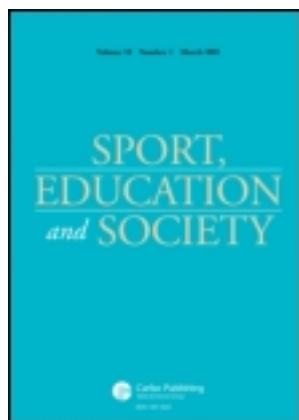


This article was downloaded by: [University of Edinburgh]

On: 23 August 2011, At: 08:02

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Sport, Education and Society

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/cses20>

### Promoting perseverance and challenge in physical education: the missing ingredient for improved games teaching

John Sproule<sup>a</sup>, Stewart Ollis<sup>b</sup>, Shirley Gray<sup>a</sup>, Malcolm Thorburn<sup>a</sup>, Pete Allison<sup>a</sup> & Peter Horton<sup>c</sup>

<sup>a</sup> University of Edinburgh, UK

<sup>b</sup> University of the West of Scotland, UK

<sup>c</sup> James Cook University, Townsville, Queensland, Australia

Available online: 23 Aug 2011

To cite this article: John Sproule, Stewart Ollis, Shirley Gray, Malcolm Thorburn, Pete Allison & Peter Horton (2011): Promoting perseverance and challenge in physical education: the missing ingredient for improved games teaching, *Sport, Education and Society*, 16:5, 665-684

To link to this article: <http://dx.doi.org/10.1080/13573322.2011.601149>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan, sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

# Promoting perseverance and challenge in physical education: the missing ingredient for improved games teaching

John Sproule<sup>a\*</sup>, Stewart Ollis<sup>b</sup>, Shirley Gray<sup>a</sup>,  
Malcolm Thorburn<sup>a</sup>, Pete Allison<sup>a</sup> and Peter Horton<sup>c</sup>

<sup>a</sup>University of Edinburgh, UK; <sup>b</sup>University of the West of Scotland, UK; <sup>c</sup>James Cook University, Townsville, Queensland, Australia

This paper explores critical notions about how improved understandings of students learning experiences within practical learning environments could sensitise teachers to appreciate the complex influences more that affect how levels of challenge and perseverance are constructed by students. The authors, in furthering their critique, build on the model of constructivism developed by Ollis and Sproule. This model attempted in embryonic terms to recognise the specific situational factors that most influenced the minded ways in which students identified and responded to learning challenges. In refining these ideas further the authors specifically consider how teaching games for understanding (TGfU) methodologies could be enhanced by recognising the meta-cognitions of students when constructing rich task led learning episodes. In conclusion, it is posited that comprehending the complexity of learning theory holds considerable promise for the ongoing development of physical education as a valuable and integral part of the school learning experience.

**Keywords:** *Physical education; Challenge; Constructivism; Mindfulness; Games teaching*

## Introduction

Nietzsche's (1885) vision of Apollo and Dionysius remains as fresh today as when first applied to psychology, health and well-being. Indeed, with the emergence of the complexity sciences and constructivist paradigms, it has remained surprisingly dormant in application. Nietzsche's challenge was to denounce the traditional, rational and orderly worldviews of his period, and create a new reason by embracing complexity within the notions of 'self-overcoming' (*ubermensch*) and 'becoming' (in contrast to being). Nietzsche believed that the traditional way of mechanistic thinking did not afford capability to excel in our dynamical, paradoxical and multidimensional life-world. We still see this argument maintained in the philosophical arguments of today as well as in scientific reports and academic studies. Within Nietzsche's philosophy, Apollo represented tradition, structure, control, logic, clarity, formality and order while Dionysius represented a spontaneous and

---

\*Corresponding author. PESLS, University of Edinburgh, St. Leonard's Land, Holyrood Road, Edinburgh EH8 8AQ, UK. Email: John.Sproule@ed.ac.uk

powerful totality representing a chaotic and ecstatic energy that ‘despises all systemisers’. Reading the Dionysian worldview in depth however, it becomes clear how Nietzsche did not wish to overcome the Apollonian worldview in full, and that Dionysian principles were not absolute. Indeed, Nietzsche’s Dionysian directly couples and inherits Apollonian traits and where their duality brings ‘order upon chaos’. This philosophy was what was represented in the original Dionysian model of expertise.

Nietzsche acclaimed himself as Heraclitean and many have shared his dynamic and situated view of change. This includes educational philosophers such as Foucault, Heidegger, Rorty, Dreyfus and Dreyfus, Dewey, Bourdieu and Merleau-Ponty to name but a few. The present paper is an exemplar of how this Dionysian worldview holds considerable promise for the ongoing development of physical education (PE) as a valuable and integral part of the school learning experience. The paper shall focus less on specifics of the Dionysian model, but more on how improved understandings of students learning experiences within practical learning environments could sensitise teachers to appreciate the complex influences more that affect how levels of challenge and perseverance are constructed by students. Thus, can we promote and develop ‘self-overcoming’. To do this we shall explore how Dionysian expertise affords more than deliberate practice (Ericsson, 2006) alone, and how constructing suitable student focused environments can afford the challenges and experiences to enhance mindful, self-regulated and meta-cognitive individuals/groups. It is proposed we utilise games teaching and teaching games for understanding (TGfU) as the platform to assist in this story-telling due to its grounding in constructivist principles.

### **Curriculum for excellence: radical reform of education in Scotland**

Almost a decade ago, the Scottish Government (then the Scottish Executive) identified five National Priorities in Education. They were achievement and attainment, framework for learning, inclusion and equity, values and citizenship and learning for life. The National Priorities in Education aimed to empower teachers and learners, and ensure that every child in Scotland reached his or her full potential. In order to realise fully the priorities, there was also a call for a more integrated curriculum that placed the pupil at the centre of the learning process. This call was, in part, as a result of the information attained during the National Debate on Education in 2002. However, it was also because of the belief that subject-based bias in secondary schools in Scotland is of little value and traditionally serve those who pursue subjects at university at the expense of learning for citizenry. Within this type of curriculum, ‘... practical abilities, investigative skills, problem-solving, oral abilities and so forth got into the secondary curriculum, within subjects, but the strain they create for assessment and certification means they remain somewhat curtailed, indeed are under pressure to be reduced’ (Bryce & Humes, 2008).

It was against this backdrop that the Scottish Government established a Review Group to identify the key principles to be applied in the curriculum redesign for ages 3–18. The remit of the Review Group was to consider curriculum reform based on evidence of practice, research, international comparisons and global, local, economic and social changes. The outcome of the Group's work was a Curriculum for Excellence (CfE) (Scottish Executive, 2009). A CfE outlines the vision for schools in Scotland in the twenty-first century and places each learner at the heart of the learning process. It aims to provide pupils with appropriate and meaningful learning experiences, linked to their age and stage of child development throughout both primary and secondary schooling. It highlights the success of past curricular innovations and builds upon them for the future so that education in Scotland nurtures successful learners, responsible citizens, confident individuals and effective contributors.

### **The physical education experience**

In *Experience and Education*, Dewey (1938) maps out what he means by an 'experience', and what it takes for an experience to carry 'educational' value. One of Dewey's premises is that student experience results from the interaction between the student and the environment. This is Dewey's 'principle of interaction'. Factors that affect student experience include those that are 'internal' to the student, and those that are 'objective' parts of the environment. The students' perceptions of, and reactions to, the objective factors are influenced by their attitudes, beliefs, habits, prior knowledge and emotions. The other premise of Dewey's theory is called the 'principle of continuity'. It states, '... every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after' (1938, p. 27), reflecting Nietzsche's constructivism. Dewey explains that people develop habits of emotional response, perception, appreciation, sensitivity and attitude. These habits, developed from past experiences, affect future experiences. Taken together, the principle of interaction and the principle of continuity determine, for Dewey, the quality of an educational experience. He describes them as 'longitudinal and lateral aspects of experience' that intercept at any situation (1938, p. 42). Understanding the quality of a person's experience by using this theory requires consideration of how the experience contributes to the development of that person's habits (principle of continuity) and the immediate nature of that person's connections with her/his environment (principle of interaction). Thus, the principle of continuity leads to experiences and perceptions that impact on the principle of interaction. We agree with the following statement by Dewey:

Perhaps the greatest of all pedagogical fallacies is the notion that a person learns only the particular thing he is studying at the time. Collateral learning in the way of formation of enduring attitudes, of likes and dislikes, may be and often is much more important than the spelling lesson or lesson in geography or history that is

learned. For these attitudes are fundamentally what count in the future. The most important attitude that can be formed is that of desire to go on learning. (1938, p. 49)

The field of adventure education and outdoor learning relies heavily on the work of John Dewey and other Heracliteans and as such the practical aspects of that field of practice overlap considerably with PE. These Dionysian principles have also been identified directly in talent development studies such as Monahan (2007) in martial arts and Varley (2006) in adventure training. Furthermore, it is worth noting that Dewey differentiated between educative and miseducative experiences. In his view an educative experience is one that helps to develop the principle of continuity. A miseducative experience is, in Deweyan terms, one that stunts or distorts future learning experiences (continuity). On this conception then it is only sometime after an experience that it is possible to judge whether it was meaningfully educational or not. We view the quality of a PE experience as being intrinsically connected with its long-term consequences and including the effects of both collateral learning as well as the results of directed lessons. The influence of the American Pragmatist movement on teaching and learning is significant and the work of Dewey represents a psycho-philosophical perspective and constructs that can provide useful conceptual frameworks for educators. It is also helpful to consider sociological perspectives and the work of French Sociologist Bourdieu, as his work concentrated on worldview constructions and, among other things, a concept he referred to as *habitus* that is now explored further.

### **Physical education habitus and ‘challenge’**

Influenced by the work of Merleau-Ponty, Foucault and Nietzsche, Bourdieu (1998) suggests that how one acts and behaves is predominantly configured by bodily orientation (or ‘hexis’) and our social structure (or ‘habitus’). *Habitus* has been further referred to as environmental structure that is produced through the socialisation processes that both embrace and inform values, attitudes and ways pupils interact and behave in their learning environment (Bourdieu, 1998). The individual habitus of pupils is informed by the homologous PE environment habitus (relating to structure, ability, gender, attitude, beliefs, challenge) to which they belong. Individual habitus is potentially a system of lasting and transposable dispositions, which integrate the past experiences of the individual and functions as a matrix of perceptions, appreciations and actions (cf. Dewey’s principle of continuity).

For the individual, habitus often operates at an unconscious level and is utilised without intention in language, thoughts and practical action. Physical education is a scenario for and contributor to habitus and examples of this are the implementation of standardised curricula and homogeneity of students’ dress code in PE classes. The fact that skills are set to a range of limits for different levels and abilities requires PE teachers to provide an effective learning environment with diverse learning

experiences to cater for the spectrum of students abilities. When the individual habitus and the PE environment habitus match they fit like a dovetail, but if slightly different (or out of synch) they are dissonant—and tensions can arise.

*Challenge* refers to the intrinsic and individual feeling that ability and skills have been stimulated, extended and possibly exceeded within the practical PE environment (Walls, 2006). Once again, we identify the relationship of challenge with a Dionysian notion of ‘self-overcoming’ and ‘*Übermensch*’. The perception of challenge experienced by pupils in the practical PE environment will potentially be instigated and affected by habitus and hexis. This will include factors such as the level of competition and ability level; that is, factors that contribute to the pupil’s experiences in the PE environment and thereby having an effect on the individual’s habitus. For example, being ‘in flow’ involves engaging in just-manageable challenges where there is a focused concentration on what one is doing at the present moment. However, being ‘in flow’ is a state of dynamic equilibrium, a fragile balance between perceived action capacities and perceived action opportunities. If challenges begin to exceed skills, pupils can become anxious, and if skills begin to exceed challenges, pupils can become bored (Nakamura & Csikszentmihalyi, 2005).

To provide challenge and to achieve the feeling of support and learning opportunities for all ability levels, PE environments may need to be restructured more toward individual needs. This is important because, for example, research findings support that a pupil is more likely to disengage from an activity if they are lacking in self-confidence in their ability or if they are lacking in ability for that task (Walls, 2006). Questions to consider include what makes someone persevere? Can it actually be defined or analysed—perhaps it can only be seen? Is determination a greatly under considered element in our whole analysis of physical education practice (not the size of the dog in the fight but the size of the fight in the dog)? How can we quantify determination and how can we teach it to enhance/develop it? How do we define success in PE for someone with limited ‘potential’ but a great deal of perseverance? For example, many international level athletes get ‘there’ by just sticking at it and having other qualities (e.g. stubbornness). Is this perseverance?

Further, now consider those pupils with limited potential or what has been considered by others as ‘natural’ ability. Sometimes such individuals can summon perseverance and get no apparent success or recognition, but they can actually achieve a personal successful outcome or a personal sense of achievement, satisfaction and literal improvement. When examining perseverance it is important to consider if you can promote perseverance per se? Is it a quality, a state or a trait? Is it skill informed, beliefs informed or personality determined? Knowing who has such qualities as perseverance may well be more important than knowing who has the skills or apparent talent.

It is important to note that perseverance may not confront ‘challenge’ because perseverance is not necessarily a function of ability or challenge. Conversely, students with higher feelings of competence and who feel good about themselves are more likely to participate and exert effort in physical activities (Raustorp *et al.*, 2005; Shen *et al.*, 2007). Thus, a curriculum not geared to individual ability could reduce the

level of challenge that participants experience and feel; that is, ability is a significant factor in participant's perception of challenge in their habitus. This has been recognised in the broader education literature with regard to teachers where the importance of trust and confidence of both teachers and students is important (Allison & Wurdinger, 2005).

Rogers (2002) has reported that high ability learners require challenging and extended curricula. Wall's findings (2006) support that participants across the ability range wanted more complex skills and participation with and against similar or higher ability levels to increase their perspective of challenge. Thus, challenging students can be about making activities more complex rather than technically more difficult. An important question here is how is ability defined? Bailey and Morley (2006) remind us that talent development should prove an exciting challenge for PE teachers and have a positive impact on the learning of all pupils, not just those identified with psychomotor talent. According to Bailey and Morley (2006) pupils in PE are recognised as talented when they demonstrate high-level ability within the range of PE contexts including physical, social, personal, cognitive and creative ability. For example, personal ability underpins an individual's capacity for self-regulation, self-belief and commitment to mastery.

Luke and Hardy (1999), in presenting a case for consideration of meta-cognitive ability as having an important role in the learning processes for children in PE, emphasised that learning should be viewed as a complex array of connections and associations between a vast number of variables from a variety of sources.

We agree with Wright and Burrows (2006) that how ability is understood has important consequences for young people, accept that it is not a neutral concept and acknowledge that whether you have ability or do not this may influence enjoyment of PE (and sport). They highlight that attributes associated with physical ability will be those most often associated with hegemonic forms of white masculinity and that the symbolic capital associated with this privileged interpretation is exploited to the full by the private school sector in the UK who have resources well beyond most state sector schools. This appears to have led to an interesting differentiation between state and private sector physical education contexts, where 'ability' has been imagined differently for different groups of children. The pragmatic position of the private schools, where improving performance in the present through expecting high standards. This contrasts with the state schools where it is intended that an experience of enjoyment in physical activity will perhaps achieve something in the future.

For example, PE in state schools in Scotland has recently been placed under the umbrella of 'health and well-being' within a CfE (Scottish Executive, 2009), partly in response to the poor health status of our young people, such as the obesity issue (Sweeting *et al.*, 2008). Thus, in Scotland, PE is viewed by some as providing learners with a platform for the future and as preparation for leading a fulfilling, active and healthy lifestyle.

Health (and sport) constructs are important in PE, but Evans (2004) argues that we need to be as concerned about how ability is recognised, conceptualised, socially

configured, nurtured and embodied in and through the practice of PE. Inspired by Bourdieu's concepts (1977, 1998), Redelius *et al.*, (2009) analysed the symbolic capital of PE; that is, what abilities are assigned value and recognised as valuable by PE teachers in Sweden. They found that PE and health, as an assessed school subject, appears to be strongly influenced by the high value placed on competitive sports by some PE teachers and this can be counterproductive. The consequences could be that many pupils and perhaps those we want PE and health to make a good impact on, the ones who are not physically active during leisure time, will learn that they are not good enough. There is a risk that they will learn that physical activity and sports are nothing for them, since the abilities that are valued—those that really count—are the ones needed to make good sporting results.

Bourdieu's (1977, 1998) conceptual tools, including his view of habitus, provide the means to move beyond biomedical notions of ability, and conceptualise ability as embedded in social and cultural relations and that it needs to encompass a wide range of movements and capacities and, arguably, not only those associated with sport, recreation and exercise (Wright & Burrows, 2006). Thus, 'ability' may not be simply the execution of a specific skill, or the capacity to demonstrate particular strategies or, even, to choreograph movement, but the embodied capacities to perform movements that are located and valued because of their relationships with particular cultures and societies. For example, the UK is a democracy where, we hope, most physical educators would accept that games have both inherent and intrinsic values for learners. Butler (2006) suggested that a TGfU approach to games teaching offers a more inclusive way to think about ability in PE leading to children developing respect for equal justice and free and open inquiry, empowering both teacher and learner and underpinning democracy in action.

### **Teaching games for understanding (TGfU) and a constructivist model of expertise development for all pupils**

In order to provide learners with a range of contexts in which to improve and demonstrate their ability, most PE curricula around the world recognise the need for a balanced curriculum and, traditionally, team games such as soccer, rugby, field hockey and basketball have played a critical and prominent role within these curricula.

Team games contribute to learning in PE because they have the capacity to enhance personal, relational and collective pupil learning and development in the physical, cognitive and affective domains. For example, in order to access games such as soccer and basketball, pupils must develop their ability to perform a range of both simple and complex motor skills within highly dynamic environments. Moreover, the decisions that have to be made about the most appropriate skill to execute during games are cognitive in nature and are based on the pupils' knowledge about their learning contexts. During game lessons, teachers can facilitate the development of this knowledge by encouraging pupils to apply skills such as critical thinking,



problem solving, reflecting, observing and discussing. Furthermore, by encouraging pupils to listen, share and show commitment, engagement in games in physical education, teachers can endeavour to enhance pupils' value systems.

One of the issues with the prominence of team games within PE curricula is that there is a view held by some that many pupils do not see the relevance of games such as soccer and basketball. However, this view is not underpinned by any empirical research. Indeed, Independent Schools in Scotland are known to deliver a 'traditional' curriculum that is dominated by team games, yet this does not appear to have a negative influence on the pupils' participation in extra-curricular physical education (Littlefield *et al.*, 2003). Additionally, Gray *et al.* (2008) found pupils in schools in Scotland could relate to traditional activities such as hockey and rugby, and believed that they were an important part of the physical education curriculum. Those pupils who disliked traditional activities did so because of their low levels of perceived competence in those activities, not because they did not value those activities.

The way in which team games are taught within PE curricula, therefore, is an important issue, particularly in relation to providing diverse and dynamic learning environments to cater for all potential and abilities. Importantly, team games lend themselves to this type of environment because of the multiple roles and skills (cognitive, psychomotor and affective)—both on and off the ball—that pupils should develop in order to access team games and experience both individual and team success in team games. Teaching games for understanding (TGfU) is understood as a problem-based approach to games teaching where the play of a game is taught to situated skill development.

It is important to highlight step 5 of the original TGfU model (Bunker & Thorpe, 1982) where Griffin and Butler (2005) remind us that the focus is on how to execute, different from a focus that is limited to a specific skill. They state that skill execution is always viewed in the context of the game. The point we want to make here is that constructivism will view the game context from the meta-cognitions of the learner such as emerging from their personal match analysis. Ollis and Sproule (2007) developed a constructivist model that appears to attend to elements of learner development, with the aim of constructing an ecological and holistic notion of adaptive expertise inclusive of: non-linear development; meta-cognitive, self-regulatory and meta-level processes; explicit (planned) and implicit (emergent) change; paradox, context and situativity; a personal, relational and collective self; and a multidimensional, pluralistic and holistic perspective of expertise.

This model embraces a complex constructivism that promotes both neo-Piagetian and neo-Vygotskian influences (Ollis & Sproule, 2007), as well as both Bronfenbrenner's (2005) and Gibson's (1979) ecological models of development. Acceptance that deliberate practice remains an element of development is maintained within this model. As stated by Ericsson (2006):

The core assumption of deliberate practice is that expert performance is acquired gradually and that effective improvement of performance requires the opportunity to find suitable training tasks that the performer can master sequentially.

The model also draws from principles such as Dewey's notions of 'habitus' and 'hexis' to understand that we are embodied. As such, much comportment is beyond the grasp of consciousness and cannot be touched deliberately and requiring 'the intentionless invention of regulated improvisation'. Hence, we can see why adaptive expertise and plasticity remains critical to the Dionysian notion of expertise as we are required to construct our 'conductorless orchestra' and required to persevere and even seek challenge if we are to 'self-overcome'.

It is interesting that the recent Tucker Center Research Report (2007) has produced an evidenced-based multidisciplinary model for developing physically active girls in the United States, and the central part of their model includes 'commit to deliberate practice'. While we do not fully contest such a proposal, we feel a commitment to positive physical activity, well-being and talent development requires much more than deliberate practice alone.

Our understanding of the TGfU approach is based on the following:

- that deliberate experience is critical, i.e. situated learning (Kirk & McPhail, 2002);
- that meta-cognition is important (Kirk, 2005), i.e. questioning, decision-making, planning and reflection-in action, on action, at performance and developmental levels, i.e. deliberate mindfulness;
- the value of transfer. For example, Mandigo and Holt (2000) reminded us that a child with games literacy understands how rules create structural and tactical similarities (and differences) between games; and
- that not everything functions at a 'cognitive level' and why a situated approach is important, in practice, experience and mindfulness. Examples include tacit learning or intuition, i.e. non-deliberate mindfulness.

This model of learner development toward expertise identifies the necessity for mindful engagement in various aspects of performance construction. The deliberate elements can be defined as both explicit and planned and can therefore be monitored and controlled through a suitable learner development framework. The 'non-deliberate' elements of the model incorporate recognition that much of the learner's development within PE is implicit and emergent. In this respect high quality teaching and learning is typically characterised by teachers who recognise that students will be experiencing different things at the same time as each other even though it may appear that they are all doing and experiencing the same thing. This is in keeping with Dewey's principle of interaction and indicates the importance of the relationship of students and teachers.

Research now suggests how informal experience during early periods of development on the physical and biological development of the brain itself. A pioneering study researching the effect of a challenging environment on brain development was conducted by Greenough *et al.* (1987). They studied the effects of synapse formation of rats placed in various environments. The rats placed in the more 'challenging' and 'complex' environments (toys, obstacles, problems, other rats) performed better in future learning tasks and had 20–25% more synapses per neuron in the visual cortex.

These findings have been drawn to the learning sciences to support the need for ‘rich environments’ in the education domain.

As drawn from the lower half of the model (Figure 1), the PE habitus serves purpose on creating a social and culturally influenced ‘rich environments’ where numerous mindful activities are required through situated learning approaches. The appropriateness of an environmentally induced rich experience for optimal learning in sporting contexts has also been recognised by the likes of Cassidy and Rossi (2006) and Green and Houlihan (2005). To assist in the ‘intentional’ as well as ‘the intentionless invention of regulated improvisation’ our model contains a dimension where challenge is also created within deliberate and non-deliberate mindfulness. For example, this may require not only classical planning and reasoning such as making decisions, reflection, problem solving or situated awareness, but also the proposed embodied, action focused and ecological backdrop of non-conscious mindful activity—all of which are important components of games learning through situated approaches such as TGfU.

### Mindfulness

Mindfulness is a means of paying attention in a particular way: on purpose and in the present moment. Langer (2000) defines mindfulness as a ‘flexible state of mind in which one is actively engaged in the present, noticing new things and sensitive in context’. We suggest a necessity for mindfulness and a generalised state of alertness to both the activities one is engaged in and the situational surroundings is required to achieve your potential. Hauw and Durand (2007) have raised the profile of context ‘performance’ mindfulness in their situated analysis of problems in competition for elite trampolinists, where they identified factors such as ‘solving problems quickly



Figure 1. Dionysian development: complex-adaptive constructivist model of expertise

and definitively while performing other actions' (i.e. not becoming pre-occupied by a mistake during the second contact).

Developmental mindfulness is where individuals promote mindful attention to their long-term, medium-term and day-to-day development, but still situated within a 'here and now' perspective. Our constructivist model of talent development for all pupils in PE suggests deliberate mindfulness, and its capability to construct a meta-cognitive and reflective learner, is of necessity to promote transcendent levels of performance. A mindfulness that assists in accepting and removing negative thought intrusions and preservative self-focused processing, whilst promoting a change process that focuses on the appropriate attentional resources. Examples of this include planning, goal-setting, reflection and situation awareness. Responsibility for performance and learning, therefore, is shared between the educator and the learner that is contrary to the current flow in the majority of contemporary educational thinking where the teacher is responsible for the 'outputs' be they exam marks, assessment grades or performances in the gymnasium, art class or sports field.

Previous research (Schack & Mechsner, 2006) has shown that skilled performers develop more flexible and detailed memory representations than do less skilled individuals, allowing them to adapt rapidly to changes in dynamic situational demands. The whole point of mindfulness is being self-regulative and meta-cognitive. That is, it is about adaptive expertise, which is of crucial importance in contemporary education given the rapidly changing societies in which today's students will be living and working in. From the TGfU perspective, an important dimension of self-regulation and meta-cognition is decision-making. Interestingly, Vaeyens *et al.* (2007) recently highlighted it is also feasible that not all elite skilled performers are exceptional decision makers, and they remind us that the skills necessary to achieve excellence in team sports such as soccer are multifaceted in nature, where weaknesses in one area may be compensated for by strengths in others. For example, a player who is not an exceptionally good decision maker may be able to compensate by developing excellent technical skills or by being quick and agile. Therefore, although some sub-elite players may outperform their elite counterparts on empirical decision-making measures, other weaknesses, such as technical ability, may prevent them from progressing to a higher level.

### **TGfU and a challenge point framework**

Guadagnoli and Lee (2004) stated:

In truth, the attainment of expertise is not a goal or a reality for most learners of motor skills. Because of our incomplete knowledge of practice variables, we are often inefficient in our practice sessions. Thus, the limited opportunity for practice, coupled with the potentially small gains in expertise resulting from each session, increases the importance of maximising the benefits gained whenever practice is undertaken.

According to the Guadagnoli and Lee challenge point framework, learning is intimately related to the information available and interpretable in a performance instance that, in turn, depends on the functional difficulty of the task. As skill improves, the expectations for performance become more challenging (Guadagnoli & Lee, 2004). Therefore, to develop a challenge for learning for all pupils, one must obtain increased information from the meta-cognitions of the learner. Ollis and Sproule (2007) developed an expanded constructivist challenge points to create adaptive expertise whilst providing sports science support to an international shooting team over a two-year period in preparation for the Melbourne Commonwealth Games. It is important to understand that life can be described as 'Heraclitean', which is the management of change created by de-stabilisation and challenge. Further, the transition towards improved performance requires that individuals or teams or organisations or school communities put themselves in more challenging positions and become 'healthier' because of it.

The Greek philosopher of the late sixth century, Heraclitus, criticised his predecessors and contemporaries for their failure to see the unity in experience (O'Brien, 1967). He claimed that opposites are necessary for life, but they are unified in a system of balanced exchanges. Heraclitus was the first Western philosopher to go beyond physical theory in search of meta-physical foundations and moral applications to explain life transition. If you think of it in a sport science term, for example, human physiology and metabolism have to be perturbed to re-organise at a healthier state. By understanding the issue as a complex-adaptive system, it is known that if you de-stabilise one component (for example, a biomechanical technique) you can, at one and the same time, challenge another component of the human template, such as the cognitive psychology of the situation. Research even shows how increasing the intensity, volume or initiation of strenuous physical activity has positive implications for gross and fine motor skills, executive functioning, cognitive functioning, emotional regulation and socio-relational dynamics (Colcombe & Kramer, 2003; McMorris *et al.*, 2009). This includes specific studies on dementia (Rovio *et al.*, 2005), brain plasticity (Kramer & Erickson, 2007), brain structure and volume (Colcombe *et al.*, 2006).

Educational empowerment and learning achievement depend on learners being prepared to adapt more readily and this feeds the need for challenge. Wall's doctoral thesis (2006) suggested that a teaching approach not geared to individual ability could reduce the level of challenge that participants experience and feel. That is, ability (in a broad conception of the term) is a significant factor on pupils' perception of challenge in their habitus. Guadagnoli and Lee (2004) developed a framework indicating that task difficulties create a learning potential whose function differ according to the level of the performer, the complexity of the task and the environment. They highlighted that because increased task and environment complexity are differentially associated with performance levels, there is a performance-learning paradox, i.e. acquisition based learning to retention and transfer focused learning. We do this by contextual interference and feedback manipulations. Indeed, we support the radical view suggested recently by Williams and Hodges

(2005), which would be to dispense with specific, blocked practice in soccer altogether and to start with variable and random practice through small-sided and conditioned games, indicative of the perceived success of 'street football' in developing elite players in bygone years (Figure 2).

A key issue with children playing street football in the past was that they were learning whilst relying primarily on their own intrinsic feedback mechanisms and subconsciously evaluating their own and others performance—active problem solvers, players taking responsibility for their own development, finding unique solutions through exploration and discovery, i.e. smart learners with adaptive rather than routine expertise. Put another way, they were engaged in a rich, complex, unpredictable and stimulating environment rather than a shallow repetitive predictable environment.

Theoretical perspectives based on ecological psychology, dynamical systems theory and non-linear pedagogy support this and explain how TGfU lessons facilitate improvements in game performance (Chow *et al.*, 2007) They contend that human intentions are 'embodied' and constrained by a number of factors including mind, body, social and biological contexts (Davids *et al.*, 2008). Moreover, they propose that movements emerge from the interaction of these constraints with the task (the equipment, rules and boundaries of the game) and the environment (the surface, weather, light). When teachers modify games (manipulate task constraints), set problem-solving tasks and apply questioning techniques, pupils explore a variety of movement solutions within authentic contexts and, as a result, goal-related, decision-making behaviours emerge without the need for prescriptive instructions. It is interesting that a recent Norwegian study (Fjortoft, 2004), 'Landscape as playscape: the effects of natural environments on children's play and motor development', has shown that physical activity play in a natural environment



Figure 2. Children playing football in a street in London during the 1950's  
Source: The Independent, Monday 14th January 2008; [www.independent.co.uk](http://www.independent.co.uk)

improved the motor abilities in five- to seven-year olds. As well as ‘landscape as playscape’ research, an emergence of play as learning literature has seen a further shift to this complex-constructivist account (Singer *et al.*, 2006; Hirsh-Pasek *et al.*, 2009).

The findings from Gray *et al.* (2008) are very important on a number of different levels. Reflective of the requirement of a personal, relational and collective action research model adopted by elite athletes (Ollis & Sproule, 2007), Gray *et al.*’s findings support that pupils are entirely capable of articulating their views about their team games experiences, views that are indispensable if teachers are to provide them with appropriate and meaningful learning experiences that incorporate considerations highlighted by Dewey’s principles of continuity and interaction. In highlighting this multifaceted view of learning, Light (2008) states that complex learning theory holds considerable promise for the ongoing development of PE as a valuable and integral part of the school learning experience.

Complex learning theory is based on the premise that, although there are different types of constructivism, they all revolve around three key tenets. Firstly, that learning is an ongoing process of adaptation shaped by the learner’s experiences. Secondly, that cognition is both an individual process and a social process, and finally, it rejects objectivist views of learning that knowledge is an internal representation of an external reality and accepts that learning involves interpretation in which there is no pre-given external reality. Light states that teaching a series of discrete skills in a simplistic, reductionist and teacher-directed way is not consistent with this view of learning. However, constructivism implies that the game context for the learner includes their reflection and analysis of former learning (for example, last week’s PE lesson). However, as Grehaigne *et al.* (2005) highlighted, ‘there is no novice at level 0’. Thus, we support learner input to the design of challenge points practice, i.e. a micro ‘community of practice’ where the learner and the teacher/coach decide together based on the learner’s game context, e.g. analysis of the previous week’s game and individual needs.

Based on Grehaigne *et al.*’s postulates (interaction—cognition—construction—plasticity) this reflects a system’s (i.e. the learner) capacity for modifying its own structure and acquiring new skills. Therefore, contrary to Light (2008) we say that although constructivism rejects instructivism, constructivism does not reject instructivist approaches if this emerges as a legitimate demand from the perspective of the learner.

Encapsulated within the Ollis and Sproule (2007) account of a challenge points framework is the holistic notion of creating a ‘constructive-change mindset’ (Egan, 2002): something that was also understood in the Ollis and Sproule account of challenge points as a ‘way of being’ and represented within the study as a ‘dynamic capability’. Gerard Egan adopts a problem-management and opportunity-development approach to ‘helping’ and development governed through a balance of support and challenge. Egan addresses the nature of challenging, specific challenging skills, the wisdom of challenging including the concept of challenging and the appropriate leverage point and helping work on the right things. Ollis and

Sproule found that the complexity is represented in that one therefore has to be embodied and engaged within the habitus to 'sense' the change due to the multilevel and ecological influences. It is encouraging high levels of engagement (as practice, experience and mindfulness) that, together, enhance authenticity of experience and refine self-regulatory learning and meta-cognitive behaviours.

Providing 'challenge point' experiences in PE and in game lessons may not be easy for teachers to achieve. Teaching and learning in PE is not simple, nor is it linear. Learning to play games such as soccer and rugby is a complex, dynamic, multifaceted and multidimensional process. When PE teachers accept that this is the case, and they adapt their pedagogy to reflect this through authentic experience and engagement, then the creation of challenging learning environments is entirely possible.

By their nature, games such as soccer and rugby are also complex. They are situated, social and relational, and require a number of skills and understandings in order both to participate and to learn/improve. However, there is a paradox about this idea of complexity and games teaching and learning. That is, the complexity of games intrinsically supports the concept of challenge, and therefore, actually enhances learning. Importantly, teachers have to embed this idea into their teaching so that their pupils understand how difficulties (or challenges) in learning can facilitate learning. In other words, teachers have to create a culture of challenge so that pupils understand how they learn, how to advance their learning and recognise when they have been successful. These skills can be nurtured when teachers hand over more responsibility for learning to the learners, a technique that is endorsed by both proponents of TGfU and a CfE in Scotland.

By setting problems that have a number of solutions, and a number of different ways to arrive at the solutions, teachers can encourage small groups, or teams, to use the variety of learning strengths and strategies each team member possess, to collectively overcome any difficulties and solve each problem. In this way, learners share ideas, construct new knowledge and develop new skills, thus meeting each challenge and enhancing individual and team performance (Wurdinger, 1997). The challenge for the teacher is to know what problem to set, what assistance to provide and how to provide that assistance. The teacher's success in meeting this challenge will be contingent on his/her knowledge of the game, the pupils and learning. Moreover, the task set and the assistance provided may also be subject to the demands made by the group, which will be based on their understanding of what is required for their learning, both at a group level and an individual level.

The Ollis and Sproule (2007) notion of challenge was therefore embraced at a collective, relational and personal level and requiring attention within performance, instructional activity, experiential activity, training scheduling over medium term time-scales and also via an ecological life-span development account. The life-span account is reflective of work such as Hendry and Kloep (2002) who recognise the life-course (inclusive of talented and experts) as a process of continuous challenge. Creation of the appropriate mindset incorporates the construction of mindful



activities, rich environment and guided assistance with formulating mindful capability.

Dweck and Legget (1988) provide supporting literature on the appropriateness of a challenge-based approach for development of a growth (rather than fixed) mindset. They proposed how a growth mindset leads to a desire to learn more and pursue developmental activity along with a tendency to persist in the face of setbacks, see effort as the path to mastery, learn from criticism and find inspiration and lessons in the success of others. Therefore, while Guadagnoli and Lee (2004) focus on the appropriateness of feedback and practice variability as an instructional constraint to induce the retention and transfer of motor skill, the Ollis and Sproule (2007) model is extended fully across the bio-psycho-socio-cultural continuum, and into medium-term and long-term development accounts. In relation to the understanding of 'dynamic capability', this notion of challenge is also extended into a personal, relational and collective self-account requiring organisations, teams and coaches to embrace the holistic mindset philosophy.

### **Paradox learning and a constraints led, meta-cognitive perspective**

We know that a random or high contextual interference practice, while detrimental to short-term performance, is better for long-term retention and learning, i.e. to promote learning, try to avoid repetitious, blocked practice by presenting a variety of skills within the same session. Although there is some evidence that blocked, non-random practice is beneficial early in learning, we support the radical view suggested recently by Williams and Hodges (2005), which is to dispense with specific, blocked practice altogether and to start with variable and random practice through small-sided and conditioned games, indicative of the perceived success, not only of teaching approaches such as TGFU, but also of 'street football' in developing elite players in bygone years. Whilst playing street football, children were learning whilst relying primarily on their own intrinsic feedback mechanisms and subconsciously evaluating their own and others performance. Active problem solvers, taking responsibility for their own development, finding unique solutions through exploration and discovery, i.e. smart learners with adaptive rather than routine expertise. Theoretical perspectives based on ecological psychology and dynamical systems theory support this and highlight the role of non-linear pedagogy in PE (Chow *et al.*, 2007). For example, learners efficiently adapting to the constraints imposed upon them during practice.

Bunker and Thorpe (1982) have supported that a literate games player can perform a broad range of skills including technical (e.g. dribbling) and tactical skills (e.g. decision-making); that is, physical literacy incorporates both the technical and the tactical with TGFU placing the performance of skills within the context of the game. This embraces the physical, technical, tactical and mental dimensions of working towards expertise; that is, holistic applied sports science within curricular PE to meet the individual needs of all pupils. Possibly at odds with this was the 2007

newspaper article by Payne who informed us that it is only when Brazilian kids reach around 14 years of age does anyone start talking to them about team shape and tactics. Until then it is all about technique, tricks, shooting, dribbling and spontaneity. Payne asked the question: 'What is the point of talking to children about triangles and blind-side runs if they cannot effortlessly control the ball, pass or shoot?' Payne suggests: 'Teach children that a game such as soccer is a dance—and their partner is the ball'. It therefore comes as no surprise that the Brazilian's acknowledge their own brand of creative, spontaneous impulsive and open 'futebol arte' as Dionysian, whereas they acknowledge the rational, rigid, tactics focused and mechanistic European brand of 'futebol forca' as Apollonian (Maranhao, 2007).

Once again, and unsurprisingly, this approach to football is reflective of Scotland's richest era when dominated by 'street football'. A primary task for us as physical educators is to increase our awareness and understanding of previous performance psychology research that has shown the importance of setting goals that can serve to enhance performance. These types of goals are known as a form of challenge point and by constantly striving to reach a goal slightly beyond the comfort zone, pupils can continually challenge themselves and, in turn, enhance their talent development. Thus, we are suggesting that a relevant teaching approach for all pupils in PE is one that builds challenge around pupil meta-cognitions.

## **Conclusion**

The paper utilised the complex-constructivist principles of the Dionysian model, to better understand students learning experiences within practical learning environments could sensitise teachers to appreciate more the complex influences that affect how levels of challenge and perseverance are constructed by students. To do this we explored how Dionysian expertise affords more than deliberate practice alone, and how constructing suitable student focused environments affords the challenges and experiences to enhance mindful, self-regulated and meta-cognitive individuals/groups.

In consideration to games teaching, we are taking the constructivist principles of TGfU at a game sense level (macro), and replicating them to a micro-level (i.e. learning the game to learning the skill that is critical to learn the game), but all under the same constructivist philosophy. Thus, we look at steps 4 and 5 of the TGfU model (Griffin & Butler, 2005): step 4 decision-making—pupils learn to make good decisions by practicing the elements of decision-making. These elements include paying attention to relevant actions (selective attention), anticipating responses by opponents and choosing appropriate skills (those that will implement the decision most effectively); step 5 skill execution—pupils are motivated to learn skills because they are learned in context and practiced after the game is played. By taking this approach, the skills then enhance game play performance and help students implement the chosen strategy. As Kirk (2005) stated, 'TGfU has never been about the mere development of tactical awareness. It has always been about

developing good games players'. Thus, skill execution and decision-making have to be addressed but within constructivist ideals, utilising situated learning principles (e.g. meaningful and authentic learning experiences). In our opinion this concurs with Perkins's (1999) three tenets of constructivism: the active learner, the social learner and the creative learner. Thus, as creative learners, all pupils should be encouraged to draw on prior experiences to construct knowledge, and our constructivist model framed within challenge points offers a way forward to enable all pupils to achieve their potential within curricular PE.

Developing decision-making skills is important for young people as they mature and take on greater degrees of responsibility in society where both instrumental and non-utilitarian views may be valued. In all, we feel we can promote and develop 'self-overcoming' as an important dimension of PE.

## References

- Allison, P. & Wurdinger, S. (2005) Understanding the power, promise and peril of the experiential learning process, *Teacher Education and Practice*, 18(4), 386–399.
- Bailey, R. & Morley, D. (2006) Towards a model of talent development in physical education, *Sport, Education and Society*, 11(3), 211–230.
- Bourdieu, P. (1977) *Outline of a theory of practice* (Cambridge, Cambridge University Press).
- Bourdieu, P. (1998) *Practical reason: on theory of action* (Stanford, CA, Stanford University Press).
- Bronfenbrenner, U. (2005) *Making human beings human: bioecological perspectives on human development* (London, Sage).
- Bryce, T. G. K. & Humes, W. M. (2008) *Scottish education: beyond devolution* (3rd edn) (Edinburgh, Edinburgh University Press).
- Bunker, D. & Thorpe, R. (1982) A model for the teaching of games in secondary schools, *Bulletin of Physical Education*, 18(1), 5–8.
- Butler, J. (2006) Curriculum constructions of ability: enhancing learning through teaching games for understanding (TGfU) as a curriculum model, *Sport, Education and Society*, 11(3), 243–258.
- Cassidy, T. & Rossi, T. (2006) Situating learning: (re)examining the notion of apprenticeship in coach education, *International Journal of Sports Science and Coaching*, 1(3), 235–246.
- 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(3), 251–278.
- Colcombe, S. J., Erickson, K. I., Scalf, P. E., Kim, J. S., Prakash, R., McAuley, E., Elavsky, S., Marquez, D. X., Hu, L. & Kramer, A. F. (2006) Aerobic exercise training increases brain volume in aging humans, *The Journals of Gerontology, Series A, Biological Sciences and Medical Sciences*, 61, 1166–1170.
- Colcombe, S. J. & Kramer, A. F. (2003) Fitness effects on the cognitive function of older adults: a meta-analytical study, *Psychology Science*, 14(2), 125–130.
- Davids, K. W., Button, C. & Bennett, S. J. (2008) *Dynamics of skill acquisition: a constraints led approach* (USA, Human Kinetics).
- Dewey, J. (1938) *Experience and education* (New York, Collier Books).
- Dweck, C. S. & Legget, E. L. (1988) A social cognitive approach to motivation and personality, *Psychological Review*, 95, 256–273.
- Egan, G. (2002) *The skilled helper* (Belmont, CA, Brooks/Cole).
- Ericsson, K. A. (2006) The influence of experience and deliberate practice on the development of superior expert performance (chapter 38), in: K. A. Ericsson, N. Charness, F. J. Feltoovich &

- R. R. Hoffman (Eds) *The Cambridge handbook of expertise and expert performance* (Cambridge, Cambridge University Press), 685–705.
- Evans (2004) Making a Difference? Education and ability in physical education, *European Physical Education Review*, 10(1), 95–108.
- Fjortoft, I. (2004) Landscape as playscape: the effects of natural environments on children's play and motor development, *Children, Youth and Environments*, 14(2), 21–44.
- Gibson, J. J. (1979) *The ecological approach to visual perception* (Boston, Houghton Mifflin).
- Gray, S., Sproule, J. & Wang, J. (2008) Pupils' perceptions of, and experiences, in team invasion games: a case study of a Scottish secondary school and its three feeder primary schools, *European Physical Education Review*, 14(2), 1–22.
- Green, M. & Houlihan, B. (2005) *Elite sport development: policy learning and political priorities* (London, Routledge).
- Greenough, W. T., Black, J. E. & Wallace, C. S. (1987) Experience and brain development, *Child Development*, 58, 539–559.
- Grehaigne, J. F., Richard, J. F. & Griffin, L. L. (2005) *Teaching and learning team sports and games* (New York, Routledge Falmer).
- Griffin, L. & Butler, J. (2005) *Teaching games for understanding: theory, research and practice* (Champaign, IL, Human Kinetics).
- Guadagnoli, M. A. & Lee, T. D. (2004) Challenge point: a framework for conceptualizing the effects of various practice conditions in motor learning, *Journal of Motor Behaviour*, 36(2), 212–224.
- Hauw, D. & Durand, M. (2007) Situated analysis of elite trampolinists' problems in competition using retrospective interviews, *Journal of Sports Sciences*, 25(2), 173–183.
- Hendry, L. B. & Kloep, M. (2002) *Lifespan development: resources, challenges and risks* (London, Thomson Learning).
- Hirsh-Pasek, K., Golinkoff, R. M., Berk, L. E. & Singer, D. G. (2009) *A mandate for playful learning in school* (Oxford, Oxford University Press).
- Kirk, D. (2005) Future prospects for teaching games for understanding, in: L. Griffin & J. Butler (Eds) *Teaching games for understanding: theory research and practice* (Champaign, IL, Human Kinetics), 213–227.
- Kirk, D. & McPhail, A. (2002) Teaching games for understanding and situated learning: rethinking the Bunker and Thorpe model, *Journal of Teaching in Physical Education*, 21, 177–192.
- Kramer, A. F. & Erickson, K. I. (2007) Capitalizing on cortical plasticity: influence of physical activity on cognition and brain function, *Trends in Cognitive Sciences*, 11(8), 342–348.
- Langer, E. J. (2000) Mindful learning, *Current Directions in Psychological Science*, 9(6), 220–223.
- 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.
- Littlefield, R., Green, B., Forsyth, S. & Sharp, B. (2003) Physical education in Scottish schools—a national case study, *European Journal of Physical Education*, 8, 211–227.
- Luke, I. & Hardy, C. (1999) Appreciating the complexity of learning in physical education: the utilization of a metacognitive ability conceptual framework, *Sport, Education and Society*, 4(2), 175–191.
- Mandigo, J. L. & Holt, N. L. (2000) The inclusion of optimal challenge in teaching games for understanding, *Physical and Health Education Journal*, 66(3), 14–19.
- Maranhao, T. (2007) Apollonian and dionysians: the role of football in Gilberto Freyre's vision of Brazilian people, *Soccer and Society*, 8(4), 510–523.
- McMorris, T., Tomprowski, P. & Audiffren, M. (2009) *Exercise and cognitive function* (Chichester, Wiley).
- Monahan, M. (2007) The practice of self-overcoming: Nietzschean reflections on the martial arts, *Journal of the Philosophy of Sport*, 34, 39–51.
- Nakamura, J. & Csikszentmihalyi, M. (2005) The concept of flow, in: C. R. Snyder & S. J. Lopez (Eds) *Handbook of positive psychology* (Oxford, Oxford University Press), 89–105.

- Nietzsche, F. (1885) *Thus Spoke Zarathustra* (W. Kaufmann, Trans., 1995 reprint) (New York, The Modern Library).
- O'Brien, M. J. (1967) *The Socratic paradoxes and the Greek mind* (Chapel Hill, University of North Carolina Press).
- Ollis, S. & Sproule, J. (2007) Constructivist coaching and expertise development as action research, *International Journal of Sports Science and Coaching*, 2(1), 1–14.
- Payne, S. (2007) *Turf war, how Britains playing fields became a battleground*. Available online at: <http://www.independent.co.uk/news/uk/this-britain> (accessed 8 February 2008).
- Perkins, D. N. (1999) The many faces of constructivism, *Educational Leadership*, 57(3), 6–11.
- Raustorp, A., Stahle, A., Gudasic, H., Kinnunen, A. & Mattsson, E. (2005) Physical activity and self-perception in school children assessed with the children and youth-physical self-perception profile, *Scandinavian Journal of Medicine and Science in Sports*, 15(2), 126–134.
- Redelius, K., Fagrell, B. & Larsson, H. (2009) Symbolic capital in physical education and health: to be, to do or to know? That is the gendered question, *Sport, Education and Society*, 14(2), 245–260.
- Rogers, K. B. (2002) Grouping the gifted and talented: questions and answers, *Roeper Review*, 24(3), 103–108.
- Rovio, S., Kåreholt, I., Helkala, E. L., Viitanen, M., Winblad, B., Tuomilehto, J., Soininen, H., Nissinen, A. & Kivipelto, M. (2005) Leisure time physical activity at midlife and the risk of dementia and Alzheimer's disease, *Lancet Neurology*, 4, 705–711.
- Schack, T. & Mechsner, F. (2006) Representation of motor skills in human long-term memory, *Neuroscience Letters*, 391, 77–81.
- Scottish Executive. (2009) *Curriculum for excellence* (Edinburgh, Scottish Executive).
- Shen, B., McCaughy, N. & Martin, J. (2007) The influence of self-determination in physical education on leisure-time physical activity behaviour, *Research Quarterly for Exercise and Sport*, 78(4), 328–338.
- Singer, D. G., Golinkoff, R. M. & Hirsh-Pasek, K. (2006) *Play = learning: how play motivates and enhances children's cognitive and socio-emotional growth* (Oxford, Oxford University Press).
- Sweeting, H., West, P. & Young, R. (2008) Obesity among Scottish 15 year olds 1987–2006: prevalence and associations with socio-economic status, well-being and worries about weight, *BMC Public Health*, 8, 404.
- Tucker Center Research Report (2007) *Developing physically active girls: an evidence-based multidisciplinary approach* (USA, University of Minnesota).
- Vaeyens, R., Lenoir, M., Williams, M. & Renaat, M. P. (2007) Mechanisms underpinning successful decision making in skilled youth soccer players: an analysis of visual search behaviours, *Journal of Motor Behaviour*, 39(5), 395–408.
- Varley, P. (2006) Confecting adventure and playing with meaning: the adventure commodification continuum, *Journal of Sport and Tourism*, 11(2), 173–194.
- Walls, G. S. R. (2006) *The ability of gender to challenge: Queensland senior physical education* (Unpublished doctoral thesis, James Cook University).
- Williams, A. M. & Hodges, N. J. (2005) Practice, instruction and skill acquisition: challenging tradition, *Journal of Sports Sciences*, 23(6), 637–650.
- Wright, J. & Burrows, L. (2006) Re-conceiving ability in physical education: a social analysis, *Sport, Education and Society*, 11(3), 275–291.
- Wurdinger, S. D. (1997) *Philosophical issues in adventure education* (Dubuque, Kendall/Hunt).