





Top 10 Research Questions Related to Teaching Games for Understanding

Daniel Memmert, Len Almond, David Bunker, Joy Butler, Frowin Fasold, Linda Griffin, Wolfgang Hillmann, Stefanie Hüttermann, Timo Klein-Soetebier, Stefan König, Stephan Nopp, Marco Rathschlag, Karsten Schul, Sebastian Schwab, Rod Thorpe & Philip Furley


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SPECIAL TOPICS: Top 10 Research Questions

**Top 10 Research Questions Related to Teaching
Games for Understanding**

Daniel Memmert

German Sport University

Len Almond

St. Mary's University College

David Bunker

Loughborough University

Joy Butler

University of British Columbia

Frowin Fasold

German Sport University

Linda Griffin

University of Massachusetts Amherst

Wolfgang Hillmann, Stefanie Hüttermann, and Timo Klein-Soetebier

German Sport University

Stefan König

University of Education Weingarten

Stephan Nopp, Marco Rathschlag, Karsten Schul, and Sebastian Schwab

German Sport University

Rod Thorpe

Loughborough University

Philip Furley

German Sport University

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Correspondence should be addressed to Daniel Memmert, Institute of Cognitive and Team/Racket Sport Research, German Sport University, Am Sportpark Müngersdorf 6, 50933 Köln, Germany. E-mail: memmert@dshs-koeln.de

In this article, we elaborate on 10 current research questions related to the “teaching games for understanding” (TGfU) approach with the objective of both developing the model itself and fostering game understanding, tactical decision making, and game-playing ability in invasion and net/wall games: (1) How can existing scientific approaches from different disciplines be used to enhance game play for beginners and proficient players? (2) How can state-of-the-art technology be integrated to game-play evaluations of beginners and proficient players by employing corresponding assessments? (4) How can complexity thinking be utilized to shape day-to-day physical education (PE) and coaching practices? (5) How can game making/designing be helpfully utilized for emergent learning? (6) How could purposeful game design create constraints that enable tactical understanding and skill development through adaptive learning and distributed cognition? (7) How can teacher/coach development programs benefit from game-centered approaches? (8) How can TGfU-related approaches be implemented in teacher or coach education with the goal of facilitating preservice and in-service teachers/coaches’ learning to teach and thereby foster their professional development from novices to experienced practitioners? (9) Can the TGfU approach be considered a helpful model across different cultures? (10) Can physical/psychomotor, cognitive, affective/social, and cultural development be fostered via TGfU approaches? The answers to these questions are critical not only for the advancement of teaching and coaching in PE and sport-based clubs, but also for an in-depth discussion on new scientific avenues and technological tools.

Keywords: culture, physical education, sport psychology, technology

All across the world, people engage in, compete, and watch various types of sports. Since the institutionalization of sport in the late 19th century, an important question in sport sciences, sport psychology, human movement science, and sport pedagogy has been how children can be taught most effectively how to play. To generate tactical decision-making possibilities (Griffin & Butler, 2005) and to look for novel, creative solutions (Memmert, 2015), it is important for children to perceive what is relevant information in their environment and to consider this information in their behavior plan. Training of general game ability to carry out invasion, net/wall games, striking/fielding, or target games comes along with the development of useful, tactical, partially exceptional solutions as a base for sports like soccer, ice hockey, team handball, basketball, field hockey, softball, volleyball, beach volleyball, tennis, table tennis, American football, rugby, badminton, cricket, baseball, squash, curling, or golf (Mitchell, Oslin, & Griffin, 2013). Generally speaking, the conceptual approaches of teaching sport-related games in schools and clubs are always about the questions of “what to do” and “how to do” it in complex game situations. The “what” type questions allow for exploration of complex tactics and easily trainable (basic) tactics (Griffin, Mitchell, & Oslin, 1997; Memmert & Harvey, 2010); the “how” type questions embrace discussions of methodological principles for teaching tactical competencies and the attempt to empirically validate them—that is, to guarantee effectiveness and sustainability in physical education (PE) and club training, an issue that seems to be critical especially in PE (cf. König & Singrün, 2013). Additionally, more general principles of play, like space, depth, and width, are important for the development of understanding “what to do” and “when to

do it” and, consequently, for the development of tactical skills.

For more than 35 years, different models have been developed in different countries to introduce team and racket sports in schools or sport clubs. Probably the most influential model worldwide has been the “teaching games for understanding” (TGfU) model, introduced by Bunker and Thorpe in 1982 (for a recent review, see Harvey & Jarrett, 2014, and Stolz & Pill, 2014b). The TGfU model succeeded in entering the curriculum plans of North America, Japan, Australia, New Zealand, and the United Kingdom. Further, the importance of TGfU becomes apparent in the regularly held and well-attended TGfU international conferences in partnership with the Association Internationale des Ecoles Supérieures d’Education Physique or International Association for Physical Education in Higher Education (AIESEP). The TGfU model became the basis for a special interest group in AIESEP in 2002. Previous TGfU conferences have been held in New Hampshire (2001), Melbourne, Australia (2003), Hong Kong, China (2005), Vancouver, British Columbia, Canada (2008), and Loughborough, United Kingdom (2012), and the conference will be held in Cologne, Germany next year (2016). One-day symposia were held prior to the AIESEP World Congresses in Jyväskylä, Finland, in 2006; La Coruna, Spain, in 2010; and Auckland, New Zealand, in 2014. The next symposium will be held in Istanbul, Turkey. In addition, the TGfU science community has published extensively in prestigious peer-review journals (e.g., *Journal of Teaching in Physical Education*; *Sport, Education and Society*; *Physical Education and Sport Pedagogy*; and *European Physical Education Review*). Finally, the impact of the TGfU model has become evident

TABLE 1
Selected Overview Textbooks, Conference Books, and Significant Events in the Area of Teaching Games for Understanding (TGfU) and Subsequent Games Concept Approaches

<i>Year</i>	<i>Authors</i>	<i>Content</i>
1982	Bunker & Thorpe	Landmark article: a model for the teaching of games in secondary schools.
1986	Thorpe, Bunker, & Almond	Launches the TGfU approach into the physical education community with this book as the first TGfU resource.
1997	den Duyn	Emphasizes game sense and initial sport-specific movement skill development through the context of game play.
1997	Mitchell, Oslin, & Griffin	Teaches with the tactics of the tactical games model, skills, and off-the-ball movements to achieve greater flexibility for the teacher.
1999	Curriculum Planning and Development Division	The games concept approach became part of the National Curriculum. Revised physical education syllabus for primary, secondary, and preservice levels. Longitudinal study by researchers at Nanyang University followed.
2000	Metzler	Describes a variety of instructional models appropriate for TGfU and other physical education curriculum models.
2001	Lauder	Uses the play practice approach to teaching and coaching sports to focus on teaching game play first instead of technique and skill.
2003	Butler, Griffin, Lombardo, & Nastasi	Presents selected quality representative papers from the First International TGfU Conference 2001.
2003	Mitchell, Oslin, & Griffin	Covers the elementary level as well as middle and secondary levels to show teachers how to move from a traditional approach to a tactical games teaching approach.
2003	Thorpe	Rod Thorpe presented TGfU to the Australian National Conference of Coaches and Officials. He subsequently worked with the Australian Sports Commission and the Australian Coaching Council to adapt TGfU for a broader range of sports deliverers (beyond teachers). The group decided Games Sense is a more attractive term for the modified approach, particularly for coaches.
2004	Light	Introduces Games Sense as an exciting and innovative approach to coaching and physical education that places the game at the heart of the session and explores key concepts as well as essential pedagogical theory.
2005	Griffin & Butler	Represents theory, research, and practice of TGfU through a comprehensive perspective, the latest research, the TGfU model, and tips to apply the TGfU approach.
2005	Grehaigne, Wallian, & Godbout	Focuses on the foundations and applications of constructivism for the teaching and learning of invasion sports and games with the tactical-decision learning model.
2006	Liu, Li, & Cruz	Proceedings for the Third TGfU International Conference: A Global Perspective of Physical Education and Sport, Hong Kong.
2006	Light, Webb, Piltz, Georgakis, & Brooker	Proceedings for the Asia Pacific Conference on Teaching Sport and Physical Education for Understanding.
2006	Mitchell, Oslin, & Griffin	Using the tactical games model, helps students to expand their ability to perform specific skills through modified game play in which they apply specific tactics.
2007	Rossi, Fry, McNeill, & Tan	Reports on the views of Singaporean teachers of a mandated curriculum innovation aimed at changing the nature of games pedagogy within the physical education curriculum framework in Singapore.
2007	Tallir, Lenoir, Valcke, & Musch	Introduction of the invasion games competence model.
2009	Hopper, Butler & Storey	Combines the ideas and perspectives of the Fourth International TGfU Conference in 2008 and highlights the current research and practice around the world in TGfU.
2010	Butler & Griffin	Brings the TGfU approach to life. This book is not a rehash or a revision of the 2005 'book; it presents all-new material on TGfU.
2010	Hastie	Introduction of the student-designed games—making games for learning.
2010	Slade	Presents how to use games to keep kids active and involved and how to teach them fundamental movement skills and game sense that will help them develop a lifelong love of activity.
2012	Butler	A collection of research studies written by practicing physical educators with a focus on reconceptualizing physical education through TGfU.
2012	Pill	Focuses on Australian football sport teaching and how to bridge the gap between the game sense theory and practical application of game-centered skill teaching.
2013	Mitchell, Oslin, & Griffin	An integrative comprehensive textbook covering early grades to secondary grades for a tactical model that helps students to expand their ability to perform specific skills through modified game play in which they apply specific tactics.
2013	Ovens, Hopper, & Butler	Focuses on complexity thinking in the context of physical education and enables fresh ways of thinking about research, teaching, curriculum, and learning.

(continued)

TABLE 1 – (Continued)

Year	Authors	Content
2013	Pill	Introduces ideas and activities of working with a game-centered Game Sense and sport education approach to physical education games and sport teaching.
2014	Light, Quay, Harvey, & Mooney	Examines new approaches in games teaching and team sport coaching that are player/student-centered and inquiry-based.
2014	Pill	With the game sense theory, develops a teaching guide for early-years and primary school educators for physical education.
2015	Memmert	Introduces tactical creativity in the field of TGfU and discusses on the basis of a new theoretical framework (tactical creativity approach) new rules for training conditions for teaching and coaching tactical creativity to children and young people.

through the publication of more than 30 textbooks and conference books (Table 1) and 1,113 peer-reviewed articles (based on a Google Scholar search completed in December 2014) since 1989 (Butler & Ovens, 2015).

As highlighted in Figure 1, the conferences and symposia have provided a fertile means for supporting and stimulating research activity around TGfU. In the last two decades, several suggestions for rethinking, theorizing, and exploring the basic TGfU model by Bunker and Thorpe (1982) have been published (e.g., Chow et al., 2007; Dodds, Griffin, & Placek, 2001; Kirk & MacPhail, 2002, 2009; Oslin & Mitchell, 2006; Stolz & Pill, 2014a; also see Table 1).

In summary, the TGfU framework has stimulated a bulk of research activity and has applied implications for teaching and coaching of both tactical and technical skills in different sport-related games. The emerging game-centered approaches place the learner in problem-solving situations, in which decision making is of central importance and

coincides with skill and movement development within this game-centered context. In the following section, we will discuss the top 10 prevailing research questions related to TGfU to enhance and develop this concept in the area of invasion and net/wall sports. A central aim is to introduce recent frameworks and models from other kinds of disciplines like psychology, pedagogics, and ecological psychology to test the value of adding them to TGfU and—if appropriate—try to combine them with the TGfU approach.

TOP 10 RESEARCH QUESTIONS RELATED TO TEACHING GAMES FOR UNDERSTANDING

In this section, the proposed top 10 research questions relating to the TGfU model are presented. These research questions were derived when establishing the conference themes for the upcoming TGfU conference

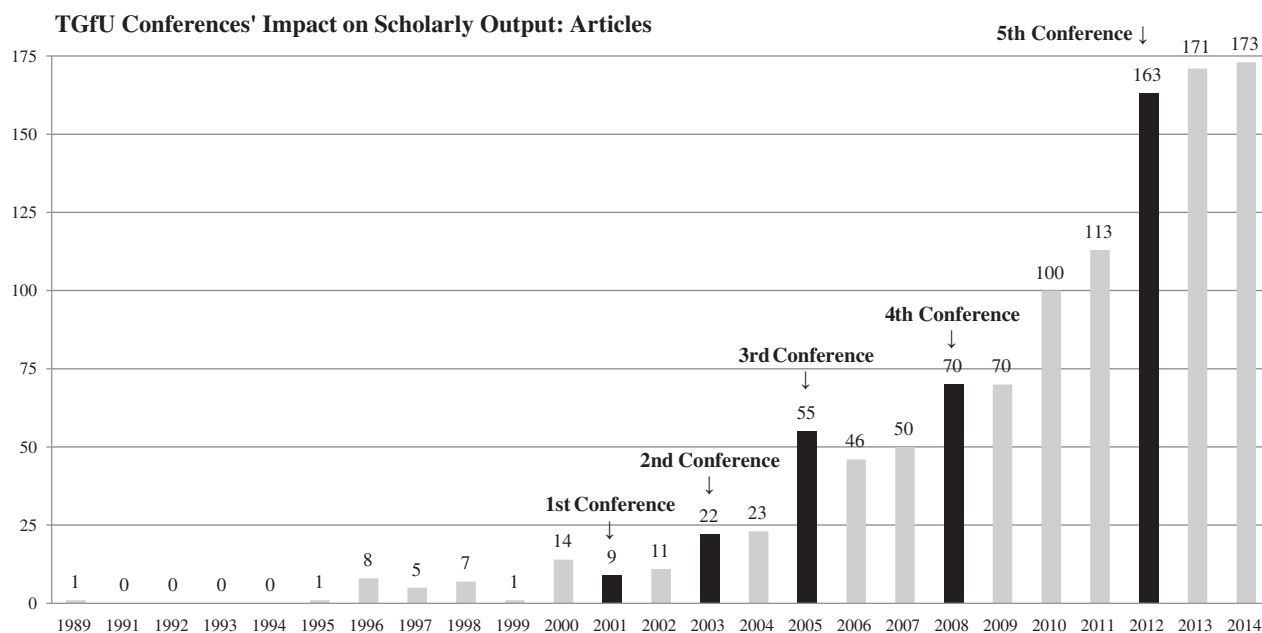


FIGURE 1 “Teaching games for understanding” (TGfU) Conferences impact on scholarly output: Articles (Butler & Ovens, 2015). © Agora for Physical Education and Sport. Reproduced by permission of Agora for Physical Education and Sport. Permission to reuse must be obtained from the rightsholder.

in Cologne in 2016. Forty-two scientific board members from 16 different countries developed and finalized the conference themes (see <http://www.tgfu2016.info>). In this collaborative endeavor, six overarching themes emerged and have been published on the conference homepage:

- (1) Using scientific approaches from different disciplines (e.g., pedagogy, psychology) to enhance game play for beginners and proficient players. This theme encompasses approaches associated with TGfU and other related approaches (e.g., small-sided games) for promoting decision making, anticipation, attention, and perception within games-based learning to develop creative and intelligent performers.
- (2) Using technology to evaluate game play for beginners and proficient players that encompasses game-play evaluation/assessment.
- (3) Complexity thinking in learning through games to consider the broad movement to understanding game learning as dynamic and nonlinear and as part of forming a complex learning system. The recognition of games as complex adaptive learning systems raises questions about how best to utilize complexity thinking to shape day-to-day PE and coaching practices.
- (4) Game making/designing for emergent learning to enable young people to design, create, or invent their own games. How can purposeful game designing create constraints that enable tactical understanding and skill development through adaptive learning and distributed cognition?
- (5) Teacher/coach development in game-centered approaches—preservice and in-service teachers/coaches learning to teach by using TGfU-related approaches as well as professional development of novice to experienced practitioners. This topic can also link to pedagogical strategies associated with TGfU such as facilitation, observation, and analysis as well as questioning.
- (6) Understanding games for learning and cultural development. This theme encompasses physical/psychomotor, cognitive, affective/social, and cultural development via TGfU approaches, which include indigenous cultural perspectives.

From these six overarching themes, the lead author derived 10 research questions in collaboration with the coauthors that are critical to the field of TGfU (see [Table 2](#)). In the following sections, we provide a brief overview and rationale for the top 10 research questions. Our central aim is to highlight why these questions are of central importance to the field, rather than providing a comprehensive review of the literature for the individual questions.

TABLE 2
Top 10 Research Questions Related to Teaching Games for Understanding (TGfU)

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1. How can existing scientific approaches from different disciplines (e.g., pedagogy, psychology) be used to enhance game play for beginners and proficient players?
 2. How can state-of-the-art technology be integrated to game-play evaluations of beginners and proficient players by employing corresponding assessments?
 3. Can complexity thinking be considered a suitable theoretical background for teaching and learning in sports-related games?
 4. How can complexity thinking be utilized to shape day-to-day physical education and coaching practices?
 5. How can game making/designing be helpfully utilized for emergent learning (i.e., enabling young people to design, create, or invent their own games)?
 6. How could purposeful game design create the constraints that enable tactical understanding and skill development through adaptive learning and distributed cognition?
 7. How can teacher/coach development programs benefit from game-centered approaches?
 8. How can TGfU-related approaches be implemented in teacher or coach education with the goal of facilitating preservice and in-service teachers/coaches' learning to teach and thereby foster their professional development from novices to experienced practitioners?
 9. Can the TGfU approach be considered a helpful model across different cultures?
 10. Can physical/psychomotor, cognitive, affective/social, and cultural development be fostered via TGfU approaches?
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1. How Can Existing Scientific Approaches From Different Disciplines (e.g., Pedagogy, Psychology) Be Used to Enhance Game Play for Beginners and Proficient Players?

The first question asks how approaches related to TGfU can benefit from established findings in neighboring disciplines in promoting decision making, anticipation, attention, and perception within game-based learning to develop creative and intelligent performers. One of the notions of recent research endeavors is to add further knowledge to the originally pedagogical-directed game-centered model of TGfU. This knowledge may come from other scientific communities such as psychology or sport psychology and can be exemplified by the research field of creativity (Guilford, 1967; Sternberg & Lubart, 1995). The primary aim of the current games-centered approaches (see [Table 1](#)) is to teach/coach tactical problem solving through small-sided games (Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011) in different types of invasion games (e.g., basketball, netball, soccer), thereby enabling learners to find the best tactical solutions. In addition to teaching tactical abilities concerned with finding the ideal solution to a given situation, tactical creativity refers to the production of varying, rare, and flexible decisions in different invasion, striking, target, and net/wall game situations (Memmert & Roth, 2007). Thus, new options and possibilities to foster tactical creativity could be incorporated in the TGfU

approach (for a comprehensive discussion, see Memmert, 2015).

The TGfU approach would benefit from further research areas in psychology or exercise psychology. Among others, these areas include motivation research (Friedman & Förster, 2001; Higgins, 1997), attention research (Goldstein, 2011; Kasof, 1997), memory research (Baddeley, 2007; Soto & Humphreys, 2007), as well as general learning research (Cleeremans, Destrebecqz, & Boyer, 1998; Reber, 1993) or exercise research (Hoff, Wisløff, Engen, Kemi, & Helgerud, 2002). All of these paradigms have already been transferred to sport sciences and have elucidated how people undertake fast and effective training to understand and store new content in more effective ways. For example, the significant influence of motivation on decision-making performance was demonstrated experimentally (Memmert, Hüttermann, & Orliczek, 2013). A longitudinal study by Memmert (2007) showed the effects of an attention-broadening training program on the development of creative performance in the area of sports. Recent empirical evidence has indicated that working memory can be considered a core concept in understanding performance processes in invasion and net/wall games (Furley & Memmert, 2013). Research studies have verified that implicit and analogy learning is a powerful learning mechanism for technical and tactical skills in a complex environment (for a review, see Jackson & Farrow, 2005). Transferring core ideas from the science of training showed the necessity of learning game ability during longer periods of time (König & Singrün, 2013; Roth & Kröger, 2011).

2. How Can State-of-the-Art Technology Be Integrated to Game-Play Evaluations of Beginners and Proficient Players by Employing Corresponding Assessments?

The assessment of game play or game performance continues to be and will be one of the most difficult assignments in PE (Chen & Rovigno, 2000; Gréhaigne, Godbout, & Bouthier, 1997; Gréhaigne, Richard, & Griffin, 2005; Griffin & Richard, 2003; Mitchell et al., 2013; Oslin, Mitchell, & Griffin, 1998; Richard, Godbout, Tousignant, & Gréhaigne, 1999). Individual game performance is a complex construct that is influenced by a number of different parameters (Hohmann & Brack, 1983; Wagner, Finkenzeller, Würth, & von Duvillard, 2014) and should not be confused with game success (Lames, 1998). The evaluator needs to differentiate individual performances in the context of team performance from innumerable different game situations and has to consider the complexity of the interactions (Carling, Reilly, & Williams, 2009; Drust, Atkinson, & Reilly, 2007). Key performance indicators of tactical behavior are also predominantly accessible as qualitative data, which are subject to reliability and validity issues (e.g., Memmert & Harvey, 2008; Nadeau, Richard, &

Godbout, 2008). The most frequently used instrument to measure individual tactical behavior following the TGfU approach in invasion games is the Game Performance Assessment Instrument (GPAI; Arias & Castejón, 2012; Arias-Estero & Castejón, 2014; Mitchell et al., 2013; Oslin et al., 1998). Another accepted instrument to measure game ability is the team sport assessment procedure (TSAP; Arias & Castejón, 2012; Gréhaigne et al., 1997; Nadeau et al., 2008).

In 2002, the International Society for Technology in Education developed the National Educational Technology Standards for Teachers to define useful technologies to facilitate a variety of assessments and evaluation strategies (see Willis, 2012). Some studies have examined the purpose and usefulness of technologies, especially video recording, by using the GPAI and TSAP to evaluate game-play performance and complex tactical behavior (Arias-Estero & Castejón, 2014; Harvey, Cushion, Wegis, & Massa-Gonzales, 2010; Pritchard, Hawkins, & Wiegand, 2008; Tallir, Lenoir, Valcke, & Musch, 2007). One approach to analyze multiple players in a sporting environment is to use manual (Perš & Kovačič, 2000) and, more recently, automated tracking systems (Baca, 2008; Baca, Dabnichki, Heller, & Kornfeind, 2009; Barris & Button, 2008) to examine the interaction among teammates and opponents during competition (Grunz, Memmert, & Perl, 2012). In many of the cases, tracking systems are only useful for indoor settings like a gymnasium or sports hall (e.g., basketball, netball, badminton, table tennis). Several systems, however, have recently been used successfully for outdoor games (e.g., Randers et al., 2010; Sarmiento et al., 2014). As an example, tracking techniques have revealed that skilled players cover less distance than less-skilled players in netball. However, the underlying tactical mechanisms are still unclear. For example, it is not clear if this finding is because expert players make better decisions and execute only the necessary runs to receive a pass or to be in an effective offensive position (Ng & Chow, 2012; Perl, Grunz, & Memmert, 2013). Assessments (e.g., Perl & Memmert, 2011) in combination with (tracking) technology measure performances in authentic match situations. Tracking techniques can support a student-centered approach to teaching game performance and skills execution in PE, but it seems to be necessary to develop more advanced key game-related indicators (e.g., finding space, marking opponents, optimal locations of shots; Chow, Tan, Lee, & Button, 2014) to fully exploit the potential benefit.

In summary, using technology to evaluate game play can help teachers link what is taught to what is assessed. But, of course, there are a number of difficulties that have been identified including cost and accessibility of technology (Woods, Karp, & Miao, 2008) and the necessary training time for teachers to develop the relevant skills and understand the technology's use (Silverman, 1997; Thomas & Stratton, 2006).

3. Can Complexity Thinking Be Considered a Suitable Theoretical Background for Teaching and Learning in Sports-Related Games?

Recently, the notion of complexity thinking has emerged as a theoretical orientation in response to the ostensible limitations of the traditional ways of understanding PE. Complexity thinking in learning through games considers the broad movement to understanding game learning as dynamic and nonlinear and as part of forming a complex learning system. According to Ovens, Hopper, and Butler (2013, p. 1), “complexity provides ways of understanding that embrace uncertainty, non-linearity and the inevitable ‘messiness’ that is inherent in educational settings, paying attention to the ways in which the whole is greater than the sum of its parts.”

In this respect, it is important to note that complexity does not reflect a single body of thought or unified theory as there is little consensus and no solid, agreed-upon body of knowledge (Alhadef-Jones, 2008; Richardson & Cilliers, 2001). Originally, the ideas about complexity stem from disciplinary fields as diverse as physics, biology, economics, sociology, and law (Mason, 2008). As the definition of complexity is elusive and the task of understanding complexity is itself complex (Ovens et al., 2013), complexity is often characterized in terms of the objects of study (Davis & Sumara, 2006), which are usually modeled as systems of interacting entities. Importantly, it is assumed that the system is self-organizing and is continually constructing its own future as continuity and transformation (Stacey, 2001). Critically, the focus is not on the system itself but instead on the process of interaction among the entities of the system, which enables the emergent properties and forms that are the focus of inquiry (Byrne, 2005).

While acknowledging that complexity is difficult to define, researchers within this field of inquiry share a set of concepts and ideas as a theoretical starting point (Ovens et al., 2013):

- a. *Complex systems* are assumed to exist in situations in which a large number of agents (in sports, e.g., athletes, coaches, and teachers) are interacting with each other in dynamic ways and are changed as a consequence of this dynamic interaction. Constraints (e.g., rules of a game) on a system influence the pattern of interaction and the consequentially occurring changes among the agents. Such constraints allow, for example, teachers and coaches to create certain games to shape a system for an athlete’s emergent learning (e.g., Davids, Button, & Bennett, 2008; Ennis, 1992).
- b. *Emergence* refers to the central idea of complexity that certain properties or features appear that were not previously present as a functional characteristic of a system (Mason, 2008; Richardson & Cilliers, 2001).

Therefore, the concept of emergence and complex systems becomes more than the sum of their parts—for example, when teamwork or tactics emerge from the activities and interactions of players.

- c. *Adaptation and learning* can be defined as the ability of complex systems to continuously reorient their structures to maintain coherence with the environment—for example, when athletes develop new tactics to enhance game play (Ovens et al., 2013).

4. How Can Complexity Thinking Be Utilized to Shape Day-to-Day PE and Coaching Practices?

In a general sense, the theoretical orientation of complexity thinking should encourage teachers, educators, and researchers to conceptualize learning in sport and PE as more organic and emergent (Butler, Storey, & Robson, 2014). With regard to teaching and learning through games, the potential of complexity is not a superior explanatory system or metadiscourse providing a more complete or superior set of explanations, but rather, it provides a new approach that has the potential to generate new, creative, and innovative ways of understanding and teaching sport games. Complexity thinking in the field of teaching and learning in games is still evolving, and future research and practical work are needed to establish the optimistic claims of complexity thinking within games. For example, one critical question to explore is how coaches and teachers can implement and shape evidence-based constraints in games to achieve the most beneficial emergence of learning and adaptation among players (see Davids et al., 2008).

5. How Can Game Making/Designing Be Helpfully Utilized for Emergent Learning (i.e., Enabling Young People to Design, Create, or Invent Their Own Games)?

With the help of simple games, students and athletes should be encouraged to develop game understanding and tactical consciousness by reflecting on games in a permanent process in group discussions. Teachers and coaches ask questions about “what,” “where,” and “why,” and not just “how.” In this way, a verbal and bodily interaction in games is tightly interrelated. Thus, the concept has changed over the last decades to a more student-centered, problem-based approach and away from a teacher-centered approach (Tan, Chow, & Davids, 2012). In addition, Light and Fawns (2003, p. 161) argued “that games taught in PE using TGfU as a form of educational conversation in which the mind, expressed in speech, and the body, expressed in action, embody the ideal holistic learning experience that simultaneously provides for cognitive, affective, social, and physical learning.”

Practical sessions have to be developed that particularly highlight the possibility of modifying and designing games to enable tactical understanding and skill development through adaptive learning. Teachers and coaches are encouraged to expand their interventions and approaches from motor and cognitive domains to social domains (Butler et al., 2014). As Butler (2013) explains, the inventing-games approach has three educational purposes: (a) to bring play back into games, (b) to help players learn about game structure, and (c) to help players learn about “democracy in action.” With a similar intention, Greve (2013) analyzed the idea of learning by reflecting using the example of team handball, and Loibl (2001) transferred the concept of generic learning to basketball.

6. How Could Purposeful Game Design Create the Constraints That Enable Tactical Understanding and Skill Development Through Adaptive Learning and Distributed Cognition?

The TGfU concept enables young people to design, create, or invent their own games. TGfU is an instructional model focused on developing learners’ abilities to play games (Kirk & MacPhail, 2002). One of the ways in which TGfU has been implemented has been through game invention, which enables learners to design games as a way of learning about game complexity. Learning begins within games that are modified to reduce skill demands and free players to engage cognitively in game play and learn physical skills as they are needed to enable play (Light & Fawns, 2003). By laying down simplified rules, altering the playing fields, and altering the play equipment, it is possible to modify and adjust game forms to the respective performance level of learners, or rather, the appropriate level of challenge (Hastie, 2010; Light & Fawns, 2003)—a strategy that has, for example, been adopted in net and wall games (Bohler, 2006). Rather than breaking a game into parts (e.g., rules, tactics), the learning process is seen as a system of interaction and adapting subsystems (Rovegno & Kirk, 1995). Game techniques are not explicitly altered before learners have reached a certain performance level requiring particular new techniques. Game forms are designed as a challenge to the players for an integrative development of their game understanding, tactical consciousness, decision-making processes, and technique execution. Therefore, learning is viewed as a self-organizing process that is emergent and adaptive with respect to different conditions.

7. How Can Teacher/Coach Development Programs Benefit From Game-Centered Approaches?

For teachers or coaches, it is not easy to implement game-centered approaches like TGfU in their units. This is because there is limited consensus regarding best practices with regard to how teachers and coaches can be supported

by incorporating the respective education and training approaches within their own teaching or preparation programs. Beyond that, there is limited research that focuses on evaluating the most suitable use of pedagogy based on game-centered approaches to achieve the best outcome for students’ learning results (Parry, 2014). In the lines of traditional pedagogies, performance-based teaching methods applying skill drills and technique practice still dominate PE (Pill, 2013). In comparison to traditional skill-based approaches, however, game-centered approaches such as TGfU, demand a more constructivist and student-centered pedagogy (Fisette, 2006). In this context, Memmert and König (2007) analyzed the impact of students’ acceptance and the general feasibility of game-centered approaches in PE. Teachers have to accommodate a different focus of learning within which they have to act as an information instructor and facilitator by placing the learner in the center of the learning process (Butler, 1997; Dyson, Griffin, & Hastie, 2004). In this regard, pedagogical strategies associated with TGfU such as facilitation, observation, analysis, and questioning have been advocated to be beneficial for developing effective teaching and coaching strategies.

In the past, relatively short instruction periods for implementing game-centered approaches provided only limited support for teachers or coaches and therefore failed to foster a pedagogical knowledge base to employ game-centered pedagogy (Harvey & Jarrett, 2014). Short instructional periods (i.e., workshops) tend to lead to an epistemological gap between game-centered approaches in theory and teaching practice. This gap, however, might be bridged through more professional learning communities by further examining professional development and teacher learning within game-centered approaches (Light, 2008) and by integrating more empirical research into teacher education—an idea that may help teachers-to-be understand and compare learning concepts on the basis of empirical evidence (König, 2014b).

However, there is another side to this discussion that is often reported by teachers and coaches and has not been adequately addressed so far. The problem is that TGfU has flourished with researchers in universities and institutes of higher education, yet the TGfU influence on teachers/coaches appears to have failed to reach them and become part of normal practice. This issue may be due to the fact that researchers publish their work in journals that are not accessible to most teachers/coaches. However, insufficient attention has been paid to (a) the ways in which ideas are absorbed into professional practice; (b) recognition of teachers’ concerns, their school culture, and professional practice; and (c) how teachers can incorporate the ideas of TGfU into their practice.

Currently, researchers speak of “translational research,” but it tends to be directed through the eyes of researchers who may have insufficient understanding of the problems of

practice and overlook its internal complexity. This issue needs to be addressed and can be regarded as a research priority for the whole profession.

8. How Can TGfU-Related Approaches Be Implemented in Teacher or Coach Education With the Goal of Facilitating Preservice and In-Service Teachers/Coaches' Learning to Teach and Thereby Foster Their Professional Development From Novices to Experienced Practitioners?

To effectively implement TGfU in school or club units, teachers and coaches have to be supported with effective professional endorsement that provides them with knowledge and skills they can implement in their teaching routines. Such a professional development has to focus on both the content and profound knowledge of how children learn most effectively (Corcoran, 1995). Dealing with new ideas is a difficult task and requires a solid theoretical framework that supports this process of change (Guskey, 2002). In her detailed overview, Parry (2014) proposed a professional-development model that supports teachers in implementing game-centered approaches like TGfU. The model consists of four key phases: (a) introductory workshop, (b) planning/designing, (c) implementation, and (d) evaluation. In Phase 1, an introductory game-centered approach workshop is conducted by one of the “experts” for the teacher participants to identify what preexisting knowledge the participating teachers have and what professional learning they need. The concept of Phase 2 is that teachers elaborate on their units of work and subsequent lesson plans together. Units and lessons are further analyzed using a benchmark observational system for game-centered approaches. During Phase 3 implementation, teacher participants are asked to teach the planned units and lessons in school. Teachers are required to submit their lesson reflections for analysis, and then teacher interviews are conducted in Phase 4. Additionally, we might learn from Borggreffe and Cachay's (2015) analysis of athlete-coach communication exploring how information can be imparted more effectively.

At present, there is no conceptual framework that provides a comprehensive guide to developing informed practice. If researchers cannot provide a comprehensive up-to-date picture of how their work can inform practice, how can we expect practitioners on their own to develop informed practice and improve learning? This relates to another big issue. We need to build a collaborative venture to ensure that new research (in all of the diverse fields) is made accessible in forms that can be “turned” into guides that become a significant and sustainable part of everyday professional practice. Surely, this issue is of major concern and therefore needs to be highlighted as a research priority. In summary, implementing a game-centered approach like TGfU demands complex professional learning that con-

siders a wide range of contextual factors within the educational setting.

9. Can the TGfU Approach Be Considered a Helpful Model Across Different Cultures?

Generally, learning has been shown to be influenced by sociocultural experiences of learners in specific contexts (e.g., Davis & Sumara, 2003). Therefore, a major topic in the development and implementation of pedagogical and methodological models or theories must be the consideration of cultural differences in physical, cognitive, and/or social learning. Based on Pinar's (2012) extensive considerations in the curricula of teaching, teaching concepts or models should not be understood as a fixed frame, but as a malleable one, which should be adapted to cultural and social characteristics of a specific peer group.

Stolz and Pill (2014b) as well as Harvey and Jarrett (2014) reviewed the TGfU literature and reported that the approaches in the practical implementation of TGfU in various countries and cultures differ more or less from each other. Thus, particularly, the different revisions of the TGfU approach in the worldwide PE literature seem to be underdeveloped for the understanding and the implication of their contents in practice (Stolz & Pill, 2014b). Comparing teaching in Singapore to teaching in Australia, Light and Tan (2006) stated that social and cultural differences in these two countries have a significant impact on the interpretation and the implementation of the TGfU teaching method. Nevertheless, further empirical studies are needed to further elucidate the TGfU concept in different cultural and social environments.

Butler (2014) stated that the development of the TGfU concept is based on a Western-oriented social-cultural background, as three important founders of TGfU are from Western countries. Thus, a major challenge of future research will be the identification of the precise global-cultural characteristics that influence the implementation and success of TGfU in learner development. A culture-orientated research perspective should not only focus on pedagogical and social approaches. In addition, further research from physical/psychomotor and/or psychological/cognitive (e.g., creativity) perspectives with a cultural background could help improve the way of teaching games all over the world.

10. Can Physical/Psychomotor, Cognitive, Affective/Social, and Cultural Development Be Fostered Via TGfU Approaches?

The TGfU-approach seems to be an appropriate way to develop physical literacy (Mandigo & Corlett, 2010), and research has shown that cognitive abilities could significantly be fostered by this approach (e.g., decision-making skills in soccer; Harvey et al., 2010). That

physical and psychomotor skills can be developed in high-intensity movement situations that occur in games seems hardly surprising. Therefore, future research might want to extend the TGfU approach to health-related topics. For example, as Western populations are affected by inactivity and obesity, future research could address how game-centered approaches might be implemented to foster strength and endurance purposefully, an approach that has been successfully realized for individual sports (König, 2014a).

Whereas Mandigo and Corlett (2010) reported evidence in their review that TGfU can promote social skills like fairness, democratic behavior, or social responsibility, further questions on social perspective could highlight ways in which this approach should be adjusted to support inclusive behavior and the integration of disabled people in games and sports citizenship.

CONCLUSION

In the past, in the present, and surely in the future, the original TGfU model of Bunker and Thorpe (1982) has gained, is gaining, and will gain growing significance in research, teaching, and coaching in invasion and net/wall games around the world. Kirk and MacPhail (2002) originally stated:

In particular, we suggest that explicit attention to the learner's perspective, game concept, thinking strategically, cue recognition, technique selection, and skill development as the clustering of strategies and techniques, and situated performance as legitimate peripheral participation in games, elaborate upon the already existing but implied learning principles of the Bunker-Thorpe model. (pp. 280–281)

This statement delivers a number of major challenges for research in game-centered approaches, like more manipulation checks, improved assessment tools, longitudinal research designs, which might require specific approaches for data analyses (Snijders & Bosker, 1999), and longer intervention programs (Harvey & Jarrett, 2014). Hence, the content of the original Bunker and Thorpe model will be enhanced and thus gain in growing significance.

In summary, our top 10 research questions related to TGfU recommend more integration of other scientific disciplines with specific frameworks as well as contextual and ecological research of game-centered approaches. In this regard, special attention should be paid to technological tools, complex and emergent learning systems, and teacher/coach and learner/cultural development. Challenging our TGfU community to embrace these research foci could lead to a reorientation of the general research content and methodology in the context of TGfU research.

REFERENCES

- Alhadef-Jones, M. (2008). Three generations of complexity theories: Nuances and ambiguities. In M. Mason (Ed.), *Complexity theory and the philosophy of education* (pp. 62–78). Chichester, UK: Wiley-Blackwell.
- Arias, J. L., & Castejón, F. J. (2012). Review of the instruments most frequently employed to assess tactics in physical education and youth sports. *Journal of Teaching in Physical Education, 31*, 381–391.
- Arias-Estero, J., & Castejón, F. (2014). Using instruments for tactical assessment in physical education and extra-curricular sports. *European Physical Education Review, 20*, 525–535.
- Baca, A. (2008). Tracking motion in sport—trends and limitations. In J. Hammond (Ed.), *Proceedings of the 9th Australasian Conference on Mathematics and Computers in Sport, MathSport* (pp. 1–7). Tweed Heads, NSW, Australia: The Australian & New Zealand Industrial and Applied Mathematics Journal (formerly, The Journal of the Australian Mathematical Society).
- Baca, A., Dabnichki, P., Heller, M., & Kornfeind, P. (2009). Ubiquitous computing in sports: A review and analysis. *Journal of Sports Sciences, 27*, 1335–1346.
- Baddeley, A. (2007). *Working memory, thought, and action*. Oxford, UK: Oxford University Press.
- Barris, S., & Button, C. (2008). A review of vision-based motion analysis in sport. *Sports Medicine, 38*, 1025–1043.
- Bohler, H. R. (2006). Spielen lernen durch Taktik lernen—Beispiel Netz- und Wandspiele. [Learning how to play through tactics]. *Sportunterricht, 55*, 260–266.
- Borggreffe, C., & Cachay, K. (2015). *Kommunikation als Herausforderung. Eine theoretisch-empirische Studie zur Trainer-Athlet-Kommunikation im Spitzensport* [Communication as challenge. A theoretic-empirical study on coach-athlete communication in high-performance sports]. Schorndorf, Germany: Hofmann.
- Bunker, D., & Thorpe, R. (1982). A model for the teaching of games in secondary schools. *Bulletin of Physical Education, 18*, 5–8.
- Butler, J. (1997). How would Socrates teach games? A constructivist approach to teaching games. *Journal of Physical Education, Recreation & Dance, 68*(9), 42–47.
- Butler, J. (2012). *Reconceptualizing physical education through teaching games for understanding*. Morrisville, NC: Lulu.
- Butler, J. (2013). Stages for children inventing games. *Journal of Physical Education, Recreation & Dance, 84*(4), 48–53.
- Butler, J. (2014). TGfU—would you know it if you saw it? Benchmarks from the tacit knowledge of the founders. *European Physical Education Review, 20*, 465–488.
- Butler, J., & Griffin, L. L. (2010). *More teaching games for understanding: Moving globally*. Champaign, IL: Human Kinetics.
- Butler, J. I., Griffin, L. L., Lombardo, B., & Nastasi, R. (2003). *Teaching games for understanding in physical education and sport: An international perspective*. Oxon Hill, MD: American Alliance for Health, Physical Education, Recreation and Dance Publication.
- Butler, J., & Ovens, A. (2015). The TGfU governance networks: From conception to special interest group. *Agora for Physical Education and Sport, 17*, 77–92.
- Butler, J., Storey, B., & Robson, C. (2014). Emergent learning focused teachers and their ecological complexity worldview. *Sport, Education and Society, 19*, 451–471.
- Byrne, D. (2005). Complexity, configurations and cases. *Theory, Culture & Society, 22*, 95–111.
- Carling, C., Reilly, T., & Williams, A. (Eds.). (2009). *Performance assessment for field sports*. London, UK: Routledge.
- Chen, W., & Rovegno, I. (2000). Examination of expert and novice teachers' constructivist-oriented teaching practices using a movement approach to elementary physical education. *Research Quarterly for Exercise and Sport, 71*, 357–372.

- Chow, J. Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araújo, D. (2007). The role of nonlinear pedagogy in physical education. *Review of Educational Research*, 77, 251–278.
- Chow, J. Y., Tan, C. W. K., Lee, M. C. Y., & Button, C. (2014). Possibilities and implications of using a motion-tracking system in physical education. *European Physical Education Review*, 20, 444–464.
- Cleeremans, A., Destrebecqz, A., & Boyer, M. (1998). Implicit learning: News from the front. *Trends in Cognitive Sciences*, 2, 406–416.
- Corcoran, T. C. (1995). *Transforming professional development for teachers: A guide for state policymakers*. Washington, DC: National Governors' Association.
- Curriculum Planning and Development Division. (1999). *physical education syllabus for primary, secondary, pre-university levels*. Singapore: Ministry of Education.
- Davids, K., Button, C., & Bennett, S. J. (2008). *Dynamics of skill acquisition: A constraints-led approach*. Champaign, IL: Human Kinetics.
- Davis, B., & Sumara, D. (2003). Why aren't they getting this? Working through the regressive myths of constructivist pedagogy. *Teaching Education*, 14, 123–140.
- Davis, B., & Sumara, D. J. (2006). *Complexity and education: Inquiries into learning, teaching, and research*. Mahwah, NJ: Lawrence Erlbaum.
- den Duyn, N. (1997). *Game sense: Developing thinking players*. Belconnen, ACT, Australia: Australian Sports Commission.
- Dodds, P., Griffin, L. L., & Placek, J. H. (2001). A selected review of the literature on development of learners' domain-specific knowledge. *Journal of Teaching in Physical Education*, 20, 301–313.
- Drust, B., Atkinson, G., & Reilly, T. (2007). Future perspectives in the evaluation of the physiological demands of soccer. *Sports Medicine*, 37, 783–805.
- Dyson, B., Griffin, L. L., & Hastie, P. (2004). Sport education, tactical games, and cooperative learning: Theoretical and pedagogical considerations. *Quest*, 56, 226–240.
- Ennis, C. D. (1992). Reconceptualising learning as a dynamical system. *Journal of Curriculum and Supervision*, 7, 115–130.
- Fisette, J. L. (2006). Spielverständnis lehren durch das 'Taktik-Spiel-Modell'—Beispiel basketball [Learning understanding of the game through the 'tactic-game-model'—example basketball]. *Sportunterricht*, 55, 267–273.
- Friedman, R. S., & Förster, J. (2001). The effects of promotion and prevention cues on creativity. *Journal of Personality and Social Psychology*, 81, 1001–1013.
- Furley, P., & Memmert, D. (2013). 'To whom should I pass?' The more options the more attentional guidance from working. *PLoS One*, 8, e62278. doi:10.1371/journal.pone.0062278
- Goldstein, B. (2011). *Cognitive psychology: Connecting mind, research and everyday experience*. Independence, KY: Cengage Learning.
- Gréhaigne, J. F., Godbout, P., & Bouthier, D. (1997). Performance assessment in team sports. *Journal of Teaching in Physical Education*, 16, 500–516.
- Gréhaigne, J. F., Richard, J.-F., & Griffin, L. L. (2005). *Teaching and learning team sports and games*. New York, NY: Routledge.
- Gréhaigne, J. F., Wallian, N., & Godbout, P. (2005). Tactical-decision learning model and students' practices. *Physical Education & Sport Pedagogy*, 10, 255–269.
- Greve, S. (2013). *Lernen durch Reflektieren im Sportspiel. Möglichkeiten im Vermittlungsprozess im Rahmen des Sportunterrichts am Beispiel Handball*. [Learning by reflecting in sports game. Possibilities in the mediation process within physical education at the example of handball]. Berlin, Germany: Logos.
- Griffin, L., & Butler, J. (2005). *Teaching games for understanding: Theory, research, and practice*. Champaign, IL: Human Kinetics.
- Griffin, L. L., Mitchell, S. A., & Oslin, J. L. (1997). *Teaching sport concepts and skills: A tactical games approach*. Champaign, IL: Human Kinetics.
- Griffin, L. L., & Richard, J. -F. (2003). Using authentic assessment to improve students' net/wall game play. *Teaching Elementary Physical Education*, 3, 23–27.
- Grunz, A., Memmert, D., & Perl, J. (2012). Tactical pattern recognition in soccer games by means of special self-organizing maps. *Human Movement Science*, 31, 334–343.
- Guilford, J. P. (1967). *The nature of human intelligence*. New York, NY: McGraw Hill.
- Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice*, 8, 381–391.
- Harvey, S., Cushion, C. J., Wegis, H. M., & Massa-Gonzales, A. N. (2010). Teaching games for understanding in American high-school soccer: A quantitative data analysis using the Game Performance Assessment Instrument. *Physical Education and Sport Pedagogy*, 15, 29–54. doi:10.1080/17408980902729354
- Harvey, S., & Jarrett, K. (2014). A review of the game-centered approaches to teaching and coaching literature since 2006. *Physical Education and Sport Pedagogy*, 19, 278–300.
- Hastie, P. (2010). *Student-designed games: Strategies for promoting creativity, cooperation, and skill development*. Champaign, IL: Human Kinetics.
- Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist*, 52, 1280–1300.
- Hill-Haas, S. V., Dawson, B., Impellizzeri, F. M., & Coutts, A. J. (2011). Physiology of small-sided games training in football: A systematic review. *Sports Medicine*, 41, 199–220.
- Hoff, J., Wisløff, U., Engen, L. C., Kemi, O. J., & Helgerud, J. (2002). Soccer specific aerobic endurance training. *British Journal of Sports Medicine*, 36, 218–221.
- Hohmann, A., & Brack, R. (1983). Theoretische Aspekte der Leistungsdiagnostik im Sportspiel [Theoretical aspects of performance analysis in team and racket sports]. *Leistungssport*, 13, 5–10.
- Hopper, T., Butler, J., & Storey, B. (Eds.). (2009). *TGfU—Simply good pedagogy: Understanding a complex challenge*. Ottawa, Ontario: Physical & Health Education, Canada.
- Jackson, R. C., & Farrow, D. (2005). Implicit perceptual training: How, when and why? *Human Movement Science*, 24, 308–325.
- Kasof, J. (1997). Creativity and breadth of attention. *Creativity Research Journal*, 10, 303–315.
- Kirk, D., & MacPhail, A. (2002). Teaching games for understanding and situated learning: Rethinking the Bunker-Thorp model. *Journal of Teaching in Physical Education*, 21, 177–192.
- Kirk, D., & MacPhail, A. (2009). Teaching games for understanding and situated learning: Rethinking the Bunker-Thorp model. In R. Bailey & D. Kirk (Eds.), *The Routledge physical education reader* (pp. 269–283). Oxford, UK: Routledge.
- König, S. (2014a). 'Killing two birds with one stone'—on the effectiveness of implicit training processes in physical education. *International Journal of Physical Education*, 15, 15–28.
- König, S. (2014b). Physical education: Implementation of empirical research into teacher education. In P.-M. Rabensteiner & G. Rabensteiner (Eds.), *Education: Vol. 3. Internationalization in teacher education* (pp. 154–166). Baltmannsweiler, Germany: Schneider Verlag Hohengehren.
- König, S., & Singrün, P. (2013). Wirkungen und Festigkeit von motorischen Lern- und Trainingsprozessen im Sportunterricht [Effect and consistency of motor learning and training processes in physical education]. *Spectrum der Sportwissenschaften*, 25, 4–31.
- Lames, M. (1998). Leistungsfähigkeit, Leistung und Erfolg—ein Beitrag zur Theorie der Sportspiele [Ability to perform, performance and success—A contribution to the theory of sport games]. *Sportwissenschaft*, 28, 137–152.
- Lauder, A. G. (2001). *Play practice: The games approach to teaching and coaching sports*. Champaign, IL: Human Kinetics.

- Light, R. (2004). Coaches' experiences of games sense: Opportunities and challenges. *Physical Education & Sport Pedagogy*, 9, 115–131.
- Light, R. (2008). Complex learning theory—Its epistemology and its assumptions about learning: Implications for physical education. *Journal of Teaching in Physical Education*, 27, 21–37.
- Light, R., & Fawns, R. (2003). Knowing the game: Integrating speech and action in games teaching through TGfU. *Quest*, 55, 161–176.
- Light, R., Quay, J., Harvey, S., & Mooney, A. (2014). *Contemporary developments in games teaching*. Abingdon, UK: Routledge.
- Light, R., & Tan, S. (2006). Culture, embodied experience and teachers' development of TGfU in Australia and Singapore. *European Physical Education Review*, 12, 99–117.
- Light, R., Webb, P., Piltz, W., Georgakis, A., & Brooker, R. (Eds.). (2006). *Proceedings for the Asia Pacific Conference on Teaching Sport and Physical Education for Understanding*. Sydney, Australia: University Press.
- Liu, R., Li, C., & Cruz, A. (Eds.). (2006). *Teaching games for understanding in the Asia-Pacific region*. Hong Kong: Department of Creative Arts and Physical Education, The Hong Kong Institute of Education.
- Loibl, J. (2001). *Basketball. Genetisches Lehren und Lernen. Spielen—erfinden—erleben—verstehen* [Basketball. Genetic teaching and learning. Playing—inventing—experiencing—understanding]. Schorndorf, Germany: Hofmann.
- Mandigo, J., & Corlett, J. (2010). Teaching games for understanding of what? TGfU's role in the development of physical literacy. In J. I. Butler & L. L. Griffin (Eds.), *More teaching games for understanding. Moving globally* (pp. 69–78). Champaign, IL: Human Kinetics.
- Mason, M. (2008). What is complexity theory and what are its implications for educational change? *Educational Philosophy and Theory*, 40, 35–47.
- Memmert, D. (2007). Can creativity be improved by an attention-broadening training program? An exploratory study focusing on team sports. *Creativity Research Journal*, 19, 281–291.
- Memmert, D. (2015). *Teaching tactical creativity in team and racket sports: Research and practice*. Abingdon, UK: Routledge.
- Memmert, D., & Harvey, S. (2008). The Game Performance Assessment Instrument (GPAI): Some concerns and solutions for further development. *Journal of Teaching in Physical Education*, 27, 220–240.
- Memmert, D., & Harvey, S. (2010). Identification of non-specific tactical problems in invasion games. *Physical Education and Sport Pedagogy*, 15, 287–305.
- Memmert, D., Hüttermann, S., & Orliczek, J. (2013). Decide like Lionel Messi! The impact of regulatory focus on divergent thinking in sports. *Journal of Applied Social Psychology*, 43, 2163–2167.
- Memmert, D., & König, S. (2007). Teaching games at elementary schools. *International Journal of Physical Education*, 44, 54–67.
- Memmert, D., & Roth, K. (2007). The effects of non-specific and specific concepts on tactical creativity in team ball sports. *Journal of Sport Science*, 25, 1423–1432.
- Metzler, M. W. (2000). *Instructional models for physical education*. Boston, MA: Allyn & Bacon.
- Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (1997). *Teaching sport concepts and skills: A tactical games approach* (Vol. 1). Champaign, IL: Human Kinetics.
- Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (2003). *Sport foundations for elementary physical education: A tactical games approach*. Champaign, IL: Human Kinetics.
- Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (2006). *Teaching sport concepts and skills: A tactical games approach* (2nd ed.). Champaign, IL: Human Kinetics.
- Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (2013). *Teaching sport concepts and skills: A tactical games approach* (3rd ed.). Champaign, IL: Human Kinetics.
- Nadeau, L., Richard, J. -F., & Godbout, P. (2008). The validity and reliability of a performance assessment procedure in ice hockey. *Physical Education and Sport Pedagogy*, 13, 65–83.
- Ng, W. X., & Chow, J. Y. (2012, June). *Performance analysis of netball players as a function of position and skill: Sports technology in action*. Paper presented at the second Association of Southeast Asian Nations Universities Conference on Physical Education and Sport Science, Kuala Lumpur, Malaysia.
- Oslin, J. L., & Mitchell, S. A. (2006). Game-centred approaches to teaching physical education. In D. Kirk, D. MacDonald, & M. O'Sullivan (Eds.), *The handbook of physical education* (pp. 627–651). London, UK: Sage.
- Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The Game Performance Assessment Instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education*, 17, 231–243.
- Ovens, A., Hopper, T., & Butler, J. (2013). *Complexity thinking in physical education. Reframing curriculum, pedagogy and research*. London, UK: Routledge.
- Parry, K. A. (2014). Supporting teachers to implement TGfU: A needs based approach to professional learning. In *University of Sydney Papers in HMHCE: Special Games Sense Edition* (pp. 127–149). Retrieved from http://sydney.edu.au/education_social_work/research/centres_and_networks/ADPN/HMHCE-papers/resources/HMHCE_GS_Ed_Article_08_2014.pdf
- Perl, J., Grunz, A. & Memmert, D. (2013). Tactics in soccer: an advanced approach. *International Journal of Computer Science in Sport*, 12, 33–44.
- Perl, J., & Memmert, D. (2011). Net-based game analysis by means of the software tool SOCCER. *International Journal of Computer Science in Sport*, 10, 77–84.
- Perš, S., & Kovačič, S. (2000). A system for tracking players in sports games by computer vision. *Electrotechnical Review*, 67, 281–288.
- Pill, S. A. (2012). *Play with Purpose: Developing game sense in AFL footballers*. HindmarshSA, Australia: Australian Council for Health, Physical Education and Recreation.
- Pill, S. A. (2013). *Play with Purpose for fundamental movement skill teaching*. Kent Town, SA, Australia: Australian Council for Health, Physical Education and Recreation.
- Pill, S. A. (2014). *Play with Purpose: Developing netball game sense*. Hindmarsh, SA, Australia: Australian Council for Health, Physical Education and Recreation.
- Pinar, W. (2012). *What is curriculum theory?* New York, NY: Routledge.
- Pritchard, T., Hawkins, A., & Wiegand, R. (2008). Effects of two instructional approaches on skill development, knowledge, and game performance. *Measurement in Physical Education and Exercise Science*, 12, 219–236.
- Randers, M. B., Mujika, I., Hewitt, A., Santisteban, J., Bischoff, R., Solano, R., ... Mohr, M. (2010). Application of four different football match analysis systems: A comparative study. *Journal of Sports Sciences*, 28, 171–182.
- Reber, A. S. (1993). *Implicit learning and tacit knowledge: An essay on the cognitive unconscious*. Oxford, UK: Oxford University Press.
- Richard, J.-F., Godbout, P., Tousignant, M., & Gréhaigne, J. F. (1999). The try-out of a team sport assessment procedure in elementary and junior high school physical education classes. *Journal of Teaching in Physical Education*, 18, 336–356.
- Richardson, K., & Cilliers, P. (2001). What is complexity science? A view from different directions. *Emergence*, 3, 5–23.
- Rossi, T., Fry, J. M., McNeill, M., & Tan, C. W. K. (2007). The games concept approach (GCA) as a mandated practice: Views of Singaporean teachers. *Sport, Education and Society*, 12, 93–111.
- Roth, K., & Kröger, C. (2011). *Ballschule. Ein ABC für Spielanfänger* [Ballschool—An ABC for beginners]. Schorndorf, Germany: Hofmann.
- Rovegno, I., & Kirk, D. (1995). Articulations and silences in socially critical work on physical education: Towards a broader agenda. *Quest*, 47, 447–474.

- Sarmiento, H., Marcelino, R., Anguera, M. T., Campaniço, J., Matos, N., & Leitão, J. C. (2014). Match analysis in football: A systematic review. *Journal of Sports Sciences*, *32*, 1831–1843.
- Silverman, S. (1997). Technology and physical education: Present, possibilities, and potential problems. *Quest*, *49*, 306–314.
- Slade, D. (2010). *Transforming play: Teaching tactics and game sense*. Champaign, IL: Human Kinetics.
- Snijders, T. A., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London, UK: Sage.
- Soto, D., & Humphreys, G. W. (2007). Automatic guidance of visual attention from verbal working memory. *Journal of Experimental Psychology: Human Perception & Performance*, *33*, 730–737.
- Stacey, R. (2001). *Complex responsive processes in organisations: Learning and knowledge creation*. London, UK: Routledge.
- Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd*. New York, NY: Free Press.
- Stolz, S. A., & Pill, S. (2014a). A narrative approach to exploring TGfU-GS. *Sport, Education and Society*. Advance online publication. doi:10.1080/13573322.2014.890930
- Stolz, S., & Pill, S. (2014b). Teaching games and sport for understanding: Exploring and reconsidering its relevance in physical education. *European Physical Education Review*, *20*, 36–71.
- Tallir, I. B., Lenoir, M., Valcke, M., & Musch, E. (2007). Do alternative instructional approaches result in different game performance learning outcomes? Authentic assessment in varying game conditions. *International Journal of Sport Psychology*, *38*, 263–282.
- Tan, C. W. K., Chow, J. Y., & Davids, K. (2012). 'How does TGfU work?': Examining the relationship between learning design in TGfU and a nonlinear pedagogy. *Physical Education and Sport Pedagogy*, *17*, 331–348.
- Thomas, A., & Stratton, G. (2006). What we are really doing with ICT in physical education: A national audit of equipment, use, teacher attitudes, support, and training. *British Journal of Educational Technology*, *37*, 617–632.
- Thorpe, R. *Teaching games for understanding: Does it meet your needs?* Paper presented at the Second International Conference: Teaching Sport and Education for Understanding, Melbourne, Australia (2003, December).
- Thorpe, R., Bunker, D., & Almond, L. (1986). *Rethinking games teaching*. Loughborough, England: Department of Physical Education and Sports Science, University of Technology.
- Wagner, H., Finkenzeller, T., Würth, S., & von Duvillard, S. P. (2014). Individual and team performance in team-handball: A review. *Journal of Sports Science and Medicine*, *13*, 808–816.
- Willis, J. (2012). Adapting the 2008 NETS-T Standards for use in teacher education: Part II. *International Journal of Technology in Teaching and Learning*, *8*, 78–97.
- Woods, M. L., Karp, G. G., & Miao, H. (2008). Physical educators' technology competencies and usage. *Physical Educator*, *65*, 82–99.