports are introducing new systems to support the referees and umpires, respectively. Currently, there is a lack of evaluation of such technologies as the respective associations and scholarly studies focus mostly—sometimes even exclusively—on technical parameters. Especially the impacts of the technologies are neglected. In this connection, the impact is not only the achievement of the objectives but also other (side) effects of the innovation, which can be positive as well as negative. This impact is quite surprising, as investigating the merit of innovations should be the main goal due to most of the common definitions of evaluation.

Our goal was to introduce a conceptual framework to overcome this discrepancy. Therefore, a wide range of analysis and tools has to be used. In advance, the prevalence of scenes that can be solved with the technology has to be investigated to point out the necessity. In addition, positive and negative effects should be considered, concerning the game itself as well as the opinions of stakeholders. After the introduction, vice versa, a systematic processing of the use of the new technology is required, including or combined with an investigation of all consequences that it affected.

This approach was used to evaluate 2 new technologies introduced in the German Bundesliga. Kolbinger and colleagues found that on average, 5.0 scenes per season could be resolved only by goal-line technology and therefore raised concerns about its cost–benefit ratio. Another study about the use and impact of the vanishing spray on free kicks showed a significantly lower extent of violations of 6.0% but no further positive side effects. Furthermore, this evaluation created valuable information about the underlying phenomena in identifying a lack of application for the minimum distance rule, as not even 1 such rule violation was punished properly.

**The Accuracy–Adequacy Model: A Theoretical Perspective for Understanding Referees’ Decisions**

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This talk aims to present the accuracy–adequacy model, a theoretical approach for understanding referees’ decisions. Although referees’ decisions have been subject to psychological research and controversial discussions for more than a decade (Brand, Schmidt, & Schneloch, 2006; Mascarenhas, Collins, & Mortimer, 2002; Plessner & Betsch, 2001, 2002; Schwarz, 2011), so far, no comprehensive theoretical approach has been developed that allows for understanding them. The accuracy–adequacy model promises to be a theoretical basis for further research on referees’ decisions. The accuracy–adequacy model assumes that referees’ decisions follow the predictions of default-interventionist models (Evans, 2008; Glöckner & Witteman, 2010). Additionally, the accuracy–adequacy model distinguishes between accurate and adequate decisions (Brand, Schweizer, & Plessner, 2009). Accurate decisions are correct according to the laws of the game, and they are based solely on cues provided by the respective incident (e.g., potential foul play). Adequate decisions, in turn, take the specifics of the respective game (e.g., prior decisions, minute of play, additional situational cues) into account.

The accuracy–adequacy model predicts that accurate decisions are primarily the result of intuitive processing. When a conflict between the accurate decision and
How Effective Is a Video Review System in Soccer?

A. Pizzera, J. Marrable, and M. Raab

For the first time in soccer history, FIFA allowed additional technology to support referees’ decisions at the World Cup 2014. Debates are pursued regarding the implementation of video review systems. The present study aimed to take up this debate and investigate if different visual perspectives and the use of slow motion influence referees’ decisions. One hundred nine (inter)nationally licensed referees (Mage = 30.8 years) took part in an online video test and judged 48 video clips on foul decisions in the penalty box. Each incident was randomly shown 4 times (3 different perspectives and 1 slow motion). Perspective A showed the typical television broadcast view, Perspective B showed the assistant, and Perspective C showed the additional assistant referees’ view. After each video clip, the referees indicated if the situation should be categorized as no foul, foul, yellow card, or red card. Decision accuracy (DA) was significantly higher for the slow-motion condition (M = 69.8%, SD = 13.55) compared with the real-time condition (M = 64.98%, SD = 13.16), t(109) = 5.07, p < .01, d = 0.48. Referees were most accurate in Perspectives A (M = 63.53%, SD = 15.37) and C (M = 65.29%, SD = 12.39), significantly better than Perspective B (M = 59.10%, SD = 12.85), F(2, 107) = 16.81, p < .01, η² = .24. The highest DA was obtained at the 3rd viewing, F(3, 105) = 5.38, p < .01, η² = .13. The results show that referees benefit from slow-motion video displays and repeated viewings, with a threshold after 3 viewings. The results also suggest that a video review system should include different video perspectives, with the broadcast and the close-up view behind the goal showing the greatest effects. These results seem interesting, considering current discussions about additional technology in soccer.

Coaching

An Investigation of Professional Top-Level Youth Football Coaches’ Questionnaire Practice

E. Cope, M. Partington, C. Cushion, and S. Harvey

To position learners as more central components in the coaching process, scholars have suggested that coaches should employ a questioning approach, which may lead to the development of desirable learner outcomes (i.e., increased problem-solving and decision-making skills, creative-thinking skills, game understanding, and superior critical reflection skills). Observational studies, however, have indicated that coaches rarely employ questions within their practice. When questions are asked, these questions rarely move beyond lower-order or “fact-seeking” inquiries. While this research provides information concerning the frequency and, in some cases, the type of questions coaches ask, it fails to report the more discursive nature of coaches’ questioning approaches, including how the coach controls the questioning exchange and player responses. To address such limitations, the purpose of this study was to investigate coach questioning practices (CQPs). We recorded the practices of five academy youth-level football coaches, who coached players aged 10 to 14 years old, and subjected the data to a conversation analysis, which enabled the analysis of interaction between coach and player(s). Findings revealed that CQPs, regardless of coach or context, followed similar discursive patterns. In particular, 3 themes presented themselves in each CQP: (a) coaches’ requirements for an immediate player response, (b) leading questions for a desired response, and (c) monologist nature of coach–player interaction. These findings showed that the coach positioned himself or herself as the gatekeeper of knowledge and learners as passive recipients. This finding reinforces the messages of previous research suggesting that coaches’ ideologies

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inform their practice and are stable structures that are
difficult to change. We concur with other researchers that
there is a need for further investigation in this area to
better understand how dominant discourse can be
challenged.

**A Conceptual Critique to Periodized Planning: Why
Rigorous, Detailed Plans in Teaching Make No Sense**

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Periodized approaches to teaching and training, whether
in sports or health settings, are nearly universally
acclaimed in the name of rigorous planning and
organization. Notwithstanding, in the present work, we
contend that periodized planning is actually contra-
dictory with well-established scientifi
cos postulates, including: (a) ignoring the knowledge brought about
by chaos theory, dynamic systems theory, and complexity
theories; (b) bypassing knowledge brought by biology
and by training theory and methodology, specifically the
complex nonlinear relationships between internal and
external loads; (c) abiding by a Cartesian philosophy,
thereby erroneously framing the concepts of training
factors, physical load, and peak performance; and (d)
mishandling statistics and probabilities, specifically by
largely failing to account for test validity, reliability,
specificity, and sensitivity, as well as ignoring concepts
such as power laws, outliers, black swans, and
nonresponders.

The aim of the present work was to explore these
conceptual drawbacks and make inferences on how we
should approach planning. Overall, variation seems to be
a relevant factor in teaching and training contexts, but
periodization does not appear to stand the scrutiny of
scientific analysis nor of more recent pedagogical
accounts. Future systematic reviews on the subject should
check whether conceptual and methodological issues are
being properly addressed by research on periodization,
instead of focusing on merely reporting the results.
Learning is an open process, and therefore, teaching and
coaching philosophies should incorporate inherent
nonlinearity and unpredictability into their core, instead
of attempting to impose externally derived abstract
programming.

**Teaching Methodologies in Football Coaching
Education**

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Framework: It is a common belief in coaching education,
highlighted by the evidence collected during the last 2
decades, that coaches do not value academic and formal
knowledge as much as experiences in context environ-
ments such as peers’ observation, expert coaches’
observation, and knowledge sharing (Gilbert, 2006;
Jones et al., 2004). In Portugal, research has shown that
coaches give more importance to guided sources, while
emphasizing experiential sources through work with
expert coaches (Mesquita, Isidro, & Rosado, 2010).
Despite the relevance of these findings, there is a clear
predominance of descriptive research in coaching
education, and studies addressing critical evaluation
learning models and programs are lacking (Erikson et al.,
2008).

Objective: This challenges the design of coaching
programs, particularly in football. Therefore, we aimed to
develop a model for coaching training that proposes a set
of interactive learning experiences, based on real
coaching practice that would emerge from the concep-
tualizations of students’ previous ideas of their “ideal
game model” and guided by expert coaches. The
proposed model embraces 2 main outcomes: (a)
presenting a set of football learning experiences in an
integrative progression framework, and (b) the possibility
to bring the football context into the classroom and take
classrooms into the football pitch.

Participants: This protocol was implemented during
32 weeks in 2 modules (football training methodology
and technical/tactical) of the master’s degree program in
sports training at the University Institute of Maia,
Portugal. Twenty-eight male students (M_age = 25 ± 1
years) participated in this intervention. All participants
had experience as football practitioners and short-term
experience as football coaches.

Learning Outcomes: The core principle is that students
can progressively be able to construct, reflect, decon-
struct, and rebuild in a progressive set of experiences
in an environment with peers and expert coaches.
The way learning experiences are introduced along the
A 5-Year Action Research Project Investigating Coach and Athlete Perceptions of a Game-Based Coaching Approach in High-Performance Domestic Women’s Field Hockey

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Despite unequivocal literature support in favor of games-based approaches across the sporting landscape, pedagogically focused research has principally investigated youth environments as opposed to adult or elite settings. Additionally, the majority of research has featured snapshot investigations concerned with relatively short-term impact. The aim of this investigation was to explore, via action research, athletes’ perceptions of and my (coach) experiences with a 5-year games-based coaching approach at a women’s field hockey club operating in the English national leagues. Specifically, founded upon complex learning theory, this investigation focused on the athletes’ perceptions of the value of games-based approaches relating to tactical learning and decision making. Throughout each year, data were collected from field notes made in one-on-one and group player–coach meetings, verbatim transcripts from player focus groups, session plan evaluations, written feedback from players, and my reflective diary. During this 5-year period, the team was both promoted to and relegated from the English Premier League. Data were analyzed thematically and produced 3 major categories comprising the purpose of training, facilitating collaboration, and engagement in learning. The data revealed initial player skepticism concerning the perceived value of games-based learning, and although the majority of athletes came to espouse the value of such approaches, it was not until Year 3 that the approach received virtually universal support. The most common difficulty experienced by players throughout the investigation surrounded perceptions of insufficient individual challenge and feedback facilitated during sessional delivery. Additionally, players struggled to embrace the games-based approach as an authentic learning environment and preferred to see sessions as mechanisms through which to embed team strategy. Furthermore, from the 4th year, players negotiated deliberate strategies to alleviate perceptions of staleness with the approach. Nevertheless, overall, the players placed considerable value on games-based learning and were collectively committed to enhancing this approach rather than seeking alternatives.

Learning Effects of the Didactic Model of Game Action Competences on the Tactical Principles of Football

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Introduction: The didactic model of direct instruction (DMDI) is the most used model for teaching football in competitive settings. However, it is difficult for players to learn the guidelines of tactical behavior during the game, such as the principles of play, through DMDI. Player-centered approaches seem to be more suitable for attaining this goal than DMDI. However, alternative models to DMDI have not been applied and validated consistently in extracurricular sports. The didactic model of the game action competences (DMGAC) could be a good alternative for learning cognitive, procedural, and attitudinal skills for the practice of football.

Aims: This study aimed to determine and compare the learning effects of the DMGAC and DMDI.

Methodology: Thirty-six children aged 8 to 11 years old in the city of Medellin, Colombia, were randomly assigned to an experimental group in which DMGAC was implemented or a control group in which DMDI was implemented. Each group had a teaching process according to the respective didactic model for 12 sessions of 80 min each. They were evaluated in 3 stages on learning the fundamentals of playing football: pretest, posttest, and a retention test. Performance and compliance with tactical principles were measured with the System of Tactical Assessment in Football, the motivation to practice football was investigated using the Sport Motivation Scale adapted for football, and the perception of tactical skills was evaluated with the Tactical Skills Inventory for Sports.

Results and Conclusions: The DMGAC group presented significantly better performance than the DMDI in the posttest and in the retention test. The results suggest that the DMGAC may be an appropriate model for teaching football because the tasks proposed in this model promote the integral development of skills, autonomy, and motivation.
Within athletic development, team-sport athletes combine several training methods emphasizing either endurance-specific adaptation (e.g., mitochondria biogenesis) or strength-related training adaptation (e.g., for neuromuscular adaptation or protein synthesis). In principle, both endurance and strength are crucial prerequisites for athletic performance; however, to date, special features such as the sequence and the training intensity distribution seem to be important components for optimal adaptation. This presentation will focus on different training concepts (i.e., high-volume training, “threshold training,” high-intensity interval training, and a combination of these aforementioned trainings with a special emphasis on how to assign the different training methods over time.

**Individualized Training Prescription and Recovery Management in Game Sports**

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Technical and tactical skills are predominant factors for a game player’s success. Accordingly, it is of particular importance to organize athletic training and the subsequent recovery interventions as efficiently and quickly as possible. An individualized physical training prescription based on multidimensional and regular physical testing is obligatory especially in elite youth players, considering the specificity of the respective game sport, the individual strengths and weaknesses of the players, their game style and position, and their anthropometrics and biological age. Besides individualizing the training prescription, currently, there is increased attention on optimizing the recovery process. Recent convincing data point out that the period between successive training and competition demands can also be adapted on an individual level because significant evidence for recovery improvements of specific interventions is missing. This talk is based on longtime experimental data in the field of diagnostics and intervention and includes practical experiences mainly in tennis but also in football and basketball players. We will conclude with practical recommendations for coaches to optimize training prescription and recovery management in elite youth players.

**The Speedcourt: Performance Analysis and Training for Team Sport-Specific Speed and Agility**

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Team sports are characterized by a nonlinear movement pattern with oscillating running intensity. Short sprints of maximal intensity are interspersed with brief recovery periods of submaximal running, which requires high anaerobic and aerobic capacity. Team-sport athletes, however, barely sprint in a linear direction but perform quick change-of-direction (COD) movements while moving forward, backward, or sideways. In addition, most COD movements are performed in response to an external stimulus such as ball movement, continuously changing game situations, and interacting opponents, which is known as reactive agility. The Speedcourt is made of a platform with the dimensions 5.25 m × 5.25 m. Twelve plates with contact sensors are integrated in a symmetric order and are displayed on a large screen. The Speedcourt shows a given or randomized sequence of contact plates to the player. With each foot touchdown on the targeted contact sensor, the next contact plate is visualized on the screen. Predefined or randomized running paths challenge the player’s COD speed or reactive agility. The preplanned COD movements were shown to be reliable in sprints of various lengths (i.e., 8 s, 15 s, and 43 s). Validity was proven with the Illinois Agility and 5–0–5 test (Düking et al., 2016). While repeated shuttle sprints are commonly used in strength and conditioning, programs were 6 sessions of multidirectional COD sprints in response to a visual stimulus on the Speedcourt superior with respect to team sport-specific speed and agility (Born et al., 2016). Additionally, preliminary data will be presented regarding the reliability of a novel incremental exercise test including multidirectional COD movements in response to a visual stimulus. Cardiorespiratory data have been evaluated and proven to be valid with the conventional procedures (i.e., Yo-Yo Intermittent Recovery Level 2 and ramp-like treadmill test). The Speedcourt represents a valuable method to improve team sport-specific speed and agility. The neuromuscular and cardiovascular performance can be analyzed reliably and validly with respect to multidirectional COD movements in response to a visual stimulus.
Periodization of Strength, Speed, and Endurance
Training During a Handball Season

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Handball is a team sport that is characterized by numerous defensive and offensive actions. Physical and physiological demands during matches have partially been investigated. The average running pace is relatively low in handball compared with other team sports like soccer, basketball, rugby, and hockey. Even though the greatest part of playing time consists of low-intensity activities such as standing (~40%) and walking (~40%), handball is an intense sport for players. Besides a large number of high-intensity actions (i.e., sprints, changes of direction, jumps, etc.), the large amount of body contact and duels increases the neuromuscular load during and after matches. These actions are very short in duration but are match-winning and are therefore important to consider. However, team-average data of match analyses are only of little interest for the practitioners, because position-specific requirements differ greatly in handball. For example, pivots run less than wings and backs but show the highest number of duels requiring a very high level of strength and speed. Therefore, position-specific tasks, drills, and training content are important and necessary to improve physical and physiological requirements. Detailed training studies, especially for certain playing positions, are missing. Therefore, most of the training content in professional handball is based on the experiences of coaches rather than scientific knowledge. Here, we will present examples of different training contents of possible periodization models in handball.

Physical Education and Team Games

Academics’ Perceptions of Model Fidelity When Using Tactical Games Models

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Metzler (2011) proposed that instructional models represent the means by which teachers design and implement decisions that create the learning environment experienced by students. It is recommended that physical education teachers follow the selected model “faithfully” by adopting the specific benchmarks of the model (Gurvitch & Metzler, 2010), lest the research be compromised (Hastie & Casey, 2014). However, Metzler (2011, p. 18) acknowledged that it will be “rare” that a model can be implemented exactly as described in the local site-specific context of physical education teaching. Consequently, the purpose of this study was to investigate academics’ perceptions of model fidelity when using tactical games models (TGMs). Participants were 44 academics from across North America, Australasia, the United Kingdom, and Europe who were identified through a literature search on TGMs and associated game-centered models using a number of multidisciplinary academic search engines. In January 2016, academics responded to 1 online survey question that probed their perspectives on model fidelity, which was part of a larger data collection on current and future research on TGMs. Data were analyzed inductively. Results showed academics could not overwhelmingly agree on the need for model fidelity in TGMs. For example, some academics vehemently supported following benchmarks and noted things such as, “Validation of the process is of utmost importance!”—particularly when it came to research. With that said, some academics were opposed to benchmarks and noted that “there will be variation diversity in application based on context” and that focusing on fixed benchmarks “disregards teachers’ professionalism.” A 3rd group of academics suggested a more parsimonious approach where “teachers should follow the most important benchmarks that are the cornerstone of the model.” Further debate on the notion of fidelity in TGMs is required so that academics can agree on requirements for TGM research and practice.

Physical Education Majors’ Experience in a Student-Designed Games Unit

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Introduction: Student-designed games (SDGs) are the process in which students create, practice, and refine their own games and where the teacher acts as a facilitator in guiding and establishing certain limits (Hastie, 2010). The purpose of this study was to examine the perceptions of a group of physical education majors as they participated in
a teaching unit of SDGs. More specifically, the study sought to identify: (a) what their appreciation was in this experience, (b) what their learning outcomes were, and (c) what their considerations were in teaching SDGs in their future professional practice.

Methods: Participants were 45 1st-year physical education majors (22 women, 23 men) from a Brazilian university, who were members of 8 game-design groups. The SDG unit lasted for 4 weeks. Data collection included: (a) field notes, (b) online discussion forum participation, and (c) postintervention interviews. Data were analyzed through a systematic process of inductive analysis and constant comparison among the 3 sources of data (Lincoln & Guba, 1985). When accumulated data confirmed similar findings, themes were generated.

Results: Ten themes were developed from the data, and these themes are located within the original research questions. In terms of appreciation, themes included (a) liking the freedom of choice, and (b) appreciating different games. In terms of learning outcomes, themes included (a) learning about games classifications, (b) how to work in groups, (c) game appreciation, and (d) SDG pedagogical methodologies. With respect to future adoption, students suggested they would (a) use SDG methodology to design other activities, (b) use SDG to promote improved relationships among students, (c) promote teamwork, and (d) use SDG as they consider an appropriate practice for children.

Conclusion: The present study supports SDG as a meaningful experience that has the potential to teach content (e.g., teamwork, game appreciation) from learning domains that are often overlooked within physical education.

Teaching the Pedagogy of Games Play to Future Physical Education Teachers

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The goal of my presentation is to create discussion among those of you who are involved in the training and development of health and physical education (HPE) teacher candidates in the curriculum area of games playing.

As a starting point, the teaching model developed by me and activity instructors in the Faculty of Kinesiology and Physical Education at the University of Toronto will be outlined and explained. This model, which I have developed during the past 5 years, uses the 4 games categorizations by Griffin and Butler (2005) as the foundations for the course content. It then uses suggestions from Lauder and Pilz (2013) and Light (2012) as the means to deliver this content. Students who are training to become HPE teachers make 4 individual or group presentations in the areas of territory, striking, net, wall, target, and adapted games. After each presentation, students are given immediate written, verbal, and visual (video of themselves teaching) feedback. Students are then required to reflect on the feedback from each presentation and compare their development from 1 presentation to the next. HPE teacher candidates are required to read Game Sense by Richard Light (2012) and Play Practice by Lauder and Pilz (2013) in Year 3 and to put pedagogical theory into practice.

In recent years, much has been written about different games-teaching methods, which have evolved from the teaching games for understanding (TGfU) model originally proposed by Bunker and Thorpe (1982) and updated by Griffin and Butler (2005). Although I acknowledge the origins of this model, in the teaching of games play, I use 2 other models that have evolved from TGfU. These models are the Game Sense model proposed by Light (2012) and the Play Practice model suggested by Lauder and Pilz (2013).

Comparison of Researchers and Physical Education Teachers’ Perspectives on the Utilization of the Tactical Games Model

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Tactical games models (TGMs) have emerged in physical education (PE) and have emphasized small-sided/modified game play, inquiry, and reflective practices with students. However, research suggests the utilization of TGMs only exists in isolated instances, particularly where teachers demonstrate “true” fidelity to these models. In contrast, many university-based academics seem to have adopted TGMs in their courses. Consequently, the purpose of this study was to investigate reasons for this disparity. Participants were 44 academics and 80 PE teachers. Academics were included based on
the search for publications on TGMs and associated game-centered models during the past 20 years undertaken using a number of multidisciplinary academic search engines. In January 2016, academics responded to 6 online survey questions that probed their perspectives on current and future research on TGMs. In the same month, PE teachers participated in a Twitter chat held in 4 different time zones. Data were analyzed inductively and generated themes placed into Windschitl’s (2002) constructivist “dilemmas” framework, which provides a heuristic to investigate beliefs, routines, and the forces that shape pedagogical practice. Results showed that both academics and teachers supported TGMs due to their focus on students’ holistic learning and affective domain development. Academics cited a range of dilemmas for teachers: conceptual (i.e., equivocal research evidence), pedagogical (i.e., model fidelity), cultural (i.e., lack of support/mentors), and political (i.e., self-serving research). PE teachers’ dilemmas included: conceptual (i.e., pseudo-principles—game as teacher), pedagogical (i.e., content/pedagogical knowledge), cultural (i.e., teacher washout), and political (i.e., competing TGM models). There is a critical need to create improved connections between academics and PE teachers through TGM professional development initiatives. Additional research evidence for TGMs is also required and could be achieved through the longitudinal examination of the micropedagogies of teacher practice in TGMs using a range of research designs.

**Talent Development in Female Soccer in Switzerland: Important Motivational Factors for Successful Transitions From an Under-16 National Team to the A-National Team**

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Female soccer rapidly and successfully developed in Switzerland in the last 10 years. In contrast, sport-psychological research in female soccer is still rare, and the development of female players should be better supported by sport psychologists in the future. The aim of the present study was to explore and identify motivational factors that might be important for successful career transitions. Participants were 64 U-National Team players ($N = 22$ under-16, $N = 20$ under-17, $N = 22$ under-19), 64 female age-matched soccer players (high level but not selected for a U-National team), and 35 players of the A-National Team (preselection for the World Championships 2015). We focused on 2 questions. First, which components differentiate between U-National Team players and their nonselected same-age peers? Second, are there any differences between the 4 national teams? In 2014, all players completed a questionnaire covering 13 psychological components based on the Sport-Related Achievement Motivation Test (Frintrup & Schuler, 2007).

Statistical analyses showed that players selected for a U-National Team differ from their peers on 9 of 13 components including higher aspiration level, stronger motivation by competition and status, and clearer long-term goals (all $p < .01$). Comparisons of the 4 national teams indicate that younger players are more prevention-motivated (more effort after failure), are more strongly motivated by status (both $p < .001$), and are tendentially less persevering ($p = .06$) than players of the A-National Team. Long-term goals are most clearly formulated by under-19 National Team players and are much clearer than those of under-16 National Team players.

The study revealed important differences between U-National Team players and less successful peers as well as differences between U-National Teams and the A-National Team. Longitudinal monitoring will reveal if these motivational factors are generally relevant for these specific transitions and at which levels sport psychologists should watch out for motivational factors.

**Specialization Regarding Constitutional Demands in Female Team Handball**

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Constitutional factors are relevant for performance in team handball (Čavala et al., 2013). Because only few studies have focused on female players and positional specialization (Weber, 2015), the current study will focus on constitutional aspects of different playing positions in female team handball with respect to the connection of specialization and success. For this purpose, 654 female players of German clubs of all performance levels were tested regarding age, body height, body weight, and body fat percentage next to biographical data regarding their
handball career. These data make it possible to calculate an expertise index stating the performance quality of every player. After statistical analysis, it is evident that there are significant differences between the positions regarding constitutional factors. Expertise correlates with constitutional performance factors. For some positions, specialization correlates positively with expertise regarding particular constitutional performance factors (e.g., body height for half-backs). Consequently, position specialization seems to contribute to success in female team handball. Players should be trained accordingly, and on the senior level, they should be selected using the appropriate information.

New Developments in Team Games Pedagogy

Professional Development for Game-Centered Approaches: One Size Does Not Fit All

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Implementing a game-centered approach (GCA) like teaching games for understanding can be problematic and requires complex professional learning that considers a wide range of contextual factors within the educational setting (Memmert et al., 2015). Yet teachers attempting to implement GCA have been given little support and have faced ridicule and even hostility in physical education (PE) settings from PE practitioners, coaches, parents, and the students themselves (Brooker et al., 2000; Light & Georgakis, 2005). At present, there appears to be no effective model of professional development (PD) that supports teachers in implementing GCA.

Research into professional learning has shown that traditional “one size fits all” homogenous approaches to PD, characterized by 1-day, 1-off, off-site workshops, is inadequate and ineffective in supporting teachers to learn in ways that can enhance practice (Armour & Makopoulou, 2011; Armour & Yelling, 2004, 2007; Casey, 2012).

Recent research has challenged this traditional model of PD and has presented a consensus on the characteristics of PD deemed effective in enhancing teacher and pupil learning. Yet, we still know little about how this research can inform practice, or more specifically, how PD can be designed to support teachers to explore what GCAs look like in their own practice.

This paper presents an alternative model of PD. The PD model was devised and implemented as part of a Ph.D. thesis, aimed at supporting teachers in implementing GCA. An overview of the 4-phase PD model (i.e., needs assessment, planning, implementation, and evaluation) is provided and is used to support teachers in planning, delivering, and assessing a GCA unit of work. This paper reports the features and characteristics of effective PD and the types of PD that are likely to enhance teacher learning when implementing GCA. As such, it explores the PD required to support physical educators in facilitating and sustaining change.

Training Teachers to Integrate Strategies to Develop Social Competencies Through Playing (Modified) Games

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Research in education and physical education has emphasized the need for continuing professional development programs that are aligned with best practices. Most teaching-games-for-understanding research has focused on how students can acquire tactical and technical competencies through playing (modified) games.

However, apart from executing the role of player, students can also learn through other roles such as referee, captain, or coach. By undertaking these roles, students are not only able to acquire tactical insights, but they simultaneously develop important social competencies such as taking the lead, accepting rules, effectively taking up tasks, listening to others, interacting in a confident and empathic way, and providing and accepting feedback from others.

In the current study, it was investigated whether physical education teachers can be trained to effectively incorporate student roles (e.g., coach, referee, captain) into their regular game lessons. More specifically, we developed and pilot-tested a framework that allows for physical education teachers to gradually integrate these roles from the 1st to the last year of secondary school through a professional development program with 5 physical education teachers. Data were collected through teacher and student interviews, observations, peer-group meetings, and document study.

Findings showed that the physical educators increased their awareness of teaching strategies, they effectively
integrated them into their game-based lessons, and the integration of roles positively impacted students’ engagement. Implications for game-based teaching as well as professional development of teachers and coaches will be discussed.

**Pedagogical Innovation in Youth Sport: An Urgent and Hard Mission**

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Introduction: Research in sport pedagogy has led to diverse and innovative teaching approaches both theoretically and practically. However, research findings have had little impact on altering coaches’ behaviors. The present study aims to examine the structure of practices for youth basketball teams and the perceptions of the coaches about pedagogical innovation.

Method: Twelve under-16 teams, ranging in ability from local to elite (8 male and 4 female) participated in the study. Each team was video-recorded at all weekly practices during the competitive season using the reduced version of the Coach Analysis Intervention System (Stodter & Cushion, 2014). Twelve coaches (aged 29 to 65 years old, with 9 to 35 years of experience), participated in semistructured interviews about their concepts and use of pedagogical innovation.

Results and Discussion: No diversity in practice structure was observed among the 12 coaches/teams. The only factor that influenced the sequence and contents of the sessions was time to competition. Eight of the coaches said they did not care about sport pedagogy theories. The other 4 were aware of recent theories, but in their opinion, “it does not work” because competition prevails over active learning. All coaches considered that every game with opposition in practice represents “decision-making training.” The findings corroborate previous research suggesting that coaches construct their knowledge embedded in their sport and club culture and that coach education programs seem to have little relevance for coaches’ behavior change. Competition seems to be the main factor that underpins the organization of practice sessions and coaches’ decisions.

Conclusions: To challenge actual coaches’ beliefs and behaviors is a necessary and demanding task. The existing coach education programs need to evolve to eliminate or reduce the mismatch between the formal state-of-the-art curricula and the cultural, ideological practice of the coaches.

**Playness Pedagogy Compass**

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There are extensive research data regarding the changing behavior of preschool children related to physical activity and free-play time in natural environments. While physical and outdoor activity is in decline, the hours spent daily in front of the screen (TV, smartphone, tablet) are alarmingly increasing. Research conducted by Canadian nonprofit organization ParticipACTION revealed that Canadian children spend an average of 7 hr and 48 min a day in front of televisions, video games, and computer screens. According to the World Health Organization (WHO), the number of overweight or obese infants and young children (aged 0–5 years) increased from 32 million globally in 1990 to 42 million in 2013. Data from the WHO’s Regional Office for Africa alone shows the number of overweight or obese children increasing from 4 million to 9 million during the same period.

By mapping out the fundamental principles of intervention that raise awareness of the importance of physical activity, the Playness Pedagogical Compass was created. It is a simple tool used to assess how well teachers are balancing their programs between various developmental needs and pedagogical goals. The 4 cardinal directions of the Playness Pedagogical Compass are: somatics, playfulness, movement, and values. Somatics consists of methods of teaching how we are physical bodies and the importance of understanding our bodies. Playfulness, the 2nd point of the compass, represents the most celebrated mode of being. The 3rd point is movement. Movement is a basic principle of cognition through tactile-kinesthetic feelings. The final point of the Playness Pedagogical Compass emphasizes the value-based importance of education. Values and relations among people are the key to enabling humane virtues to flourish and bringing meaning into life. The presentation will explore the definitions of these 4 cardinal points and will show how pedagogues might employ them to better understand their teaching.
Global Initiation to Team Sports

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The present work presents the implementation of an innovative pedagogical practice to teach sports in a school-based physical education context. The aim is to develop students’ tactical awareness, ability, and willingness to cooperate by introducing a different approach for teaching sports. This global approach addresses sports initiation and maximizes learning and active participation where game time is vital in each lesson to facilitate the acquisition of different competencies and their future implementation in real game situations and competition. This global approach to sports initiation helps students to develop their understanding of games by focusing on the essential components of technical and tactical elements in the main forms of cooperation-opposition to address the common skills and strategies (similarities with different games) and for better play. Teachers will teach concepts that are transferable to more than one game to allow the versatility of the practicing child and adolescent, to improve students’ all-around game play, to enable students to enjoy game playing and make them never stop playing, thereby establishing a playful, active, practical, and motivating methodology through the game, which reduces the time of pause and organization, to ensure full utilization of time practice in each session. This new teaching style has proved to be an excellent learning environment for every student to be an active learner (thinking and decision making), where participating seemed satisfying and significant (greater knowledge and understanding of invasion games).

Psychosocial Factors Affecting Team Performance

Effect of an Emotional Intelligence Learning Package on Sports Directors’ Inclination Toward Emotional Intelligence Acquisition and Retention

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This is a preliminary report of a longitudinal study designed to examine the efficacy of the Concise Emotional Intelligence Learning Package (CEILP) on the status, acquisition, and short-term and long-term retention of emotional intelligence (EI) in athletes and sports personnel consequent of exposure to the CEILP as an activation tool for EI acquisition. This study investigated the inclination to acquire EI as a psychological criterion for wellness attainment in participants after exposure to the CEILP. EI implies the intimate transaction of inner and outer forces, physical and social, that fuse to lead man to behave as he does. The study adopted self-regulation theory for its theoretical base and conceptualized EI as an acquired skill in occupational and career dispensations, job performance, and satisfaction. The study employed a mixed-method research design. Thus, the quasi-experimental research design 1-group, pretest-posttest (GP-O-T-O) was mixed with a focus-group discussion. The Emotional Competence Inventory, an 18-question instrument that assesses the handling of emotions in life and work settings (Boyatzis, 1994), was employed to assess participants’ entry emotional status (pretest) while the Self-Assessment Questionnaire (Boyatzis et al., 1996) a 28-question item was adapted and used to collect inclination to EI (posttest) data. A matched-pairs t test indicated a pretest descriptive result (N = 10; $M = 30.70$, $SD = 5.83$) as well as posttest (N = 10; $M = 42.90$, $SD = 7.40$) and inferential, $t(9) = -4.199$, $p = .002$. Findings indicated significant preparedness for acquisition and retention of EI by participants as regards wellness attainment at the workplace. It was recommended that EI skill training should be extended to all cadres (rank and file) of personnel in the Ministries of Sports, Youth, and Social Development.

Synergistics Are Observable Within and Across Multiple Levels of Skill Analysis

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This presentation proposes an integrated approach to teaching skills and argues against polarizing comparisons that are often made between individual skill practices and Game Sense approaches. Previously, I have written that skill may be defined as the expression of the relational dynamics (synergies) that emerge from nonlinear, self-organizing, interacting system components, and I argue that this can be observed at multiple levels. For analytical purposes, these levels may
be described as intrinsic, individual, and interactive. Each level of analysis offers insight into the complex system synergies involved in skillful performance. Often, when focusing on coordination dynamics in game contexts, the focus is still on the individuals’ actions and not the relational dynamics between individuals, and this focus limits our understanding of the true nature of skill. Therefore, any analysis of skill should involve more than what can be observed at the level of the individual/environment interface.

**Reinventing the Game (RTG) and the Learning of Games**

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One way of approaching teaching of games is to be wholly game-specific in the teaching process. In the reinventing the game (RTG) approach, lessons will be from the perspective of breaking down a game (or building up a game—inventing), while keeping in focus the different components of similar game types. The novel element of this approach is the scaffolding of all learning and teaching to the identified 4 fundamentals: the passing, movement, scoring, and interception components of any game for net/wall, invasion, and striking & fielding. These fundamentals are combined with the field-of-play constraint to get students to understand and play better in games within and across categories, thereby enhancing long-term learning and using teaching games for understanding (TGfU) underpinnings. An ex-post factor qualitative study was done on the perception of games learning among a group of 14 for 2 years in a single-sex school. The responses were recorded through a self-developed survey looking into perceptions of game appreciation and learning. In 2012, the Secondary 2 students, the whole cohort of 14-year-olds, were given a survey to look at their perception of games learning after about 0.5 years of existing physical education lessons. In 2013, 3 classes were exposed to explicit the RTG approach. The other 8 classes were exposed to various levels of RTG processes mentioned earlier and also relied on existing TGfU approaches. The students were then given a similar self-evaluation in September 2013. The results show that such an approach indeed has the potential to impact students’ understanding, appreciation, and thus future involvement in sports. The approach of providing a common scaffold, with the added complex system perspective for each of the components (called rules in RTG), for teaching and learning provides a promising alternative to the more common teaching of sports in silos.

**Developing Sport Team Culture and Collective Leadership**

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This presentation summarizes and reflects on the team culture and collective leadership themes highlighted through analysis of interviews with high-performing New Zealand sport teams (e.g., the All Blacks). The rationale for the research was based on Edgar Schein’s (2010) 3-level theoretical model of organizational culture integrating artifacts (rites and rituals, symbols, and stories), values and beliefs, and core assumptions. The findings from content analysis of semistructured interviews with captains and coaches indicate the pride in the All Blacks legacy, pride in selection, and pride in winning, which are also constant factors in their success. Symbols, such as the jersey with the silver fern, as well as rituals like the haka have become increasingly important. The learning culture and learning leadership within the All Blacks instils a commitment to total honesty in self and team reflection. Team leadership has moved beyond the traditional view to a more shared-influence process. The development of a collective leadership approach and a learning culture establishes a more formalized identity and culture that is performance-driven (Johnson, Martin, & Watson, 2014). The presentation will also highlight how these findings can be transferred to regional and school environments. Examples will be provided of the development stages of team building involving setting “great expectations” and integrating team rituals (e.g., songs) and team values (e.g., trust, respect, spirit, pride, and commitment), which are consistently reinforced. Examples are also provided of the development of a collective “senior” leadership approach, which is focused on reinforcing a sense of pride and unity throughout the team. Leaders are actively encouraged to engage as role models for other team members. Individual performance outcomes are also linked to team aims and objectives.
**Decision Making in Association Football**

**Expert Perception and Decision Making in Assistant Referees: From Increased Understanding to Improved Performance**

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In today’s highly competitive sporting environments, stringent requirements are imposed on athletes and players. Evidently, they must possess a myriad of outstanding mental, physical, technical, and tactical skills. In addition, deliberate practice of domain-specific perceptual-cognitive skills, such as anticipation, pattern perception, and efficient visual search behavior, is required to enable efficient and correct decision making under pressure.

Besides athletes and players, match officials are also subject to increasingly high demands. In this respect, the current presentation will focus on maximizing the performance of assistant referees in association football. Five experimental studies will be discussed, all aiming to improve assistant referees’ perceptual-cognitive skills, which are considered particularly important for an appropriate assessment of offside situations.

Although these findings predominantly relate to assistant referees, the current methodology can also be applied to other groups. For example, some parts of the design can be implemented to train the perceptual and cognitive decision-making skills of elite athletes, referees, physicians, and pilots. Although the impact and effects of certain decisions may be domain-specific, the influence of external factors (stress, time pressure, incomplete information) is equally prominent across all domains. Future research, therefore, should translate the present findings to other research domains in which making correct decisions under pressure is of great importance.

**Technology and Refereeing: Video Assistance in Real Time or Slow Motion?**

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Introduction: The primary task of officials in team sports is to control competitive matches so they are played in a fair and safe way and in accordance with the laws of the game. Sports officials interact with players in a dynamic environment under conditions of extreme pressure because their decisions might have a direct impact on the outcome of a game. Recently, football’s lawmakers have given the green light to use video technology to support referees. Therefore, we examined the impact of video speed on the decision-making process of association football referees.

Method: A group of 88 experienced Union of European Football Associations top-class referees assessed 60 video clips of foul-play situations using an online video platform. For each situation, referees had to consider a technical decision (no foul, indirect free kick, direct free kick, penalty kick) and a disciplinary decision (no card, yellow card, red card) both in real time and slow motion. Accuracy scores were calculated as the total number of decisions that corresponded with the reference decision of an expert panel.

Results: Decision-making accuracy for the technical decision was higher in slow motion (67%) compared with real time (56%), particularly for corner-kick situations. There were no differences in the accuracy scores for the disciplinary sanction across video speeds. Further analysis of the weighted mean, however, revealed that situations were assessed more “conservatively” in slow motion compared with real time. Specifically, this means that slow motion results in more red cards compared with real time.

Discussion: The impact of slow motion on the perception of foul play depends on the specific situation and the type of decision. Our results show that situations are assessed differently in slow motion and real time, and this has important implications for the introduction of video technology. Specific guidelines and protocols for the use of slow-motion replays are discussed.

**The Effect of Manipulating Task Constraints and Player Numbers in Small-Sided Games in Field Hockey**

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Small-sided games (SSGs) are widely used by coaches as a training drill to improve technical skills, decision making,
and the physical capacity of athletes. The structure of these SSGs can be manipulated in many ways, and previous research has shown that manipulating the number of players and field size in basketball and soccer influences players’ behavior (Casamichana & Castellano, 2010; Klusemann et al., 2012). However, as coaches manipulate more than just the number of players and field size, more understanding is needed about the influence of these different task constraints on player behavior. Therefore, the aim of this study was to examine the effect of manipulating task constraints and the number of players on game performance of children in field hockey. A total of 14 field hockey players aged 10.2 years to 14.8 years (40% girls) completed 24 matches of 2 7.5-min halves where task constraints (1-goal game, 2-goal game, cage hockey [indoor hockey sideboards were placed on the sidelines], or possession game) and number of players (3 players per team or 6 players per team) were manipulated. Match performance was determined by using notational analysis (SportscodeTM). A 2-way analysis of variance with repeated measures (with task constraint and player numbers as within-participant factors) was used to determine the effect of task constraints and player numbers on player behavior. Results revealed that reducing the number of players led to a significant increase in technical actions performed by young field hockey players (i.e., number of passes, number of dribbles) and that the possession game differed the most from the 1-goal, 2-goal, and cage hockey games. It seems that the removal of a goal led to more teamwork and less individual actions. The discussion will focus on the practical implications of SSGs for the acquisition of technical skills in field hockey.

The Face of Schadenfreude: Facial Reactions to Failures of a Rival Sport Team

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Schadenfreude is defined as the pleasant emotion that arises in response to another person’s misfortune. Schadenfreude can also be experienced at the intergroup level—for instance, in response to the failure of a rival soccer team. To investigate which facial expression people show when experiencing schadenfreude and whether this expression differs from pure joy, we recorded facial expressions via facial electromyography. We tested 32 soccer-interested men. Schadenfreude was induced by videos of the Dutch national soccer team failing in scoring penalty kicks and joy by videos of the German national soccer team scoring penalty kicks. Additionally, participants judged each stimulus according to valence, arousal, joy, schadenfreude, and sadness, and they were also videotaped. Results show that strong emotional reactions were triggered in a sport context. Electromyography results revealed that participants could not resist a smile when watching the Dutch soccer team messing up penalty kicks. Schadenfreude expressions did not differ from joy with regard to involved facial muscles (increase of Musculus zygomaticus major and M. orbicularis oculi activity, decrease of M. corrugator supercilii activity, no activity change of M. frontalis medialis). Smiles were stronger in response to the outgroup’s failures compared with the ingroup’s successes, but according to self-report, participants felt more pleasure when the German team scored. These results show that schadenfreude is associated with a spontaneous and honest smile, a so-called Duchenne smile. In a follow-up study, participants had to judge whether the videotaped participants experienced joy or schadenfreude. Results indicated that joy and schadenfreude can be differentiated by an observer. Possibly, schadenfreude can be differentiated from joy by an asymmetric smile or body posture, which will be investigated in future studies. These results have important implications for research on the nature of (social) emotions.

Training Science

The Problem of Strategies of Volitional Control of Movement for Movement Quality and Movement Creativity

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The current research examines experimental improvisation processes to investigate the role of volitional control strategies in both the quality (fluency, economy) and creativity of movement execution.

Forming the theoretical foundations of this work are the concept of human movement as a process (Hossner, 2015; Schürmann & Temme, 2015; Temme, 2015), the use of volitional control for successful writing (Mai & Marquardt, 1996), the deactivation of functions of movement monitoring during jazz improvisation (Limb & Braun, 2008), and the synchrony and fluency of
movement in group improvisation (Noy et al., 2011). By means of our proposed research paradigm, we want to explore how conscious and unconscious strategies of movement control manifest themselves in movement behavior. We hypothesized that strategies of volitional movement control do not enable—but rather disturb—movement behavior and movement quality. The 1st step of our approach was a theoretical study (philosophy, pedagogy) about concepts of movement and movement control. Our findings are able to bring those concepts into question, which conceives movement as an action. Through the lens of activity theory (Leont’ev, 2012), we see movement as a process that runs by itself. This concept of process is connectable with our qualitative movement observations (Laban). We found that strategies of (self-)instruction lead to different ways of moving: Participants who work with control strategies of making movement(s) tend to show less fluency and creativity than do those participants who use strategies/self-instructions of “free floating” or “let-go.” In the 2nd step, we want to create a context in which strategies of volitional movement control are suppressed and strategies of “free floating” are provoked: Concerning the fluency and creativity of movement, we compare shared improvisations as a context of dynamic adaption with contexts of lead and follow. The different strategies of movement control are also relevant for movement learning and creativity in sports.

**Survey About the Effect of Speed Training for Tennis Players With and Without New Tensile Strength-Training Equipment Called IVO**

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Introduction: The meaning of speed in tennis is without doubt (Ferrauti et al., 2014). A player with an outstanding speed ability has an advantage in comparison with others. The maximum speed of a player is just as important as the skill to stop and speed up (Fernandez-Fernandez et al., 2010; Kovacs, 2006). The goal of the study is to show the effect of training with a tensile strength tool called IVO.

Procedure: Twenty tennis players (mostly students, only men) took part in this study. Ten participants always used the training tool, and 10 did not. The study lasted 6 weeks with training 3 times weekly. One training session lasted 20 min. There was a specific diagnostic test before and after the survey. All participants did a 20-m linear sprint, a pendulum sprint, and a specific tennis agility sprint. The 2nd part of the diagnostic is the leg curl, leg extension, countermovement jump (CMJ), and drop jump (DJ) test.

Results: Most of the results of the survey are still being reviewed. So far, it looks like there is a significant difference between the IVO participants and the control group relating to the results of the leg curl, leg extension tests, the CMJ, and the DJ test. All results will be available for the conference.

Discussion (Assumption): The results show that you can improve the strength of leg muscles (and speed) with specific speed training. By using the tensile strength tool IVO, you can get better results in comparison with the results without resistance.

**Systematic Training of the Opening Shots in Tennis**

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Introduction: In men’s world-class tennis, 80% of all points are finished after a maximum of 8 strokes. Within these points, only serve and return cover 45% (Weber et al., 2010) of what underlines their importance. However, not only the length of the rallies seems to be statistically significant, but also the position of the 3rd shot.

Methods: The test sample contains 15 matches (Round 16, quarterfinal, semifinal, final) from Wimbledon 2008 (Grambow, 2009). The results are categorized in placement, frequency, success rate, and direct service winners. Additionally, the player’s position hitting the 3rd shot is analyzed by frequency and success rate.

Results: Comparing all men’s matches starting with Round 4 up to the final of Wimbledon 2008, 35% of all points are finished after serve and return and 62% after 4 shots (Grambow, 2009). Within these matches, the serving player hits the 3rd shot of the rally nearly half the time (48%) in an offensive position and is winning the point 66% of the time. The 3rd shot is taken 40% in a neutral position and 12% in a defensive position. The winning percentages drop to 47% (neutral) and 26% (defensive).

Discussion: Because the majority of rallies are finished or decided in the early stages (serve and return plus the opening shots), the training should focus a lot on these parts of the game.
Influence of Some Social Characteristics of People With Intellectual Disabilities for Practicing Sport and Physical Activity in the Republic of Macedonia

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We explored the impact of some social features for practicing sport and physical activity for people with intellectual disabilities in the country. The survey respondents were people with intellectual disabilities who provided answers to questions from a questionnaire. The 101 respondents to the survey were Macedonian citizens who are categorized as persons with intellectual disabilities, regardless of their gender, ethnic, religious, socioeconomic, and residential background and their diagnosis established on the basis of medical analysis. On the official figure of people with intellectual disability in Macedonia, this research surveyed 2% of the same population, which represents a relevant number for successful interpretation of the results. In the questionnaire, participants were given opportunities to express their social and socioeconomic data including: age, socioeconomic status, residential status (urban or rural), ethnic affiliation, and diagnosis of disability. One can generally conclude that the state and its institutions, be it state or any local authority in turn, must pay very close attention to this issue or give institutional opportunities for persons with intellectual disabilities for practicing sport and physical activity in the country.

Mental Representation and Cognitive Intervention: A Systematic Comparison on the Effects of Action Observation and Motor Imagery on the Development of Mental Representation Structure and Skill Performance

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Despite increasing comparative studies on neurophysiologic mechanisms and the motor-learning effects of action observation and motor imagery, the 2 cognitive interventions have not yet been compared in terms of changes in cognitive representations and their relationship to skill acquisition. In this study, we compared the effects of action observation and motor imagery on the development of mental representation structure and golf-putting performance during the early learning stage. Forty novices were randomly assigned into 1 of 4 groups: action observation, motor imagery, physical practice, and no practice. Tests were conducted before and after 3 days of practice and then after a 2-day retention period. The tests measured the mental representation structure of the putting as well as the accuracy and consistency of putting performance. Results showed that the 3 practice groups (i.e., action observation, motor imagery, and physical practice) significantly improved both the accuracy and consistency of their putting performance on the postpractice and retention tests compared with their pretest performance. The no-practice group did not show any improvement in putting performance over test sessions. Moreover, it was found that the mental representation structures of all 3 practice groups changed during practice, resulting in more elaborate and structured representations of the putt. Interestingly, with regard to the ease of use of action observation and motor imagery, the results of the postexperimental questionnaire showed that the use of action observation was significantly more efficient to reduce one’s mental workload compared with the use of motor imagery. Taken together, these findings confirm the results of previous studies on the learning effects of the 2 cognitive interventions. However, they also contribute further evidence that mental representation plays a crucial role in controlling motor skill performance and that ease-of-use action observation may be superior to motor imagery as a cognitive intervention.

‘Dyed in the Wool’ Competition and the Adaptation of Performance Routines in Self-Paced Tasks

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Introduction: Optimal performance in training and competition is significantly related to performance routines (Lidor, 2009; Velentzas, Heinen, & Schack, 2011). However, no studies have scrutinized the
adaptation of such strategies in critical competitive situations. The present study aims to address this gap by analyzing the use of routine depending on prior performance.

Method: Twenty-eight female gymnasts from 3 different competitive levels participated in this study (near experts, \( N = 9 \); intermediate, \( N = 9 \); novices, \( N = 10 \)). The task of handspring on vault was chosen. Eight sets of 2 video sequences were presented in a random order, and the 1st vault was classified as successful or unsuccessful. The participants were asked to report their routines (think-aloud protocols) simultaneously on video.

Results: The analysis of the routines’ use frequency reveals no significant differences between groups, \( x^2(2) = 0.189, p > .05 \) (cognitive); \( x^2(2) = 0.115, p > .05 \) (behavioral). A more specific analysis shows significant differences between the 3 groups concerning the use of process-regulatory strategies after an unsuccessful 1st handspring, \( x^2(2) = 7.95, p = .036 \).

Discussion and Conclusion: The results of the present study are partly in line with previous research or assumptions showing that athletes tend to adapt their routines to regulate the movement execution after unsatisfactory performance in the 1st trial. However, effort must be invested to clarify the effects of routine adaptation on the optimization of learning and performance (e.g., tennis serves or basketball free throws).

Mental Rotation of Tactical Instructions in Basketball Increases Processing Demand and Execution Inaccuracy

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Coaches in sport games use tactic boards to present instructions in time-pressure situations like timeouts, often with a tendency toward high demands in visual-spatial transformation (e.g., mental rotation; Schul et al., 2014). We assume that the use of these tactics impedes information processing as well as execution accuracy. In a within-subjects design, 10 novice students (\( M_{\text{age}} = 23.4 \) years, \( SD = 1.43 \)) were instructed with static visual tactical instructions on a laptop screen showing basketball-playing patterns for a single player either with low spatial disparity to the players’ on-court perspective (basket at the top; \( 0^\circ \) orientation) or upside down (basket at the bottom; \( 180^\circ \) orientation). Twenty playing patterns were presented in each of the orientations in a randomized order. Dependent variables were the observation time (information-processing demand) and the radial error between the target positions and the actual executions (spatial accuracy) measured by video analysis for 3 positions (screen, catch, and shot position). Observation time was significantly longer for the \( 180^\circ \) orientation (\( M = 13.73 \) s, \( SD = 5.87; p = .001, d = 1.71 \)) and for the \( 0^\circ \) orientation (\( M = 8.68 \) s, \( SD = 3.36 \)). Furthermore, the analysis-of-variance Orientation (\( 0^\circ, 180^\circ \)) \( \times \) Action (screen, catch, shot) interaction for spatial accuracy showed a main effect of orientation (\( p = .023, \eta^2 p = .45 \)), as the radial error for the \( 180^\circ \) orientation (\( M = 129.6 \) cm, \( SD = 20.5 \)) was significantly higher compared with the \( 0^\circ \) orientation (\( M = 112.3 \) cm, \( SD = 14.0 \)). The effects are explained by mental rotation processes that are necessary to transform the instructional perspective into the players’ perspective on the court. Accordingly, coaches should align tactic boards to players’ on-court viewing perspective.

Technique Feedback in Basketball: Individual Diagnostic System Based on Cognitive Representation

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Technique performance is a central topic in motor learning in sport games, but it is also a crucial factor for successful performance during sport competitions. Building on the assumption that mental representations are the cognitive base for motor actions, we will present a cognitive diagnostic system for the jump shot in basketball. We will show how to measure and analyze individual cognitive structures of the jump shot. Based on the results, we give insight into how the information can be used in technique training.

Therefore, the cognitive representation can be compared on an individual level and on a group level. Thus, it is possible to contrast expert or biomechanical reference structures with the individual structure of an athlete. Furthermore, this study investigates the cognitive representation of the jump shot of 15 basketball novices in reference to an expert. The results show significant differences between the expert and the
novices. The expert shows a well-structured and functionally organized cognitive structure, whereas novices’ cognitive representations were organized less functionally. In summary, we present an approach to use cognitive representations to enrich technical training in game sports.

**Gaze Control in Basketball Jump Shots and Free Throws**

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Introduction: Visual control is 1 of the main factors influencing the efficiency of basketball shooting. Proper visual fixation toward the hoop and backboard during shooting is necessary for preprogramming various movement parameters (e.g., direction, force, velocity, timing, and eye–hand coordination). The main aim of the study was to examine the relationship between gaze behavior and shooting efficiency in static and dynamic conditions.

Materials and Methods: Thirteen elite and near-elite basketball players performed the dynamic 60-s 2-point jump shot test. In this study, the fatigue protocol by Pojskić et al. (2011) was used. Before and after the jump shot, test players performed 2 free throws. During the test, heart rate was recorded at 1-s intervals. A mobile binocular eye-tracking system (SensoMotoric Instruments [SMI] ETG 2w, Germany) was used to record the numbers of fixation points, gaze-stabilizing fixation points (quiet eye), and total fixation time during the static and dynamic shot tasks. SMI BeGaze software was used for data analysis.

Results: The initial results showed that players’ shooting efficiency depended on the fixation duration (r = .791, p < .01) and frequency of fixation (r = −.665, p < .05). Highly skilled players had a lower frequency of fixation on the hoop during shooting than did near-elite players (p < .05). After the intensive dynamic 60-s 2-point jump shot test, the increase in free-throw frequency of fixation (p < .01) and the decrease in free-throw duration of fixation (p < .05) were observed.

Conclusion: It was concluded that gaze behavior during the preparation and execution of the shot leads to higher levels of accuracy. Moreover, physical effort can affect the visual control of basketball players during the execution of shots.

The study was supported by Grant No. RSA2 018 52 from the Polish Ministry of Science and Higher Education, under Contract No. 0012/RS2/2013/52.

**Analysis of the Teaching–Learning Process and Procedural Tactical Knowledge in Mini-Basketball**

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The aim of this study was to analyze the teaching–learning (TL) process and the development of procedural tactical knowledge (PTK) in mini-basketball training sessions. Eleven children aged 10 to 12 years old participated in this study. The basketball TL process proposed by a physical education teacher with 10 years of experience was assessed. Eighteen training sessions were recorded and analyzed to determine the time spent on and the frequency of use of the task conditions proposed by the teacher. PTK was assessed before and after the training sessions during game-test situations. The tactical parameters to measure PTK were (a) offering and orienting (OO) and (b) recognizing spaces (RS), both subdivided in convergent and divergent. The experts in the evaluation of PTK presented an internal consistency of .88, measured using the Cronbach’s alpha coefficient. Cohen’s Kappa coefficient for interobserver reliability was, on average, .86 for the task conditions observed during the training sessions. The total duration of the observed training sessions was 1,267.46 min, distributed into conversation with the players (226.49 min), isolated activities of skill training (249.82 min), small-sided games and tactical intelligence games (TIGs; 639.93 min), and 5-v-5 games (151.22 min). Regarding the task conditions, the frequency of use of isolated activities of skill training (27.34%) and TIG (39.31%) was predominant. The nonparametric Wilcoxon test showed an increase in PTK from pretest to posttest in the OO convergent (Z = −2.822, p = .005) and in the OO divergent (Z = −2.259, p = .024) parameters. The proposed activities of TL observed in the training sessions favored the development of the parameter OO, which evaluates
the tactical behavior of the player in attack without the ball.

The Effect of Competitive Anxiety and Complexity of Task on the Processing Efficiency and Performance Effectiveness of Table-Tennis Players

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The aim of this study was to examine the processing efficiency theory in sport skills with different levels of complexity. Sixteen table-tennis players were tested using table-tennis tasks with low and high complexity and 2 levels of anxiety. The test included 2 decision-making tests in which ball color signified the target to which the ball should be hit. Cognitive anxiety was manipulated through a competitive ranking structure and prize money. Participants’ accuracy in hitting targets was taken as a measure of performance effectiveness, while probe reaction time (PRT) and perceived mental effort (RSME) were recorded as measures of efficiency. Data were analyzed using separate factorial repeated-measures analysis of variance for each variable in which anxiety (low and high) and complexity (low and high) were within-participant factors. The result showed that anxiety had no significant effect on performance effectiveness in both tasks (p > .05). There was a significant increase in PRT in both tasks under high- versus low-anxiety conditions, but this increase in RSME values was only found in tasks with low complexity (p < .05). In total, the results provide support for processing efficiency theory.

Soccer Small-Sided Games Manipulated by Representation: The Additional Player Effect

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Manipulating games by representation is a useful strategy in teaching games for understanding (TGfU) units because it allows players to develop specific tactical contents in line with practitioners’ levels of proficiency. In this sense, small-sided games (SSGs) with different pitch sizes, numbers of players, and specific rules are commonly used in TGfU units in many sports, including soccer. In these games, it is possible to change the number of players unequally between the teams to create situations of numerical superiority. This context is particularly useful to represent tactical situations in which a zone defense must be adopted by the players to reduce the opponent’s chance to score goals. However, the influence of offensive numerical superiority on the tactical behavior of soccer players is still inconclusive. This study aimed to compare the tactical behavior of under-17 soccer players when playing SSGs with an additional player inside the pitch (4 v 3) or 2 support players at the sides (3 v 3 + 2). Eighteen youth male soccer players participated in a 3-week data collection period in the respective configurations. Tactical behavior was analyzed through the System of Tactical Assessment in Soccer, a protocol that allows for the tactical behavior assessment related to fundamental tactical principles. Chi-square tests with significance levels of .05 were used to analyze the data. Results showed that the 4-v-3 game allowed players to perform more offensive coverage and offensive unity principles when attacking, while the 3-v-3 + 2 game led the athletes to perform more width and length and penetration principles. Similarly, the 4-v-3 game demanded more actions of defensive coverage from the defenders. In summary, both configurations allowed players to perform a consistent number of actions without the ball, and the specific behaviors observed can be used to better adjust the game representation to teacher intentions within the TGfU unit.

Covered Distance and Activity Profile of African Professional Soccer Players According to the Playing Position: Reports From Soccer World Cup 2014

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Some researchers have suggested that the distance covered during high-intensity running in matches is a valid measure of physical performance in soccer because of its strong relationship with training status. In addition, the activity profile of African professional soccer players during match play could be helpful as a good indicator of training.

The purpose of the current study was to describe the activity profile during soccer-match play, including the total covered distance, number of sprints, top speed, and time spent in different activities during matches among African professional soccer players who participated in...
the 2014 Men’s Soccer World Cup, and the difference between the playing positions.

All data were obtained from the international soccer federation website (FIFA). The participants were professional soccer players from 5 African teams. The analyses included all matches that were played during the 1st round (3 matches for every team). The results showed a significant difference in total covered distance ($F = 17.50, p = .01$), covered distance in ball possession ($F = 12.03, p = .01$), covered distance not in ball possession ($F = 18.79, p = .01$), sprint number ($F = 3.12, p = .05$), and time spent in low, medium, and high activities ($F = 10.19, 12.62, and 6.71$, respectively; $p = .01$). The results showed significant differences between playing positions for all parameters except the total sprint number during the game.

Algerian players had the highest total covered distance and spent the most time in high activity during match play, while the players from Ghana had the highest number of sprints. The results based on playing positions demonstrated that midfielders had the best values in the covered-distance parameters, while forward players had the best values in sprint number and top speed during matches.

**Rule Changes in Competitive Ball Games to Increase Game Participation of Players With Low Playing Skills**

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A key issue in physical education (PE) is the high level of heterogeneity regarding abilities and motor skills of students. In individual sports, this issue can be addressed by methodical-didactic alternatives (e.g., internal differentiation) offering motor tasks of variable degrees of difficulty. In team sports, internal differentiation is a particular challenge. Sports games do not only require equal teams for a balanced competition, but they also require a minimum of individual differences in performance within the teams. Observations during PE demonstrate that in teams with highly varying playing skills, strong players often dominate and play with each other. Thus, the inclusion of weaker players is limited and may result in loss of motivation. Experiences from practice show that participation of students with lower playing skills can be improved through basic rule changes in competitive sports games. For example: (a) Separate the playing field into zones in which only specific players of both teams are allowed; (b) include several goals or targets per team; (c) implement areas that do not allow aiming for the target or goal; (d) restrict individual players’ movement with the ball; (e) assign different players with varied ball handling and/or movement options; (f) replace intensive body-involving forms of defense with symbolic defense actions; (g) introduce alternative forms of catching and stopping the game’s object; (h) stipulate indirect target actions; (i) do not place targets at the end of the playing field, but on it; and (j) create low, small-area, or adjustable targets, play without a goalkeeper, and design high obstacles for wall/net games.

**Behavioral Regulation in Coaches: A German Version of the Coach Motivation Questionnaire (CMQ-G)**

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The organismic integration theory (OIT) is used as the theoretical model for understanding motivation in several contexts, such as sport and coaching (Hagger & Chatzisarantis, 2007). The OIT describes 6 different forms of behavior regulation (i.e., amotivation as well as external, introjected, identified, integrated, and intrinsic regulation). McLean, Mallett, and Newcombe (2012) developed the Coach Motivation Questionnaire (CMQ) to assess these different behavioral regulations in coaches. The present study presents preliminary results on the validation of a German translation of the CMQ. The sample includes 233 coaches (72.5% male; $M_{\text{age}} = 37.3$ years, $SD = 13.7$ years) from 32 different individual and team sports. Whereas 28.7% of the participants had experience in coaching for up to 5 years, 24.9% had experience of up to 10 years, and 46.4% had experience of more than 10 years. The original version of the measurement has been linguistically adapted after a translation and back translation. Five subscales of the CMQ show good internal consistencies (Cronbach’s alpha = .76–.88), whereas the subscale of Introjected Regulation was not found to be internally consistent (Cronbach’s alpha = .60). According to the criteria of Hu and Bentler (1999), fit indexes of an initial confirmatory factor analysis (CFA) were not strong, $\chi^2(194) = 441.87$, $p < .001$ (chi square/degree of freedom ratio [CMIN/DF]...
In recent years, game-centered approach (GCA) research has been well populated with studies that enhance the theoretical underpinnings of coaching of games. Nevertheless, there has been limited attention paid to how GCA models such as teaching games for understanding (TGfU) can be merged with alternative fields of game studies to make games accessible. This study acknowledges similarities between a coach and a digital game designer using the notion that “good game designers are practical theoreticians of learning” (Gee, 2013, p. 21) and that the rationale for TGfU and rationale for digital video games are similar—to attract and sustain participation and performance through challenging and enjoyable practice.

This study aims to capture the author’s experiences of implementing “good digital design features” (Gee, 2013) into her practice as a coach mentor for the English Football Association, where she mentors grassroots (youth participation) football coaches from 1 local football club. The coaching climate for mentees at their grassroots club involved a focus on technical outcomes, with a high amount of coach instructional feedback. As a result, players have become acclimatized to a coach-centered environment, where players do not develop their decision-making skills, which was the rationale for Bunker and Thorpe’s (1982) TGfU.

To capture the coach mentor’s experiences, thoughts, and reasoning throughout the season (9 months), an ethnographic approach was adopted using audio-recorded field notes and a personal diary as the instruments for data collection. The results illustrate how the coach mentor strategically uses her mentor–mentee relationship to reshape the narrative used with mentees to “think like a digital game designer” in the coaching context. The intention of this study is not to offer a prescriptive model of practice, but to raise the awareness of the real-life challenges of changing the way coaches think and act.

**Joint Action Imagery: The Influence of Mental Practice on the Functional Structuring of Tactical Skill Representations in Skilled Futsal Players**

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While research on imagery and motor skill learning is vast, research on imagery and tactical skill learning is scarce and lacks systematic approaches and their evaluation (Guillot et al., 2009; Memmert et al., 2009; Westlund et al., 2012). In the present study, we developed an approach to practice joint action by way of imagery and evaluated its impact on tactical skill development. Specifically, the impact of a joint action imagery intervention on representations of team-specific tactics in skilled futsal players was investigated. Players were assigned to 1 of 2 groups: a mental practice group and a (no mental practice) control group. The mental practice group practiced 4 team-specific tactics (i.e., counterattack, play making, pressing, and transitioning) by repeatedly imagining joint actions during specific game situations for 3 times a week during the course of 4 weeks. Players were tested prior to and after the intervention for their representations of team-specific futsal tactics and employed structural-dimensional analysis of mental representations (Schack, 2012). Results revealed well-structured representations for both groups before and after the intervention, reflecting 4 team-specific tactics. Importantly, the mental practice groups’ representations were more similar to those of an expert after the intervention as compared with the control group. This study extends recent findings on expert–novice differences (Lex et al., 2015), indicating that joint action imagery can have a significant impact on players’
tactical skill representations in long-term memory. Consequently, practitioners may consider implementing micro-sessions of imagery within their tactical training sessions to help foster representations of team-specific tactics in team sports. Future research should investigate joint action imagery interventions and their impact on different levels of joint action organization to more thoroughly understand tactical skill development and to deliver most effective interventions on the way to tactical expertise and game intelligence (Memmert et al., 2015; Raab et al., 2007).

**Enacting Change in a Secondary Physical Education Department**

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This poster explores enacting change in a physical education (PE) department and the successful implementation of curriculum and pedagogical innovations (CPIs). The focus examines how to initiate effective pedagogical change using CPIs such as: teaching games for understanding (TGfU), sport education, physical literacy (PL), personal and social responsibility, movement education, and inventing games. The educational significance includes assistance with the successful implementation of PE innovations for the 21st century. The cultural transformation cultivates an environment that will embrace innovations. This poster attempts to describe the experiences of secondary PE teachers enacting curricular and pedagogical change in a secondary PE department. The following thematic sections are explored: knowing, learning, and teaching; TGfU, PL, and PE; pedagogical change in PE; PE culture and curriculum innovation; technology as a change agent; PE department cultural change; phenomenology as methodology; and movement. Collaborative teacher inquiry was the methodology used in this investigation of the experiences of teachers. PL was the influence that brought the teacher participants on board and motivated the participants as they strongly believed in the lifelong benefits. The setting for enacting change was in a secondary PE department. “George” and “Steve” are coresearchers, along with 5 other teacher participants. Data were collected through blogs, field notes, temperature checks, and questionnaires. Our study has provided us with an understanding of how teachers can successfully implement CPIs in a secondary PE department. The findings have been categorized into 5 major themes: curricular and pedagogical innovations; cultural change; leadership and support; relationships and collaboration; and barriers to implementing change. This study provides a starting point for future research, debate, and reflection on encouraging cultural changes that make PE departments relevant in the 21st century.

**Sports Education in Brazil: Motriz Publications and References to TGfU**

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This study aims to analyze the Brazilian academic work produced on physical education about teaching methods, while emphasizing the teaching games for understanding (TGfU) method and the responsible authors. For now, we used as a research source the publications available on Motriz, an important scientific journal for educational purposes in the physical education field. The describing keywords we used on the journal’s searching tool were “teaching games for understanding”; “TGfU”; “métodos de ensino”; “ensinar para a compreensão”; and “pedagogia do esporte.” We have found 19 articles, among which 12 refer to pedagogical or methodological aspects. These articles, published from 2004 to 2012, reinforce the learning of tactical aspects and the orientation to team sports instruction based on the ecological perspective. Three publications establish comparisons between the application of diverse teaching methods and the learning of the technique and game comprehension. Another 4 articles introduce pedagogic proposals to team sports education and even suggest the use of a didactic book in physical education classes. The game analysis based on its complexity is also a topic of research. The University of Campinas is represented in the authorship of 5 articles and provides the biggest contribution to this journal about the theme. In the 2000 decade, a period of experimental studies, the first comparative studies were produced on the effectiveness of traditional methodology and ecological proposals. The concept of TGfU appears in the introduction of the “family of games” idea, concerning the transfer of knowledge acquired between various modalities. Among the works referring
to TGfU consulted by researchers, we can highlight Bunker and Thorpe (1982), Bunker and Thorpe (1989), Werner, Thorpe, and Bunker (1996), Griffin, Mitchell, and Oslin (1997), Griffin, Butler, Lombardo, and Nastasi (2003), and Griffin and Patton (2005). The research articles observed present affinity and understanding about the TGfU method in theoretical and experimental aspects.

**Sports Education in Brazil: Movimento Publications and References to TGfU**

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This study aims to analyze the Brazilian academic work produced on physical education about teaching methods, while emphasizing the teaching games for understanding (TGfU) method and the responsible authors. For now, we used as a research source the publications available on Movimento, a scientific journal for educational purposes and holder of the best qualification in the physical education field for the past 10 years. The describing keywords we used on the journal’s searching tool were “teaching games for understanding”; “TGfU”; “métodos de ensino”; “ensinar para a compreensão”; and “pedagogia do esporte.” We have found 48 articles, among which 11 refer to pedagogical or methodological aspects. The 1st article, originally from Portugal, was published in 1999. This theme only reappeared in 2008, with Brazilian authors analyzing the different dimensions of sports education. The article discusses several topics: historical perspective of sports education, pedagogic and didactic models, professional qualification, and analysis of the impact on the teaching practice. In general, these articles present the evolution of sports education apprehension, focused on technique, and nowadays enable the development of cognitive aspects by the student, while importing the adoption of ecological teaching models. The studies show that the most acquainted model between teachers and coaches is the technical model, a reflex of the teacher qualification still based on traditional education. Among the ecological models, the most mentioned was the “situational” model, which presents features that are similar to TGfU. Among the works referring to TGfU consulted by researchers to organize their studies, we can highlight Bunker and Thorpe (1982), Thorpe, Bunker, and Almond (1984), Hopper (2002), Griffin and Butler (2005), Pearson, Webb, and McKeen (2005) and Curtner-Smith (2006). This study allows us to infer that TGfU is not yet well systematized within Brazilian physical education, however; it is employed in the intellectual production of this field.

**Reframing Physical Education Instruction for Students With Cognitive Disabilities Using the Teaching Games for Understanding (TGfU) Model in Canadian High Schools**

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Beyond the constraints of the classroom, physical education (PE) affords the teacher the use of indoor and outdoor space, specialist equipment, individual and group learning, and the instructional curriculum approach for physical activities. These spaces and an accurate curriculum model provide students with opportunities to thrive academically and develop physical fitness.

The purpose of my research is to introduce the teaching games for understanding (TGfU) model as a pedagogical approach that can facilitate inclusive PE. Physical educators will take into consideration the cognitive, psychomotor, affective, and strategic instructional approaches in the TGfU model to inform their planning. The students with cognitive disabilities will have the opportunity to access the curriculum through problem-solving skills and aptitude in physical activities by constant individual training and experience. TGfU is proposed as an instructional approach for physical educators because the model provides excellent strategies (environment and tasks) for the inclusion of every level of competence, including students with cognitive disabilities. The following research questions will guide this study: How does the use of TGfU pedagogy principles affect the learning of students with cognitive disability in PE programs? In a TGfU PE class, what affordances of learning and skills are offered to students with cognitive disabilities? What happens to learning in PE classes when students with cognitive disabilities are included in planning through assessment in TGfU lessons?

The proposed study will be conducted using critical action research (CAR), emerging from the need to
Involving teachers, students, and researcher in planning, thinking, and acting out the process. The data will be gathered through classroom observation, interviews, students’ self-reflection, and videography. CAR is envisioned to facilitate learning within the PE classroom for students with cognitive disabilities using the TGfU approach. Interviews and videos will be analyzed using the induction method to convey themes embedded in the excerpts.

The Impact of the Educational Complex With Manner Mini-Educational Groups in Attack-Serving Skill Learning in Volleyball for Students

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The sciences and experts in the educational field depend on a rule that every individual alone has experience, educational background, and techniques of their own, which distinguish them from others, so these individuals need educational materials that help them to perform the tasks according to their abilities and educational level and to achieve their ambition.

Self-learning is considered one of the most effective teaching means because this technique gives freedom to the learner for positive and effective participation in an educational activity.

The aim of the study was to identify the impact of using an educational complex with manner mini-educational groups in learning attack serving in volleyball. The researcher has used an experimental method consisting of 2 equal groups (experimental and control groups). Each group includes 12 students. The experimental group used the educational complex, which includes several illustrative and educational methods of skill such as transparencies, skill illustration pictures, and video display (audio and visual).

Learning is in the form of small educational groups, and each group includes 4 students. The learning program continued for 8 weeks. Every week involved 2 educational programs that lasted 90 min each. The researcher concluded that the use of the mini educational group method in the educational complex had a significant impact in learning attack serving in volleyball and assisted the students in discovering their physical, skill, and cognitive abilities, while also saving the time required for performance. We recommended focusing on the mini educational group method in the educational complex in learning attack serving and blocking in volleyball.

Individual Training Control and Intervention in Young Elite Volleyball Athletes

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The increase in performance parameters is a central issue in high-elite sports, especially for young athletes. To ensure optimal development of motor performance, the use of individual training programs seems beneficial (Vaeyens et al., 2008). One concept for goal setting is the SMART principle (Locke et al., 1990), which defines desirable goals as Specific, Measurable, Attractive, Realistic, and Terminated. The aim of this study was to determine if and how much young elite athletes benefit from SMART guidance of individual performance in athletic parameters.

Data were collected from 9 well-trained, competitive female volleyball athletes on a national level who were aged 15 to 18 years old. They participated in assessments of motor performance using a pretest–posttest design (pre1, pre2, post1) including sprint (5 m, 10 m, 20 m), jumping (countermovement, drop, volleyball attack, block jump), tapping, agility, and endurance tests. From pre2 to post1, each participant completed an individualized training intervention (2–3 times per week) in addition to team training for 11 weeks. SMART-based training aimed to increase 3 performance parameters with descending priority. From pre1 to pre2, participants performed nonindividual team training.

Results show that 8 of 9 participants improved their 1st priority, mainly set on jump height (cm) and contact time (ms) with increments greater than 6%. In Priority 2, 3 participants increased their sprint (s) and jumping performance greater than 6%. In the 3rd priority, 3 participants reached rates greater than 6%. From pre1 to pre2, there was no 6% increase in any parameter.

Results show that participants increase their athletic performance via individualized programs, but only 1 participant increased her performance in all priorities. Overall, the results indicate that elite youth athletes
benefit from adequately guided individual interventions; however, setting 2 or more priorities seems to induce interference or suboptimal trends in other parameters.

**Evaluation of Exercise ‘Field’ Tests (6-Min Walk, Shuttle Test, Step Test) in Assessing Exercise Capacity in COPD and Heart Failure Populations: A Systematic Review**

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Purpose: The purpose of this study was to evaluate the reliability and validity of the 6-min walk field test (6MWT), the incremental shuttle field test, and fixed-height step field test with respect to their ability to predict exercise capacity in patients with chronic obstructive pulmonary disease (COPD) and heart failure.

Methods: A systematic review was achieved via 6 databases to assess pertinent Arabic-language full-text articles published from January 1, 1990, to November 30, 2013. Participant characteristics, validity, interventions, and predictive and reliability values for each article with deference to exercise capacity as defined by peak oxygen (VO2peak) levels were extracted and compared. Quality Assessment of Diagnostic Accuracy Studies scores were determined for each study.

Results: Eleven studies met the selection criteria. Comparison of the studies investigating reliability shows that the 6MWT has good reproducibility. The 6MWT presented high correlation with VO2peak levels and the ability to estimate VO2 (exercise capacity) reliant on distance walked, in contrast to the shuttle test, which demonstrated moderate correlation with VO2peak levels. Cutoff distances vary from 350 m to 510 m depending on the study; if total distance walked remains equal or less than these values, the 6MWT and shuttle field test (SWT) retain their strong predictive value, whereas the fixed-height step test demonstrated moderate correlation with VO2peak levels. The duration is variable (90 s to 10 min), but the step height (23.0 to 50.8 cm) and stepping rate (22.5 to 35.0 steps/min) remain constant throughout the test.

Conclusion: The field tests (6MWT, SWT, and step test) have good reliability, high validity, and a significant ability to predict exercise capacity in patients with COPD and chronic heart failure.

**The Relationship Between Investing the Time of the Main Part in Lessons of Team Sports (Basketball, Volleyball, and Handball) and Direct and Indirect Teaching**

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Purpose: This study was conducted to identify the relationship between investing the time of the main part in lessons of team sports (basketball, volleyball, and handball) and direct and indirect teaching.

Methodology: Three male students in the Department of Physical Education & Sport Sciences at the University of Babylon, aged 19 years old, were randomly selected to participate in this study. A descriptive method approach was used to collect data. The Anderson Questionnaire for Observation was applied to assess the students’ activities by 3 referees from the academic staff. For data analyses, we calculated means and standard deviations, as well as ratios of direct to indirect teaching and time teaching to lost time teaching.

Results: The results showed different behaviors between team sports (i.e., handball, basketball, and volleyball), while arithmetic means for some of the behaviors of the same sports were convergent.

Conclusions: This study showed that the ratio of the time distribution of students’ behaviors in the main part of the sports team lessons varied. Furthermore, handball gained the highest percentage in direct teaching in comparison with indirect teaching, followed by basketball and finally volleyball.

**Position-Specific Psychological Profiles in Female Team Handball**

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Motivation, volition, and action control influence handball performance and might as well play a role in talent selection, because biological factors as predictors are seen as controversial (Gonçalves et al., 2012). Positive feedback in psychological coaching promotes performance (Popa, 2006). Position-specific psychological demands have to be specified as already accomplished in other team sports (Hughes et al., 2012) to provide
optimal conditions for coaching. Differences between positions and the connection between expertise and position specialization concerning psychological factors have to be questioned.

Five hundred ninety-two female players from German leagues have been tested via motivation questionnaires (Elbe & Wenhold, 2005), volition questionnaires (Wenhold, Elbe, & Beckmann, 2009), and action-control questionnaires (Hakemp-Sport, Beckmann, & Wenhold, 2009). Additionally, a player’s biography was used to assess expertise. Position-specific differences and correlations of expertise and psychological factors as well as specialization were checked.

Differences were found regarding action control when performing and lack of activation, while factors and specialization correlated characteristically with expertise per position. The context of specialization and performance has to be researched further to provide optimal coaching conditions and positional selection.

**Endurance Capacities are Correlated With the Technical-Tactical Playing Performance in Elite Junior Team-Handball Players**

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To participate in elite team handball, it is accepted that certain anthropometric characteristics and physical capacities are required. However, their associations with technical-tactical playing performance, which may have a direct impact on match outcomes, are unknown. Therefore, this study investigated the relationships between various anthropometric characteristics, physical capacities, and technical-tactical playing performance in elite team-handball players.

Nine male junior team-handball players (aged 18 ± 1 years) competing in the German Bundesliga were tested for several anthropometric characteristics (body height, mass, and fat) and physical capacities (30-m speed and 22-m agility, counter movement jump and squat jumps, one-repetition maximum bench press and core strength endurance, and interval shuttle run test distance). The players were also video-recorded during a preseason tournament that involved 5 matches against opponents who were all competing in the German Bundesliga. The number of successful and unsuccessful technical-tactical actions (e.g., goals, assists, or blocks) were analyzed with analytic software. According to Brack (2002), the playing actions were transformed into a single technical-tactical score. Spearman rank correlations coefficients (r) and common variances (R^2) were computed for statistical analyses.

The level of core strength endurance (r = .51, R^2 = 26 %) and shuttle run test distance (r = .63, R^2 = 40%) were largely correlated with the technical-tactical playing performance across the tournament. No further large correlations were found (r < .25, R^2 < 6%).

While body height, power, and agility in particular are believed to play key roles in elite team handball, our findings show that only capacities associated with endurance were highly correlated with the technical-tactical playing performance in elite junior players. One explanation may be that players with better endurance capacities were more frequently involved in technical-tactical actions across the tournament or that they had experienced less physiological stress during play, thereby potentially favoring the players to execute technical-tactical actions successfully more often. Whether our findings allow conclusions for competitive matches remains unanswered and should be investigated in further studies.

**Decomposing Performance Factors in Jump Throws Reveals Subgroups of Handball Players With Specific Training Recommendations**

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The jump throw is one of the most applied techniques in team handball. Therefore, analyzing underlying performance factors is important because they may provide a basis to adjust training interventions. The aim of this study was to decompose the performance factors in jump throws and to find subgroups of athletes. Each group is expected to benefit most from specific training contents.

One hundred thirteen male handball players (M_age = 15 ± 0.38 years, M_height = 184 ± 7.1 cm, M_mass, 74.83 ± 9.31 kg) participated in this study. From each athlete, standing reach height (SRH), jumping reach height with a countermovement jump (JRH), ball height with a handball-specific single-legged jump and straight arm (BHJ), and ball release height during a jump throw (BHT) were measured. Performance factors were derived as
differences between these measures (JRH–SRH = UJA for unspecific jump ability; BHJ – JRH = SJT for specific jump technique; BHT – BHJ = STT for specific throwing technique). A hierarchical cluster analysis (Euclidean distance and Ward’s linkage method) was used to find groups of athletes based on the derived and scaled difference measures (UIA, SJT, STT).

The dendrogram shows a clear distinction of 4 groups of athletes. Mean values within each cluster reveal (a) 1 group with high UJA values, (b) 1 with low UJA values, (c) one with high SJT but low STT, and (d) 1 with low SJT but high STT. These results may be interpreted with respect to consequences for training, because (a) and (b) are groups that are primarily characterized by strength aspects while the properties of Groups (c) and (d) affect technical aspects of performance. In the next step, intervention studies with different foci will be performed to confirm this approach.

**Technical Performance Demands on the Different Playing Positions in Team Handball**

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This study analyzes the technical demands in female team handball on different playing positions. Position-related differences in the technical requirements for team handball are not sufficiently specified to date. Wings and goalkeepers are sometimes put in their position to keep young and inexperienced players away from the more important positions in the middle of the court like pivots, center backs, and half backs. Further, female team handball is underrepresented in research. To make use of the full potential of all players, position-specific training should be applied. This study investigated handball-relevant technical basic factors and their position-specific development. Six hundred fifty-four female handball players from German leagues at all levels were tested cross-sectionally concerning technical ability (time needed for 20 passes against a wall, time needed for slalom-dribbling parcours). The handball-specific expertise of the players was used as an independent variable. Performance differences between the positions, measured by a formula quantifying the deviations between positions (specialization), are seen as a dependent variable. The chosen factors significantly differ between positions, and expertise correlates with specialization in some positions. For example, wing and back players should specialize in passing/catching and dribbling. Specialization, therefore, is a relevant factor in female team handball when it comes to handball technique, while a basic level for passing and catching is needed in all positions. Therefore, all positions should be well trained regarding technical ability with a special emphasis on wing and back players.

**Core Demands on the Goalkeeper Position in Female Team Handball**

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Team handball requires position-specific training regarding constitutional, physical, coordinative, technical, psychological, and tactical aspects. In female team handball, the demands structure is not sufficiently specified yet, particularly not for goalkeepers. Youth players who lack physical fitness, technical ability, or tactical ability might be positioned in the goal to keep them out of the field (Matthys, 2012). This practice leads to further deficits for which the team cannot compensate later. In various handball-specific tests, goalkeepers perform worse than field players (Zapartidis et al., 2009). Nevertheless, several of the tested goalkeepers play in high leagues and therefore apparently do match the demands of the game. On that account, position-specific demands for goalkeepers have to be clarified. For this purpose, 654 female players from German leagues (91 goalkeeper) were tested using a complex test battery that assesses common handball performance indicators. Two kinds of correlations were calculated: correlations between expertise and factor values as well as between expertise and specialization regarding each factor (quantified using a suitable formula). In summary, the test battery only identified few performance demands regarding goalkeepers (e.g., both handedness, good sprint performance more than 30 m, throwing speed, psychological factors, and technical skill). This finding could mean that the demands for goalkeepers have to be made more concrete in future testing. For selected factors, goalkeepers should practice harder to adjust to the performance results of the field players (e.g., sit-ups, Half Cooper test, throwing speed, wall passing, and others). Coaches should implement these findings in their training routine while a test battery for goalkeeper core demands remains to be established.
**Position-Specific Conditional Demands in Female Team Handball**

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Conditional demands for female handball players are not yet sufficiently specified, particularly not in respect to position-specific performance (Weber, 2015). For optimal match preparation, individualized training taking the specific demands of every position into consideration is necessary. Consequently, the aim of the study was to gain insight into position-specific demand profiles of female team handball players to establish training recommendations for each position.

Data from 652 female handball players from Germany were analyzed using a test battery assessing handball-relevant factors. Conditional, constitutional, technical, tactical, biographical, and psychological parameters were tested using handball-specific tests.

For conditional factors, significant differences ($p < .001$) between positions were observed for several parameters (effect sizes ranging from 0.126 to 0.693). An interesting finding that emerged was that position-specific specialization was correlated with playing level. Following from this finding, it is possible to derive practical interventions such as, for example, half back players specializing regarding their throwing speed.

Specialization is therefore linked to success in female team handball. However, a number of basic factors are important in all positions. For the goalkeeper position, the demands could not be specified in this study.

**Tactical Demands in Female Team Handball on the Different Playing Positions**

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Team handball requires well-developed tactical abilities. The influence of position-specific issues on the tactical skills of female players is still unclear, while players differ in other performance factors according to position. Consequently, specialization regarding tactical skills has to be researched. Position-specific training and selection should be applied to make use of all players’ full potential.

Six hundred fifty-four female handball players with varying skill levels were tested concerning their tactical skills, measured using video-based testing (Wegner et al., 2010). Players had to name the most promising action following the playing situations in the videos and were given points accordingly. Playing expertise was measured via the players’ biographies.

There are positional differences regarding tactical skills and correlations between expertise and specialization for back players. Specialization regarding tactical skill therefore is a limiting factor for match performance. Half backs displayed the best results followed by center backs, wings, pivots, and goalkeepers. Considering expertise gathered during youth training, several different expertise factors per position correlated positively with tactical skills. When testing for correlations between physical fitness, constitutional factors, and tactical skills, the correlations in some positions were negative. This finding could indicate that less fit players are not able to gain sufficient tactical experience because they are positioned in the wing, pivot, or goalkeeper position where they do not have to organize the game in the center of the court. To ensure optimal development of tactical skills in all players, specialization in team handball should not start too early, and selection according to constitutional parameters at an early age should be discouraged (Visnapuu & Jürimäe, 2008).

**Hybrid Teaching Model (TGA + BS) in Badminton: Tactical and Technical Performance Under Different Practice Distributions**

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Introduction: In sport pedagogy, area intervention studies with different models of teaching revealed impacts on learning (Hastie, Ojedab, & Luquinc, 2011; Metzler & Hathaway, 2006). The study aimed to analyze the tactical-technical performance of school children after applying a hybrid teaching model under different practice distributions.

Method: The sample consisted of 27 students ($M_{age} = 12.37 \pm 0.49$ years) divided into 2 groups (G1, double session 1 time per week; G2, isolated session 2 times per week) without experience in badminton. We evaluated tactical and technical performance via the Game Performance Assessment Instrument (Oslin, Mitchell, & Griffin, 1998). The hybrid teaching model used contents of the
tactical game approach (Griffin, Mitchell, & Oslin, 1997) and ball school (Roth, Kröger, & Memmert, 2002) invested in 16 training sessions.

Results: Both groups had greatly improved after treatment for the variables Skill Execution Index and game performance (G1, p = .02 and .02; and G2, p = .009 and .003, respectively). For the Decision-Making Index (DMI), G1 and G2 did not improve. The analysis between groups in the posttest did not reveal significant differences for any variables. The DMI results in this study stand in contrast to those of French et al. (1996) and Hastie, Sinelnikov, and Guarino (2009).

Conclusion: It is not possible to say what the most efficient practice distributions are. Little pedagogical intervention time may have contributed to the students’ rallies, which was more motivating due to its cooperative nature. The practical implications of the results are discussed.

Impacts of an Experimental Scoring System in Badminton on Selected Aspects in Men’s Singles

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The present study deals with the results of the Badminton World Federation’s (BWF) test session regarding an experimental badminton scoring system with best-of-5 games to 11 points without setting. The testing took place from August 1, 2014, to November 2, 2014, and included Level 3 and Level 4 tournaments (BWF, 2014).

In this study, 2 tournaments with the experimental scoring system until 11 points (T11) are compared with 2 tournaments until 21 points with setting possible (T21). The chosen tournaments are comparable concerning place and time.

Five men’s singles were checked per tournament. The focus of the match analyses was concentrated on the following categories and hypotheses: (a) number of rallies per match, increasing in T11; (b) total playing time, decreasing in T11; (c) pure playing time, decreasing in T11; (d) time of rally, increasing in T11; and (e) number of shuttle contacts per rally, increasing in T11.

The number of rallies per match decreased from 82.1 in T21 to 68.0 in T11. The total playing time decreased from average of 42:56 min to 36:36 min, and the pure playing time decreased from 11:50 min to 10:38 min. The time of rally increased from 8.48 s to 9.38 s, and the number of shuttle contacts per rally increased from 9.27 to 9.80.

Although the results do not show any significant changes, it is obvious that all results showed a tendency to support the former hypothesis. One reasonable explanation for not reaching a significance level could be the size of the analyzed sample. To build up a secured base for further decision, samples in future studies should be enhanced in number of analyzed matches and the focus has to be spread to all Olympic badminton disciplines (men’s singles, women’s singles, men’s doubles, women’s doubles, mixed doubles).

Physiological Demands of Elite Ultimate Frisbee

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Introduction and Goal: Ultimate Frisbee (UF) is a fast-growing team sport worldwide, but to date, physiological and physical demands of UF have only been addressed on low playing levels (Krstrup & Mohr, 2015; Scanlan et al., 2015). Therefore, our study assessed cardiovascular loading during an elite UF game and examined the relationship between cardiovascular loading and intermittent running performance (IRP).

Methods: Ten male elite German competitive UF players (Mage = 25.7 ± 4.5 years) performed a YoYo IR1 Test (m and HRpeak) and a regular UF game in which heart rate (HR) was recorded continuously. Distribution in HR zones (Z1, 50–60%; Z2, 60–70%; Z3, 70–80%; Z4, 80–90%; Z5, > 90%) and summated HR zone scores (SHRZS) were calculated, and differences between the 1st half (H1) and 2nd half (H2) as well as correlations with YoYo IR1 performance were analyzed.

Results: Elite UF players showed a moderate-to-high cardiovascular loading (HRpeak = 100 ± 1%; HRmean = 80 ± 4%; SHRZS = 354.4 ± 38.1 a.u.) with HR distributions of Z1 = 2 ± 4%, Z2 = 11 ± 7%, Z3 = 29 ± 9%, Z4 = 44 ± 9%, and Z5 = 13 ± 11%. SHRZS was significantly (p < .05) higher in H1 (358.0 ± 43.7 a.u.) compared with H2 (339.5 ± 41.3 a.u.). Correspondingly, a significant interaction effect for HR (Zones × Halves, F = 3.1, p = .04, etasq = .25) with a shift toward lower HR zones was detected. YoYo IR1 performance (2,024 ± 246 m, HRpeak = 193 ± 10 S/min) was not correlated with cardiovascular loading.

Discussion: IRP of elite German UF players is well above lower-class UF players (Krstrup & Mohr, 2015). Furthermore, regardless of IRP, cardiovascular loading seems slightly lower in elite UF players compared with
lower-class UF players (Krusterp & Mohr, 2015) and players of other field sports (Alexandre et al., 2012), but they show similar signs of fatigue.

Kinematic Trends Observed at the Hip During Dynamic Jump Movements: Proficient Versus Nonproficient Jumpers

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Objectives: The object of this study was to determine if differences exist in hip kinematics during counter-movement jumping.

Methods: Fifteen semiprofessional soccer players ($M_{age} = 22.2 \pm 4.1$ years) volunteered to participate in the study. Participants completed 6 countermovement jumps with landmark body markers for the motion capture system analysis. Participants’ kinematic hip data were then analyzed.

Results: Joint motion data analysis revealed that those participants who achieved greater jump heights maintained a position of external rotation and abduction bilaterally at the hip during the descent and accent of the jump. Participants who achieved lower jump heights incurred a level of hip adduction and/or internal rotation during the jump.

Conclusions: Kinematic differences exist at the hip joint between proficient and nonproficient jumpers. The position of some external rotation and abduction appears favorable for force production in countermovement jumping. Given that many sporting activities involve jumping movements, hip kinematics could offer further insight into talent identification.


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In the past 2 decades, Chinese physical education researchers have done enormous work on the teaching games for understanding (TGfU) model. This poster presentation summarizes the related research work based on the China National Knowledge Infrastructure database, Airiti Library database, and Taiwan thesis database. By using research methods including literature survey, statistics, expert consulting, and clustering analysis, we divide the history of the TGfU research in China during the past 20 years into several stages. We also analyze the distribution feature and developing trend of the geographic regions, research institutes, authors, publications, funding, and academic factors that have made significant contributions to the TGfU research field. From the analysis, 4 key research themes are identified: theoretical research of TGfU, experimental research on ball-game TGfU education, experimental research on TGfU Game Sense, and teacher education research on TGfU. We have the following important findings: (a) The TGfU research became more and more rational during the past 20 years in terms of quantity; (b) the theoretical TGfU research in China has a small number of publications and tends to be localized; (c) the TGfU research in China is more focused on the learning effect than in the affection—there is only 1 study on Game Sense about a case study of college students’ volleyball; and (d) there is a lack of teacher education research on TGfU in China.

The Role of Affordances in Developing Children’ Manipulative Movement Skills: An Application of the Challenge-Point Framework

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The purpose of the present study was to investigate predictions of the challenge-point framework (Guadagnoli & Lee, 2004) by comparing 2 groups of challenging and nonchallenging games in developing manipulative fundamental movement skills. Thirty 4- to 6-year-old children were selected from a kindergarten in Tehran and were grouped according to pretest scores. The specific games were used and were designed for developing manipulative skills in both groups. The task difficulty of these games, however, was increased in the challenging group, while it was kept constant in the nonchallenging group. The intervention lasted 8 weeks with 2 sessions each week lasting 42 min each. Children’s manipulative skills were
assessed using the Test of Gross Motor Development (2nd Version) before and after the intervention. The results of a multivariate analysis of variance showed that improvement of groups in the total score of manipulative skills and all subscales was not significant. Only catching was significant. In total, the challenge-point theory’s predictions in a kindergarten setting and on development of manipulative skills in healthy children failed to be proven. However, more improvement in the challenging group in catching shows that this method is more effective in developing complex skills.

‘Higher, Faster, Stronger?’ An Empirical Study on the Pedagogical Content Knowledge of German PE Teachers

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Pedagogical content knowledge (PCK) is considered a central cognitive component of the professional competence of teachers (Shulman, 1986). Approaches to the conceptualization and measurement of PCK for prospective and professional teachers have been developed increasingly in recent years with a considerable emphasis on mathematics as a subject. In recent times, other subjects have also moved into focus. In comparison, corresponding work in the area of teacher research for the subject of physical education (PE) is still at the beginning (Blömeke & Paine, 2008). Therefore, the aim of this study is to capture theoretically and empirically PCK of prospective PE teachers, representing the basis for a PE lesson that, for example, initiates a deeper understanding of team and racket sports. For this purpose, a theoretical education and didactic area-dedicated test instrument will be designed, prepiloted in smaller samples, and then didactically and empirically optimized and piloted in a broader sample (including a contrast population). Samples of different stages of training and expertise will be selected. Through the piloting of the test instrument to a wider sample, a contribution to the PE teaching theory in the field of teacher profession research will be presented. Actually, the pilot of the study can be discussed by dimensional analysis. Finally, the test instrument will be suitable for comparative studies (e.g., to assess the effectiveness of PE educational-learning opportunities in PE teacher education with regard to team and racket sports) in the long term.

A Pilot Application of TGfU in Sailing: Effects on Game Performance, Knowledge, and Adherence

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The purpose of the present work was to determine whether an intervention with the teaching games for understanding (TGfU) approach led to improvement in game performance, knowledge, and adherence. The participants were 9 sailors (M<sub>age</sub> = 8.44, SD = 1.24 years) from randomly selected organized boat race clubs. This study followed a quantitative approach. We designed 12 TGfU sessions of 60 min each that were validated for sailing by 3 experts. Also, the coach was trained in the approach. The participants were assessed on what and how they decided was executed in relation to the wind, other boats, and racing rules before and after the intervention sessions (pretest and posttest). Decision making, skill execution, game performance, and game involvement were collected using the Game Performance Assessment Instrument while performing a race; the game knowledge was assessed with an ad-hoc questionnaire; and the enjoyment, perceived competence, and intention to be physically active were measured with 2 psychological scales. We verified the treatment according to the TGfU premises. We found nonparametric statistically significant improvements in decision making (p = .03), skill execution (p = .01), game performance (p = .001), and game involvement (p = .02). The participants reported high scores in game knowledge, enjoyment, perceived competence, and intention to be physically active when practicing sailing. The outcomes seemed to support the premise of TGfU, given that participants significantly improved after the intervention in the variables related to performance. This result was important because it serves as a teaching framework for coaches and determines the “what” and “how” of tasks, provides feedback, and gives guidance for the behavior of children and coaches. However, the results were not conclusive because we did not have a control group. We showed it is necessary for participants to be aware of the reasons for their decision making to improve their performance and motivation in the real-game context.
Effects of the Lifestyle Modification Program on Blood BDNF and Its Associated Factors in Korean Collegiate Students

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Background: Multiple epidemiological studies have documented that both vegetarian diet and moderate exercise indicate various mental and physical health benefits, respectively, but the combined effects of the both interventions on mental health have not been extensively studied yet.

Aim: To clarify the combined effects of a vegetarian diet and physical activities on mental and physical health, we tried to analyze the influence of the physical exercise program and regular vegetarian diet for 10 days on blood brain-derived neurotrophic factor (BDNF) level, mood status, and physical fitness factors by the profile of mood states (POMS) test in Korean collegiate students.

Methods: A total of 54 Korean collegiate students (M age = 18.0 ± 1.0 years) including 36 men and 18 women were included in this study. They performed the regular physical activity program with vegetarian diets and were staying at the residential building together for a total of 10 days. Variables including body composition, physical fitness factors, POMS score, and blood BDNF level were measured twice before and after the intervention.

Results: Our program showed the beneficial effects of improvement of physical fitness and weight loss. Especially, the blood BDNF level was significantly increased in the both females (t = −2.761, p = .013) and male students after the intervention (t = −3.392, p = .002), respectively, suggesting the beneficial contribution of this intervention on the mental health of Korean collegiate students.

Conclusion: These data suggest that our program may be a useful tool for the mental and physical health improvement of Korean collegiate students. Further studies using larger sample sizes will be needed to replicate the health-benefit effect of this intervention.

Relationship Between Sport Participation Motivation and Teaching Games for Understanding Among Novice Handball Players

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The teaching games for understanding (TGFU) approach breaks games skills down into step-by-step movements that allow students to be more successful at complicated skills. As students begin to develop their skills in a given task, it can increase the amount of active participation and “promote enjoyment for participants.” Some research suggests that TGFU is an effective approach to increasing fun in sport. The purpose of this study was to evaluate the relationship between sport participation motivation and the TGFU approach among novice handball players. We compared motivation to participate in sport in a group of 19 student novice handball players (aged 10–12 years old) in Tehran City, Iran, who have been trained in the TGFU approach for 3 months, to 20 participants who have being trained based on a traditional technique-based approach for the same time period. We used the Sport Participation Motivation Questionnaire for evaluation of sport participation motivation status of the participants. An independent t test was used to compare sport participation motivation level between the 2 groups. The results revealed a significant difference between the 2 groups in sport participation motivation level: The TGFU group had significantly higher sport participation motivation compared with the other group (p < .05).

Effect of the TGFU Approach on Motor Development and Social Maturity of Elementary School Students

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The teaching games for understanding (TGFU) approach was developed to tap into children’s inherent desire to play. If TGFU, as a new pedagogical model in physical education (PE), is to become a movement that will broaden the scope of PE, it must be anchored in sound research that explores its influences on different domains. Of significant importance in the delivery of learning opportunities within a TGFU structure is the notion that it has the potential to enhance development of psychomotor, cognitive, affective, and social skills. The purpose of this study was to examine the effect of the TGFU approach in soccer on the motor and social development of Grade 4 elementary school students (10 years old) compared to the technique-based approach. Two Grade 4 classes (each 15 students) from an elementary school in Tehran City, Iran, were selected as the experimental and control groups. The experimental group was followed for 10 soccer units, which were taught using the TGFU approach in 5 weeks (2 sessions per week). At the same time, the control group was trained based on a traditional technique-based
approach. The Movement Assessment Battery for Children (2nd Edition) and the Vineland Social Maturity Scale were used to evaluate motor development and social maturity of participants, respectively. An analysis of covariance (ANCOVA) statistical method was used to confirm the results when there were significant differences at the baseline level (pretest score was used as a covariate). The ANCOVA results revealed a significant difference between the experimental and control groups in both motor development and social maturity variables (p < .05). The findings of this study showed that the experimental group that was taught with the TGfU approach had significant main effects in motor and social development compared with the group taught the traditional technique-based approach.

Effects of Dyad Training on Children’s Learning of Front-Crawl Swimming

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Swimming lessons were based on games that included pedagogical principles of teaching games for understanding (TGfU) like representation and exaggeration for both groups. The aim of the present investigation was to examine the effects of dyad training on learning front-crawl swimming. Twenty 7- to 10-year-old boys with the same experience in swimming were assigned to 2 groups of dyad or individual training. After receiving instructions and observing some perfect performances of the skill, 1 of each dyad entered the water and the other 1 stayed outside. The 1 outside (just like a coach) gave feedback to the partner after each trial. After some trials, they exchanged their roles. Children in the individual-training group all entered the water and simultaneously performed the skill after having gotten instructions and making perfect model observation. Thus, 50% of practice trials in the dyad group were physical and 50% were observational, while all of the practice trials in the individual group were physical. Practice trials were marked in a checklist by the instructor. Swimming lessons were facilitated in some way according to pedagogical principles of TGfU for both groups. All participants came back to the pool for a retention test 1 week after the end of the 8-session intervention. In the retention test, each child swam 10 m individually, and their performance was filmed for later analyses. Results showed that the dyad-training group was significantly better than the individual-training group (p < .05). Thus, we can conclude that dyad training not only increases the efficiency of a practice condition, but also enhances its effectiveness and therefore is a good method for optimizing the practice condition with the use of observational learning. Also, dyad training is a cooperative learning method that is compatible with TGfU principles.
SELECTED PRACTICAL WORKSHOPS

Note: Only English abstracts considered.

**Playing With Purpose: Engaging Learners in Game Play Through a Check, Connect, Reflect Approach**

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The teaching games for understanding (TGfU) model enables students to explore their understanding of gamelike situations and the tactical decisions they will have to make within game play. But one must remember that the learner is at the heart of the TGfU model. Educators who design situated-learning experiences to meet cognitive and physical learning as well as students’ personal and social connectedness to the game experience a more active learning environment.

This active workshop will explore British Columbia (BC), Canada’s newly redesigned education curriculum and the positive correlation and applications of the TGfU games model that can be practically implemented at all 3 levels of physical education learning (elementary, secondary, and postsecondary). By developing a “know, do, understand” model of teaching, students learn 3 main conceptual competencies to guide their learning in the physical education environment: communication, thinking, and personal and social learning. The 3 levels of core competencies as stated by the BC Curriculum (2015) are as follows:

- Physical and cognitive learning: Through students’ competency as thinkers, concepts and content can transform a new understanding.
- Social learning: The set of abilities that students use to impart and exchange information, experiences, and ideas to explore the world around them.
- Personal learning: The abilities students need to thrive as individuals to understand and care about themselves and others and to find and achieve their purposes in the world.

Through active participation in invasion-game play as well as discussion of student-centered research and educational experiences, this practical workshop will highlight TGfU as a vehicle to support games learning at the different levels of education as they relate to: elementary education, secondary education, and teacher education.

**Lacrosse: Learning to Play the Game Quickly and Enjoyably**

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This workshop will demonstrate an engaging, success-orientated progression for learning to play lacrosse featuring collaborative challenges and enjoyable game play. Participants will experience and critique the various learning tasks in an integrated manner to clarify and probe the what, how, and why of the progression. This process will enable participants to identify strategies for engaging in and maintaining positive learning states. The session will address ways to adjust the context to differentiate learning opportunities for the diversity of participants, and it will demonstrate how to harness the power of collaborative learning. The framework outlined in this session has been successfully implemented with novice participants of all ages from primary school children to adults in South Australia, emerging from professional expertise and grounded in decades of real-world practice.

The noncontact game of lacrosse provides the ideal context for learning all aspects of skilled play. Participants will play the game and explore how the specific “shape” of the game creates positive opportunities for learning. Consideration will be given to how the game can be focused and adjusted to accommodate players with minimal experience and then how it can be extended with variations to the game and specific rule conditions to challenge more advanced players.

Participants will also experience a range of individual and partner challenges with novel variations and combinations to assist in the development of technical ability, communication, and agility. Attention will be drawn to the process of creating the opportunity and engaging individuals and teams in a self-managed, reflective system.

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Hockey: Sport-Specific Warm-Up in Field Hockey

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Background: With the increasing popularity of field hockey, the importance of injury prevention in amateur and professional hockey players constantly rises. With the focus on no-contact events, most common injuries in hockey involve the lower extremities as well as the lower back (Dick et al., 2007). In contrast, correctly implemented warm-up programs have been considered to enhance performance (Bishop, 2003; Zech et al., 2014). Whereas field hockey involves several dynamic and highly specific movement pattern components during practice and games, goal-oriented warm-up should be considered regarding the respective sport.

Aim: Therefore, the overall aim is to point out the relevance of sport-specific warm-up programs to provide an approach for long-term no-contact sport injury prevention in field hockey.

Lecture Content: In the current lecture, the state of the art of hockey-specific warm-up exercises and insight into the possible practical implementation will be provided. The emphasis will be on a variety of neuromuscular training components, focusing on the functionality of exercises and targeting lower-limb stability as well as sensorimotor control. Components such as strength, agility, and balance will be included, with a special focus on hockey-specific movement control. With the approach of a successive increase in level of intensity as well as exercises with and without additional equipment, an overview on possible examples of application will be provided.

eFUNiño: Innovative Training Control via LED Equipment in Soccer

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Training’s effectiveness depends in part on the optimal fit of the training’s demands and the players’ performance level. For effective training in perception and quickness of action, constant, controlled adaptation of the training environment’s complexity is needed. In football, the main path of perception is the visual. That is why coaches should be able to vary selectively the visual cues of the training environment during perception training depending on the performance level.

Innovative and intelligent light-emitting diode (LED) equipment offers possibilities for adaptations of the environment’s complexity in real time. Goals and vests with attached LED lights can be used to change team membership or goal constellation during training in real time, which demands players’ constant vigilance and cognitive flexibility. The adaptation can be applied manually or be controlled via smartphone app. Using such applications, the coach is equipped with more capacity for observation and coaching.

During the workshop, the following content will be shown: (a) training control in mini-football (eFUNiño) with the help of LED equipment; (b) driving of different game scenarios without external verbal advice; and (c) presentation of complex training goals with different light scenarios throughout the vests and goals (e.g., diagonal play, training with spatial restrictions).

Tennis Australia Hot Shots Program Adhering to the Guiding Principles of the Game Sense Approach

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The instructional practices of tennis teaching/coaching internationally have traditionally been characterized by high levels of explicit verbal instruction with a particular emphasis on developing technique in isolation prior to the tactical aspects of the game. However, in recognizing that players should be exposed to planned activities that foster development in 4 central domains—the physical (technique), social (interaction), cognitive (decision making), and affective (fun and enjoyment) domains—Tennis Australia has developed the Hot Shots Program, which acknowledges the benefits of incorporating a more game-based teaching approach for tennis. Learning is positioned, at least initially, within modified games to emphasize understanding of the way rules shape game behavior, tactical awareness, decision making, and the development of contextualized stroke mechanics (technical skill). This workshop will present a variety of tennis games and play practices from the Tennis Australia Hot Shots Program adhering to the guiding principles of
the Game Sense approach, where players develop their technical skills with understanding by being actively involved in game play in an inquiry environment distinguished by the pedagogical use of questions to shape the complementarity of technical and tactical game development.

**Inventing Games Through Democracy in Action and Adaptation**

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During the inventing games (IG) process, students create their own games based on the 4 teaching-games-for-understanding games categories (target, striking, net/wall, and invasion games). Because students invent their own games, they are able to design them in a way that makes them accessible to their particular level of cognitive, psychomotor, and affective ability. After playing their games, students discuss ways in which rules, dimensions of play, objects, equipment, and number of players can be developed to make playing more inclusive and enjoyable for all. The games evolve as students explore them through play and reflection. Through encouraging learners to invent their own games, teachers can help learners to develop respect for equal justice and for free and open inquiry. In this way, students come to understand their responsibility to protect individual and collective rights and freedoms. When it comes to teaching democracy, it is important to pay close attention to the entire context in which learning takes place, because by definition, the notion of democracy applies to individuals as they operate within the community.

In this practical session, we will explore learning progressions, group roles, and environmental constraints that can be used in IG by applying a democratic process to student learning. IG fosters participation by working in small groups, with an emphasis on cooperation to create optimum challenging conditions for all players through trial, review, negotiation, and redesign. In IG, players focus on creating play as a shared experience, where winning results in a game change (adaptation to challenge the winner) to create a closer game in the next game encounter. We all start with more or less an advantage in game situations, but rarely do we examine how we can create equal opportunity for success within the learning situation, within a democratic structure.

**Playing Football TOGETHER: A Pupil-Centered Approach to Teaching Football in Physical Education**

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Even though football is enormously popular among children, few things in physical education in schools are as difficult as initiating and especially maintaining a match in which all children are included. The reasons for this difficulty are manifold. First, there is hardly any other sport in which the pupils’ pre-experience differs so much, resulting in a level of play that is more heterogeneous than in any other ball game. Second, in comparison to games in which the ball can be controlled with the hand, ball control with the foot is an added difficulty, especially for children and youth with little or no experience. Third, the ball flies through the air with a higher frequency and at a higher speed than in other ball games, which not only adds to the difficulty of controlling (stopping) the ball, but can also induce fear of the ball especially in inexperienced players.

As a result, children with football experience often dominate the game even more than experienced players in other ball games such as handball or basketball, while inexperienced children hardly have a chance to actively participate in the game.

In this workshop, we will present a child-centered approach to teaching football in physical education aimed at reducing the aforementioned problems. The teaching unit centers on dividing classes into small teams, each led (and coached) by an “expert” player. The teams stay together throughout the whole unit, while identifying and practicing skills needed to improve individually and as a team. We present worksheets and group tasks designed to develop an understanding for common elements of the game and basic tactics needed for success. Our aim is to put the responsibility for the game into the hands of the children and allow them to make their own adaptations to maximize the level of challenge and fun.

**Questioning in Game-Centered Approaches to Teaching and Coaching**

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The purpose of this workshop presentation is to share 3 questioning methods that can be employed during the
teacher’s/coach’s employment of a game-centered approach (GCA). These methods are (a) the debate of ideas, (b) the GROW model (Goal, Reality, Obstacles/Opportunities, and Way forward), and (c) the reflective toss. It is hoped that presenting these 3 methods will aid teachers and coaches at the upper elementary school, middle school, and high school levels in transitioning to a questioning approach and, in the process, help them to develop their pedagogical content knowledge, which is a key requirement of using a GCA. The workshop presentation will also demonstrate how the teacher/coach becomes a coparticipant (Davis & Sumara, 2003) in learning within a GCA that empowers learners to take responsibility for their learning.

Development of Cognitive Skills Through Psychokinetic Games

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Sports games are characterized by variability. During the game, an ongoing and rapid change of ball possession, tasks, opponents, and game situations exists. This rapid change requires from the players a high degree of development of cognitive skills. They should perceive the game, act properly, detect the required tasks, and weigh the possible solutions appropriate for the situation. “Psychokinetic games” have been designed to train cognitive skills and collective coordination as required in sports games. Based on a modular (Hossner, 1995) and incidental learning (Kröger & Roth, 1999) approach, characteristic game situations in sports games were identified. The typical tasks include coordinative actions performed under various information requirements and time-pressure conditions. By implementing psychokinetic games during training, special attention is paid to the individual and their impact on the collective actions. The game begins with a simple passing task, and after each pass, players change the field’s formation, relocate themselves, and pay attention to the next pass. The passes are carried out with orientation changes; anticipating the position of the partners and the correct dosage of the strength and speed of the ball are required. With the insertion of 2 or more balls, the degree of complexity is further elevated, because all the balls and all players should be in motion simultaneously and continuously. This simultaneous and continuous motion places high demands on the attention, concentration, and anticipation of the players. The use of psychokinetic games is a didactic strategy that stimulates the development of cognitive skills such as perception, anticipation of movement, attention, and concentration as well as the coordination of individual and collective actions. Psychosocial processes are also taken into account. The single player is not only the object of training, but the subject of the training process (Glassauer & Nieber, 2003).

Innovative Strategies for Challenging and Transforming Coaching and Teaching Practice

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This practical-based session will demonstrate how the play-practice processes of “shaping” and “focusing” the play are applied to engage players in games-based contexts to facilitate learning. While basketball is the activity, the emphasis is on the key principles for reflective coaching applicable in many sports.

This session will highlight the importance of teaching through the game by exploring the design of authentic challenges engaging players to play and adapt. Attention will be directed to strategies for differentiating the context to cater to a diverse participation. The sport educator needs to scan a dynamic environment, analyze what is happening, and adjust aspects of the context accordingly or alternatively to empower groups to personalize the play through variations in the task, individual, or environment.

The concept of “focusing” the play or “teaching in the game” will be demonstrated as a strategy for accelerating learning and drawing attention to specific aspects of skilled play. Weighted, numbered go-for-goal games will provide the context in which to focus the play to develop “game sense” defined by Launder and Piltz (2013, p. 16) as “the ability to use an understanding of the rules, tactics, strategy and of oneself (and of one’s teammates) to overcome the problems posed by the sport or by one’s opponents.” These games are ideal for focusing on the tactical aspects of game sense as players adopt attack roles, with and without the ball, as well as defending.

The session will also demonstrate strategies for “enhancing” the play to promote player engagement. This enhancement includes embedding a variety of feedback loops within the learning context to maintain engaged states through adjustment, adaptation, and learning.
This workshop will integrate theory with practice to provide sport educators with the best opportunity to reflect on, challenge, and transform their practice.

Coaching for Understanding at an Elite Level: Theory to Practice

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The teaching games for understanding (TGfU) approach has not been widely adopted in coaching, especially at an elite level. There are various reasons for this resistance including occupational socialization in professional sport and the reactionary nature of the governing bodies that control traditional games. Based on many years of action research and reflective practice, this presentation argues that situated learning based on modified games, which espouse constructivist learning theories, provides a highly suitable coaching model for use in elite sport. The benefits to high-level performers in terms of improved decision making, contextual skill application, and developing players who are not coach-dependent will be identified, explained, and demonstrated.

This practical presentation will exemplify how TGfU can, through the use of a facilitative and democratic coaching style, empower soccer players to apply high-order skills effectively, solve their own complex problems, and make correct decisions on the field. The coaching session will challenge players to address specific tactical situations and will be followed by a critical discussion on the efficacy of such an approach.

Teaching Games in the Early Years: Weaving Complexivist and Play Discourses

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This practical workshop invites you to consider a teaching approach that draws on and supports complexivist and play discourses in fostering young children’s learning in, through, and about games in the early years (3–8 years old). The approach focuses on supporting children to learn the nature of games as socially constructed activities with some explicit rules on which players have agreed. It is underpinned by complexivist discourse in 2 ways. Firstly, it emphasizes creating an enabling constraint in the form of a structured and flexible framework to guide teachers and children to play games in many different and shared ways. Secondly, it encourages fostering interactions among children and teachers to enable ideas and activities to be shared and tinkered with to generate new possibilities in games teaching and learning. This emphasis on generating new possibilities is consistent with Esposito’s (1995) definition of play as an encounter with possibilities. Generating new possibilities emerges from children and teachers coexploring and cocreating game experiences that are meaningful to both while enabling children to experience and learn game-related concepts such as game structure and game design. I draw on the play concepts of inside-out and outside-in perspectives to argue that this teaching approach simultaneously values both perspectives. The inside-out perspectives of players relate to the focus on meaningful game experiences, while the outside-in perspectives of games education relate to the focus on learning game structure and design. I share examples from my research that have contributed to the development of this approach and invite you to consider new possibilities for games education in the early years.

Opportunities for Integrating Attention Training in Daily Practice

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Attention plays a crucial role in sports games. It is one of the mental foundations for a successful player because it has an impact on many parts of the game like performing under pressure, creativity, perception, decision making, and the development and execution of techno-motoric skills. One reason attention has become more and more important is the increasing pace of sports games during the last decade. Consequently, attention is an important factor for a player’s development and performance. Outside of the field of sports, there is evidence that attention training at a young age can boost attention. First, results of my own scientific work and my experience as a sports psychologist indicate that attention can be trained very effectively at a young age in football. Hence, training at a young age should have a positive impact on the development and therefore later performance of players. Therefore, it seems reasonable to train the ability of attention regularly from an early age onward. However,
there seems to be too little time in daily practice to carve out additional time for extra attention training. The aim of this practical workshop is to illustrate how to integrate basic and situation-specific attention training into daily practice at all age levels.

First, a short theoretical framework of the main concepts in attention research will be given—including focus of attention, selective attention, divided attention, and vigilance—and its meaning for team sports will be discussed. Then some practical football drills—for example, warm-up, passing, and shooting—and the possibilities of integrating attention training will be demonstrated. Furthermore, different styles of coaching and its effects on attention will be exemplified. At the end, there will be room for discussion about further ideas and transfer to other sport games.