



Participant Development in Sport: An Academic Review

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The approach adopted in this *Academic Review* sought to gain the advantages of collaborative research, while benefitting from the specialist expertise within the group. **Bailey** and **Collins** directed the project and developed the overall strategy adopted in the analysis. **Bailey** coordinated the process of literature searching and reviewing, and led the writing of sections other than the domain-based sections; **Collins** provided the structure of the sections through development of certain key definitions and constructs. **Pearce** acted as project manager and was responsible for searching for and disseminating literature among the team. **Ford** led the writing of the biological domain section. **MacNamara** and **Collins** led the writing of the psychological domain section. **Toms** led the writing of the social domain section. All members of the Review Team participated in the process of gathering and sharing of literature, reading and critiquing sections and preparing the final report. All take ownership of the final document.

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Executive Summary

Participant development is a central aspect of any sports development framework as it is concerned with the activities experienced, the pathways followed and the obstacles encountered by players during their sporting and/or physical activity careers. This review seeks to identify the main findings/principles associated with participant development, the methods used to generate this information, and the strengths and weaknesses of the supporting research. It does so by focusing on three broad areas of inquiry: the biological domain, the psychological domain and the social domain.

Biological Domain

During childhood and adolescence there are measurable changes in body shape and structure. These changes relate to an integrated natural development of genes, hormones, nutrients and environmental factors that bring anatomical, neurological, muscular and metabolic/hormonal adaptations. Consequently, this has a direct impact upon the development of specific fitness components. A significant amount of evidence shows that this biological maturation is non-linear and dynamic, meaning an active variance in the development of fitness components between individuals.

At present, the application of such information by practitioners to enhance athletic performance is poor. To date, the best-known model to include such considerations is the Long-Term Athlete Development (LTAD) model. Participant development models must have the flexibility to account for individualised growth rates and by using physical measures, such as peak height velocity and peak weight velocity, the LTAD model advances practitioner understanding to some degree. It uses successful training ethos alongside a greater scientific basis for children and adolescents, and moves away from early specialisation in sport and physical activity to optimise athletic development. The model also acknowledges the need for a balanced training load and competition reflective of the stage of maturation.

It is commonly accepted that training can bring changes in athletic performance. It appears there are natural accelerated improvements in overall athletic performance in young people aged 5–9 years old, as well as specialised fitness-component developments during adolescent biological maturation. Moreover, from conducting training at appropriate maturational time periods, some research suggests accelerated development of athletic performance, known as 'windows of opportunity'. However, participant development should not be driven by windows of opportunity as there is a lack of cause-and-effect evidence; therefore, practitioners should also be aware of the importance of training to advance all fitness components throughout biological maturation during non-critical training periods.

There is a need for long-term training studies to determine whether windows of opportunity actually occur. There is no evidence that failure to exploit these windows of opportunity with appropriate training will result in inhibited development and ceiling limitations later on. A fundamental question is whether these critical periods are included to help develop elite performance beyond an athlete's natural genetic make-up, or merely achieve optimal elite performance faster. Similarly, will misuse of the critical periods bring an increased likelihood of fixed or, more disturbingly, detrimental athletic effects upon participation during adulthood?

Psychological Domain

Individuals are likely to encounter a range of long and short developmental stages and, perhaps more crucially and a greater challenge, transitions between these stages as they progress in their sport. Unfortunately, most existing models fail to acknowledge the non-linear and dynamic pathways that typify prolonged engagement in sport. Instead, they tend

to suggest participants may progress towards either elite sport participation or may, instead, choose to maintain involvement through the recreational years. Alongside the goal of lifelong participation, the design of any effective system must adequately allow for a continuum between these two goals, rather than treating them as separate targets. Such a consideration is missing from these twin-track stage models, since they account for neither the many non-linear pathways inherent in development nor the 'return routes' that are characteristics of the path to excellence.

Although these models describe development as a progression through different stages, they offer little insight into how individuals move through or between stages and different development pathways. While ability can be seen as the building block or defining feature of talent, the process of talent development occurs through a period of structured learning - a process rather than a single event. Therefore, identification of potential must address both the 'ability to get there' as well as the 'ability to be there'. Despite this clear and common characteristic, talent identification processes in sport have persisted with attempts to identify 'talented' athletes based on a limited range of discrete, outcome-based variables (eg performance at age 12) that are tacitly assumed to underpin and, even, inevitably lead to, senior success. For example, many traditional and popular talent identification models (eg Talent Search) use testing protocols that are based almost entirely on a snapshot of current performance (ie how well an athlete performs at **that** particular moment in time) as opposed to an individual's capacity to develop in the future.

In simple terms, effective talent development will recognise and cater for the varied pathways and different challenges individuals will face as they progress up the pathway. Crucially, many of these concerns will apply irrespective of the eventual goal, whether this is elite performance **or** lifelong physical activity participation. While reflecting upon certain psychological factors being characteristic of those achieving the greatest success in sport, it is important to consider the role psychological factors perform within participation development models. These 'psychological characteristics of developing excellence' (PCDEs) include mental skills, such as imagery or goal setting, as well as the attitudes, emotions and desires young athletes need to successfully realise their potential. For example, an individual must employ a variety of skills to optimise development opportunities (eg first-time appearances at a new level of competition, significant wins and losses, the 'challenge' of learning a new skill), adapt to setbacks (eg injury, slumps in performance, peer-group challenge) and effectively negotiate key transitions encountered along the way (eg selection, demands for increased practice, the push to conform to adolescent stereotypes). Without these important skills and the ability to negotiate developmental challenges, an individual may not maintain the motivation to achieve excellence at any level of participation, regardless of his or her 'talent'.

Therefore it is recommended that participant development models include PCDEs as a key part of their recommendations for practice. Since psychological characteristics appear to be a consistent predictor of performance, regardless of domain or level of achievement, a model promoting the development of a range of PCDEs enables individuals to make unrestricted participation choices across the lifespan.

Social Domain

A number of key social/environmental factors can affect participation, attrition and involvement in sport and physical activity during childhood and adolescence. While there is evidence of the importance of factors, such as the family, socioeconomic status, educational background, geographical location, gender, ethnicity, peers and identity, there is little consideration of any of these factors within existing participant development models. The most influential factor seems to be the family, and young people from a two-parent/carer family have far more opportunities and access to provision than those from a single-parent/carer family. This is often attributable to socioeconomic variables, as well as

practical issues, such as work, transport and the requirements of siblings. With approximately one quarter of young people in the UK living within single-parent families, it is clear that familial support systems and networks are fundamental considerations. Socioeconomic status is also important as, for example, the cost of kit, fees, transport to and from training and matches is vital for involvement in many sports and more crucial as the performer gets older and wishes to participate at a higher level. Clearly, those from two-income families have a financial advantage.

A participant's educational background (and opportunities afforded to participate in sport at and through school) is also important. Those attending fee-paying schools have an advantage of more physical education/sport time and, often, professional coaches over state-funded schools. So, time, opportunity and provision are important. Linked to this is the emerging recognition of geographical location and the 'opportunity' to participate. Research has highlighted that the size of the area in which you live has an effect on access, opportunity and provision. A medium-sized city can be far more facilitative of participation than a rural or urban area. The issues of gender, peer influence and ethnicity also cannot be forgotten, however, these tend to be secondary factors, closely linked to family, socioeconomics, education and geographical location.

There is a need for participant development models to acknowledge and understand the relevance of the social person as much as the body within the sporting experience as without such awareness, it will be impossible to produce a coherent and comprehensive strategy. Furthermore, social and environmental opportunities impact upon involvement at every stage and level of engagement, so, unlike the biological or psychological domains, the thesis underpinning this area comprises a range of social and environmental factors, such as family, socioeconomic status, geography and schooling, which significantly affect participation.

In short, any future participant development models must, not only acknowledge biological and psychological issues, but also reflect the social background of the participants. If future models fail to do so, they will be neither accurate nor effective.

Moving Forwards

The *UK Coaching Framework* aims to 'promote a holistic view of the child, athlete and player'. At its best, a participant development model must be holistic, addressing the complexity of interactions between different domains of functioning and offering clear practical guidelines and directions for further investigation and development, while also providing an empirical and theoretical justification for these statements. Unfortunately, the current state of research in this crucial area does not provide a sufficiently comprehensive understanding of the key interactions between domains, nor provide a sufficiently firm base for future progress and application.

There is little doubt that the recent emergence of participant models like LTAD and Côté's Developmental Model of Sport Participation (DMSP) has brought significant advances in the understanding of sports participation. The same could be said for the progression of the *UK Coaching Framework*. Each model has sought to move beyond the informal approaches that have characterised sports development in the past, and offers an excellent basis for debate and evolution. This Academic Review moves the debate further by gathering, analysing and summarising relevant scientific literature, together with summary recommendations.

Recommendations

- Participant development ought to remain a central feature of the coaching framework for the UK
- Interdisciplinary research should become the norm, rather than the exception, in sports coaching research
- Models, research and proposals should be continually and independently evaluated
- Participant development should be based upon the concept of the development of excellence in different contexts
- The relationship between performance and participation is synergistic
- There is a clear and present need for 'joined-up thinking'
- Policy and practice need immediate revision and future changes should be informed by a purpose-driven research agenda.

Section One: Introduction

This *Academic Review* is written in response to sports coach UK's stated intention for policy and programme development to be underpinned and scrutinised by ongoing robust research. Participant development is a central feature of any comprehensive coaching model and sports coach UK has explicitly identified it as such within *The UK Coaching Framework* (2008) and a host of related initiatives.

Aim and Structure of the Review

This *Academic Review* seeks to 'identify the main findings/principles associated with participant development, the methods used to generate this information, and the strengths and weaknesses of the supporting research'. It does this by focusing on the disciplinary sport-science literature related to participant development and its cognate areas, which we interpret as the biological, psychological and social domains. Since this is the first attempt to collate and analyse such information, there remain significant gaps. However, the review provides a basis for further detailed reviews and new primary research, and is an essential first step in building and evaluating the evidence base.

In light of the acknowledged contested nature of many of the concepts underlying participant development, initial sections are dedicated to articulating our understanding of the main models, their scope and the terms of the debates.

The Approach Adopted in this Review

The empirical basis for participant development is still forming and, to date, there has only been limited academic evaluation of the empirical and theoretical authority of existing and proposed models. The models identified within the Invitation to Tender have influenced the development of the existing UK Participant Development Model, while sharing certain features, and reflect potentially incompatible premises. In part, this may be because of their focus on different domains and the fact they are informed by different disciplinary expertise. However, there is little doubt that this is a nascent area of research.

Previous attempts to evaluate critically age- or context-specific frameworks have generally relied upon self-evidence to generate their criteria for assessment. For example, an otherwise valuable analysis of sport development models, commissioned in Australia, is undermined by the fact the authors give no indication of their sources or the rationale for the standards they employed to evaluate the models, as though these are simply obvious to all¹. The expertise of such reviewers aside, we would suggest that self-evidence is an inadequate basis for critical judgement. Instead, reviews that draw together empirical data as the bases of theory generation and testing² are needed.

Specifically, we suggest the way forward is to carry out reviews that identify the main findings of relevant research in cognate disciplines, and then use these to evaluate the different models of participant development. The diverse and, often, ill-defined nature of the literature relevant to discussions in this area means that systematic and comprehensive approaches to reviewing are inappropriate in this case. Instead, we have adopted what is sometimes called an 'expert review' stance, in which subject specialists draw upon their familiarity with alike fields to identify and analyse relevant empirical and theoretical work.

¹ Kirk, Brettschneider and Auld (2005).

² Layder (1998).

Biopsychosocial Model of Development

Sports participation, like any other aspect of human development, is influenced by a host of integrating factors. The selection and classification of these factors is, inherently, a matter of judgement, combined with the need to balance inclusivity with parsimony. With this in mind, we have decided to organise this review around three domains that seem to represent the core subject knowledge that underpins participant development in sport: physical; psychological; and social domains. Taken together, these domains reflect the biopsychosocial nature of development (see Figure 1.1, below).



Figure 1.1: Elements of the biopsychosocial model of development

The biopsychosocial model has become an increasingly popular way of characterising human development (Kiesler, 1999). This model posits a dynamic interaction between biological, psychological and social factors, all of which play a significant role in human functioning (Engel, 1977). Approaches that fail to acknowledge the multifaceted nature of development, perhaps by focusing too narrowly on physiological or psychological processes, are in danger of missing the complex, dynamic and non-linear nature of development (Abbott et al, 2005) and are, therefore, inherently inadequate.

To date, biopsychosocial approaches are relatively new to sport science (aside from a specific application in understanding sports injuries, Brewer, Andersen and Van Raalte, 2002 and drug use, Sharp and Collins, 1998). Smoll and Smith (1996), however, are well-known for their attempt to take the diversity of influences on sports participation seriously.

In some ways, this study can be understood as an attempt to extend the biopsychosocial form of analysis within the context of sport. We 'unpick' the central elements of development – biological, psychological and social – and use these domains as focal points for academic reviews of the relevant literature. We then go on to summarise the key findings from these reviews and posit recommendations for policy, practice and future research.

First, however, we will examine some of the models of participant development currently influencing UK sports coaching and development policies, and elucidate some of the distinctions and assumptions that often remain unstated.

Section Two: Underpinning Philosophy and Operational Definitions

Of the many challenges to clarity in the area of participant development, the plethora of terms and diversity of meaning, ascribed to the same concepts, are particularly irritating. Of course, the complexity of the topic means researchers will examine it from a variety of perspectives and some confusion is almost inevitable. Another confounding factor, one which is far less excusable, relates to the different objectives for the participant development process. The aims of any particular initiative are rarely stated explicitly so the conclusions offered cannot be contextualised and compared; for example, an implicit dichotomy is believed to exist between 'sport' and 'participation'. As we shall discover here and in subsequent sections, this dichotomy is neither genuine nor useful in terms of the broad agenda, and governmental support to participant development requires it to be so. Interventions may limit themselves as defensive mechanisms, but often, as a direct result, many miss the important value-added components, which can accrue from an integrated, people-focused approach.

Reasons for Involvement

Participant development in sport and physical activity is dynamic and non-linear and there are multiple pathways that individuals may take as they progress in their activity (Abbott et al, 2005). This non-linearity, coupled with the importance of 'key events and transitions' in the developmental pathway (Ollis, Collins and McPherson, 2006), makes it essential for support systems to offer flexibility, individual optimisation and 'return routes' as features of any formal 'pathway to excellence'.

Traditionally, excellence in sport has been conceptualised in terms of outcome measures in the form of medals, records and victories (Penney, 2000). More recently, however, and reflecting growing interest in lifelong participation in physical activity, there has been a call to expand this definition to include excellence, in terms of personal participation and improvement (Miller and Kerr, 2002). As such, excellence is differentially defined in this review as either:

- **Elite Referenced Excellence (ERE):** Excellence in the form of high-level sporting performance, where achievement is measured against others with the ultimate goal of winning at the highest level possible
- **Personal Referenced Excellence (PRE):** Excellence in the form of participation and personal performance, where achievement is more personally referenced by, say, completing a marathon or improving one's personal best.

The former definition is clearly concerned with performance excellence in high-level sport, such as national and international competition. Conversely, the latter definition advocates excellence as the achievement of developmentally appropriate challenges across the length of one's lifespan, as well as the *acquisition* of those personal qualities which contribute to lifelong health and well-being (Cimons, 1999). As such, accomplishments such as completing a marathon, knocking time off a personal best, participating in recreational activity or, even, digging the garden (enthusiastically) can be considered as the pursuit of 'excellence' when, from the performer's perspective, they are measured in terms of personal achievement (Weiss and Amorose, 1992).

To be truly adequate, however, one other category must be considered³; this third perspective is defined as follows:

- **Participation for Personal Wellbeing (PPW):** Taking part in physical activity to satisfy needs other than personal progression.

Typical motivations for PPW might include the improvement of one’s social life (eg making/keeping friends), the enhancement of one’s identity (eg being a member of a high-status group or club), personal renewal (eg through activity which is both enjoyable and spiritually fulfilling) and the maintenance of aspects of self-esteem (eg staying in shape).

It is important to recognise these objectives are not distinct, although the degree of overlap is differential across all three.

The Need for a Continuum between these Objectives

One key outcome of this review is its support for the contention that the three objectives described above are interrelated, at least in developmental terms. These ideas are critically considered in subsequent sections. For the moment, however, the need for enabling a ‘flow’ between the three should be apparent; for example, in meeting the aim of ‘lifelong physical activity’. This ‘Three Worlds’ Continuum is presented schematically in Figure 2.1⁴.

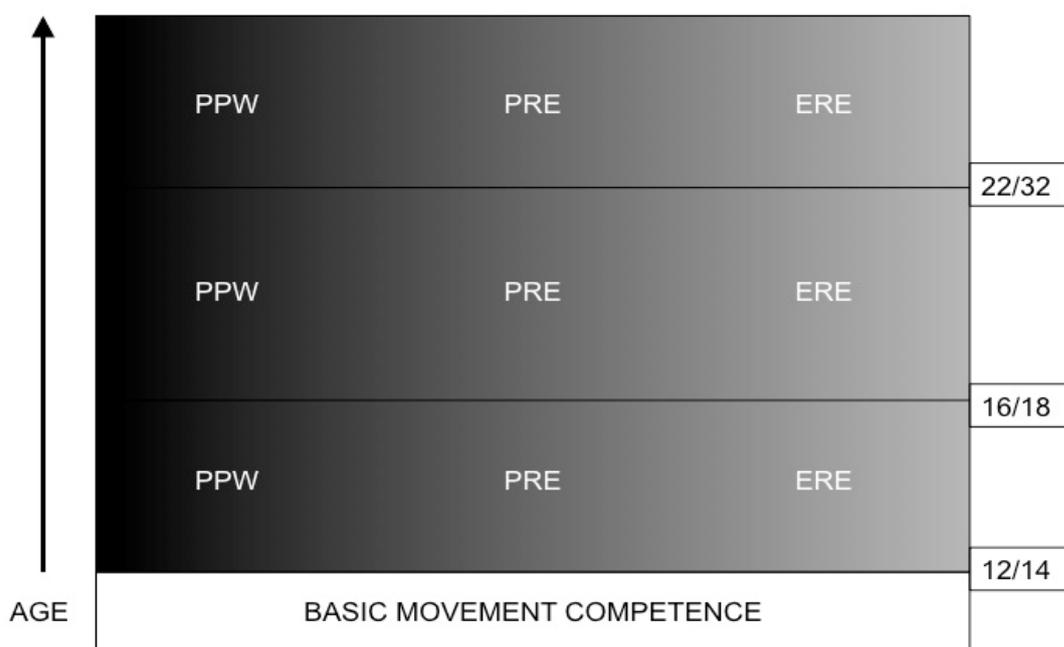


Figure 2.1: The ‘Three Worlds’ Continuum (developed from Jess and Collins, 2003)

³ One other reasonably orthogonal categorisation is apparent, namely personal development, in which involvement is focused on ‘character building’. Involvement in martial arts is often typified by this focus, whilst some outdoor adventure initiatives (Outward bound onwards) carry a similar aim. We do not consider this objective in this review, as it does not seem to fit with the brief offered.

⁴ Our use of the terms ‘worlds’ to describe our framework explicitly reflects Karl Popper’s cosmology in which three worlds are ontologically distinct, but necessarily and continually interacting (Popper, 1972).

empowered to progress back and forth between the three 'types' of activity. On this basis, young high-level performers can subsequently stay involved at a participation level whereas late developers or returners can try their luck in the ERE and PRE worlds at any age. These ideas are developed in Section Five, which focuses on the psychological domain. Age boundaries to the different stages are arbitrary; in fact, age transitions would be dependent on a combination of factors with high inter-individual variation.

As explained in the introduction to this section, both the categories and the continuum are based on historical and pragmatic imperatives. Major stakeholders are apparent for each of the categories (eg UK Sport/British Olympic Association for ERE; home country sports councils and governing bodies of sport for PRE; and health organisations/local health trusts for PPW). Of course, as with the categories themselves, overlap is always apparent, although rarely well coordinated. For the needs of national government, however, flow across the continuum is essential since each aspect is crucial at some point of an individual's lifespan. For example, in simple terms, the multiple medal success of a Sir Chris Hoy or Dame Kelly Holmes loses utilitarian value if they subsequently drop out; neither George Best nor Paul Gascoigne offer good role models in this regard. Thus, facilitation of effective movement back and forth across the continuum as individuals age, is essential for the realisation of government targets and underpins the legacy ideal espoused by organisers of the London 2012 Olympic Games and Paralympic Games.

Critical and Sensitive Periods

As another example of institutionalised obfuscation, we suggest the undefined and, often, interchangeable use of these two terms, most notably in physiologically oriented research. A more detailed consideration is covered in Section Four, which addresses the biological domain. For the purposes of this review, however, we propose the following distinctions, which will aid clarity throughout.

Critical Period

The use of this term suggests some unique, special and otherwise unobtainable advantage to the effective exploitation of the period so described. Thus, for example, the identification of a critical period for strength gains (ie between the ages of 10 and 12), would suggest such a focus is imperative and, if not realised in time, will never be fully achieved. There are obvious and strong implications attached to the use of this label, together with significant consequences for important constructs, such as specialisation. Unfortunately, however, there is a distinct lack of empirical support for such a pervasive and powerful construct.

Sensitive Period

By contrast, the use of this term suggests a 'softer' relationship. Thus, if the example period used in the previous definition is described as sensitive, extra gains may be expected for the same efforts in, rather than before or after, the age span identified. However, no statement implies whether equally profound gains may not be made by training volume (albeit perhaps larger) completed at another time.

The distinction between these two descriptions is highly significant for this review, hence the level of detailed consideration presented in Section Four. For the moment, however, consider one such implication as an example of how policies and procedures can flow from the use of different terms. If a period is described as *critical*, this dictates that the fullest possible exploitation is essential for the ERE agenda. As such, early selection into specific training is required. Of course, *sensitive* periods may be equally crucial for ERE, if, and only if, the sole goal is age-group success. Thus, early selection and effective training are central to developing the competitive edge for our youth/junior superstars. Yet, this importance

dissipates in circumstances where other imperatives (eg the need for a multi-sport, multi-skill base; avoiding age-related burnout) are shown to carry more weight in the design of an optimum developmental pathway. Interestingly, a longer, slower development pathway may even be the optimum system for developing eventual ERE at senior level. In short, all, bar one very restrictive goal, can be equally or better achieved by less dogmatic attention to these periods.

Critical Moments, Critical Episodes or 'Deliberate Experience'

Another key definition/set of definitions relates to the differential impact imposed by incidents with high personal significance. Typical experiences may be major wins or losses, selection/de-selection from a squad or embarrassing moments. Referred to by Côté and Hay (2002a) as critical incidents, these examples characterise the acute and clear situations which most would agree are impactful. However, two other aspects need to be embraced within this construct. Firstly, that these incidents can be chronic as well as acute; for example, the experience of poor coaching, long-term parental pressure or coping (successfully/unsuccessfully) with overly severe training loads. Based on this premise, 'critical episodes' may be a clearer and more accurate term. Secondly, the extent to which the individual's metacognitive skills (which might, simply, be called their attitude), lead them to interpret and exploit experiences as positive or negative. Ollis et al (2006) refer to this as 'deliberate experience'. The crucial implication arising from all these ideas is the role played by the individual's metacognitive skills. In short, thinking positively may be crucial for optimising development.

These metacognitive skills become all the more important when a lifelong perspective is taken. It is interesting to note how childhood experiences are powerful in determining later attitudes and behaviour. For example, physical education teachers are often cited in retrospective surveys as either the most or least influential/popular teachers. However, many physical education-haters are committed exercisers in adulthood (this would make an interesting study to confirm the importance of adolescent perceptions for adult behaviour decisions). As such, psychological constructs such as self-determination (see Section Five of this review) are important 'mediators' of critical moments, enabling the individual to make the most of episodes, positive or negative, and progress towards a well-motivated and internally rewarding adult exercise habit.

Capacities, Competencies and Characteristics

We are aware of an ongoing discussion, led by sports coach UK, about the most appropriate language to be used when addressing the elements constitutive of successful engagement and performance in sport. As with the other distinctions offered in this section, one should not become so preoccupied with words that one ignores the things to which they refer, but it is also important to recognise that some words are more valuable than others in communicating meaning, especially when such meaning is laden with often unfortunate connotations.

Consider Coaching Ireland's (2008) talk of the development of participants' technical, tactical, physical, mental, lifestyle and personal capacities. Capacity refers to 'the maximum amount that something can contain or produce' (www.askoxford.com) and, therefore, is inherently associated with notions of limitation and restriction. Turning to a diverse range of literature, it is possible to generate a list of other terms, aside from excellence, such as 'capabilities' (Sen, 1999); 'qualities' (Pirsig, 1974); or 'abilities, competencies and expertise' (Sternberg and Grigorenko, 2003). Unfortunately, even these are value-laden, suggesting positive connotations. As with any other descriptive terminology applied to humans, we suggest these are best described by use of the word 'characteristics'. Therefore, unless the dimension is objectively quantifiable, in which case the term 'capacity' is clearly warranted (eg aerobic capacity), we suggest the human attributes developed by, or acting as

precursors to, participation in physical activity are described as characteristics. After all, one person's commitment is another's obsession!

Section Three: Models of Participant Development

Participant development is a central feature of any comprehensive coaching model and sports coach UK has explicitly identified it as such within the *UK Coaching Framework*. Yet, the empirical basis for participant development is still forming. While sharing certain features, the models identified within the Invitation to Tender for this review, which have influenced the development of the existing UK Participant Development Model, also reflect different premises and disciplinary backgrounds. In part, this may be because of their focus on different aspects of participation. However, again, there is little doubt that this is a nascent area of research.

This section introduces the topic of participant development models, outlines some of the most influential models and explores some of the distinctions implicit within them. In subsequent sections, we focus on evidence drawn from cognate domains for participant development in sport.

Why Models?

Model building is an increasingly common approach in applied research and policy development. Models can help make sense of the varied factors that might impact on a particular phenomenon or situation, their possible interrelationships or causal sequence. The *UK Coaching Framework* is an example of a model, in that it seeks to provide a concise statement of the key factors judged to be especially significant in the evolving national approach to coaching and participation. Similarly, most national sports development and performance strategies are presented in the form of models, which set out what their architects consider to be the most salient features. These can then, in turn, be critically evaluated to investigate their coherence, their evidential basis, their internal consistency, or whatever happens to be of interest. For example, Kirk, Brettschneider and Auld (2005) undertook an international review of youth sport policies, in which they represented the national strategies of four countries (England, New Zealand, China and Germany), focusing, particularly, on the principles those authors believed to construct and constitute models of junior sport participation. However, an inherent weakness of their or, indeed, any similar principles-led approach, lies in the difficulty of demonstrating the validity of the principles against which existing models are tested.

Some writers have suggested it is useful to distinguish between the terms 'model' and 'theory' (Keeves, 1997). Scientists investigating a problem situation may generate a series of hypotheses that might develop from earlier studies, theoretical considerations or, simply, from hunches and intuitions. Time and testing may see these hypotheses develop or contribute to an emerging theory. In the meantime, it may be necessary to frame these hypotheses in a somewhat abstract way and offer a model that provides a coherent, comprehensive and parsimonious structure for the potential interrelations between these hypotheses. Also, as Kaplan (1964, p.285) pointed out, an effective model can be valuable in generating new and unexpected ideas for inquiry: 'The value of the model lies, in part, in its abstractness, so that it can be given many interpretations, which thereby reveal unexpected similarities. The value also lies in the deductive fertility of the model, so that unexpected consequences can be predicted and then tested by observation and experiment'.

It is not the case, though, that all models aspire to prescribe best practice. On the contrary, it is entirely reasonable for models to seek to capture certain features of a situation and the relationships between them, without going on to articulate supposed implications for practice. Perhaps the simplest typology of models in sports development would distinguish between *descriptive* and *prescriptive* accounts: the former attempt to provide an accurate description of an event and its variables; the latter focus on the values or principles that *ought to* characterise the event. Bailey and Morley (2006) are certain their model of talent development in school PE is a prescriptive account: 'Our model describes a framework for

investigating the actualisation of abilities related to physical education and it draws together a wide range of evidence, analogy and theory, framed within value judgements regarding the nature and purpose of physical education' (p. 212). In their review, cited above, Kirk, Brettschneider and Auld (2005) are also clear about where their interests lie: 'The model prescribes the process in terms of setting out clear guidelines for how junior sport participation should proceed' (p. 2).

A different approach is taken by Jean Côté and his collaborators, whose early work primarily presents depictions of the processes through which young people become socialised into sports participation (Beamer, Côté and Ericsson, 1999; Côté, 1999; Côté and Hay, 2002a). Of course, it is somewhat inevitable that these authors go on to offer implications for practice, but this could be criticised for stepping beyond the warrant of their retrospective research into prospective guidance. For example, Côté and Hay (2002a) conclude, in their account of the findings of investigations into the career development of elite Canadian and Australian rowers, gymnasts, basketball players, netball players and hockey players, that it is possible to identify 'implications for children's involvement in organized sport' (p. 498). However, they have broken the logical imperative that one should not infer an 'ought' from an 'is'; we should maintain a fact/value dichotomy (Putnam, 2002). Whether or not we accept this guidance in absolute terms or not, it does seem important to recognise the danger of leaping from empirical research and propositions of a 'would-be' factual nature (which are assessed in terms of their truth-likeness) to statements of value and policy (which are assessed in terms of whether or not they are 'right' or 'good').

On the face of it, we are presented with an apparently unbridgeable divide between evidence and guidance, and claims of fact and statements of values. Such a divide might, rightly, cause anguish to those aspiring to either evidence-based practice or value-led research, and this anguish may prove useful in curtailing the enthusiasm of the numerous writers on sports development or coaching, who casually skip from very specific or discrete findings to, apparently, global and far-reaching implications for policy. However, it can be possible and valid to eliminate, or at least blur, the dichotomy between research findings and policy guidance. One context in which this blurring seems most appropriate is the discussions of objectively desirable values. This is a highly contentious topic and the details are far beyond the remit of this report (for further discussion, see Bailey, Bloodworth and McNamee, 2007). It will suffice here to say that empirical research seems best placed to inform policy when it relates to the realisation of 'good' achievements. This is the approach adopted in this report, when we talk about the development of 'excellence' and 'excellences' in sport, based upon the terminology of Collins and his collaborators (eg Abbott and Collins, 2004; Abbott et al, 2005; MacNamara, Holmes and Collins, 2006).

The 'Traditional' Model of Participant Development

There is always a danger of using the concept of a 'traditional', 'standard' or 'conventional' model simply as a straw man to knock down, rather than a genuine stance. However, there do seem to be certain presumptions or working principles that have historically characterised discussions about sports development (Fisher and Borms, 1990; Kirk, Brettschneider and Auld, 2005) and these are often entrenched or accepted as self-evident. For the purposes of this report, these assumptions are interesting too because the published theoretical models that act as its foci were provoked, to some extent, by the perceived weaknesses of existing models. So, the intention here is, simply, to make clear some of the themes that have characterised the 'traditional' model.

Pyramid Thinking

Simply put, the pyramid model is as follows: a broad base of foundation skills participation, with increasingly higher levels of performance, engaged in by fewer and fewer people (see Figure 3.1, below)⁵. Kirk and Gorely (2000) state the “pyramid model of sport development is now well-entrenched and is known to many people...as the sport development continuum” (p. 121) and Fisher and Borms (1990) report “the pyramidal system of development [is] favoured by most countries” (p. 15). Houlihan (2000) has suggested that versions of the pyramid characterise many UK sports development policy statements, and Kirk, Brettschneider and Auld (2005) argue its influence can be seen in numerous international sports participation models and “the assumptions underpinning the pyramid model continue to have a powerful residual influence on thinking about junior sport participation and sport development in sport policy” (p. 2). Moreover, the language in a recent UK government-supported research report into elite dance development is interesting, in part, because of explicitness: ‘Constructing a Pyramid of Progression for Talent in Dance’ (Schmidt, 2006).



Figure 3.1: The pyramid model of sports development (adapted from Tinning, Kirk and Evans, 1993)

Despite its popularity among policy makers, there have been numerous criticisms levelled at the pyramid approach. One line of attack has been the moral one: built into the pyramid’s design is the systematic exclusion of players, no matter how good they are in absolute terms, as fewer and fewer players can play at each level. Another difficulty raised by critics is that the logic of the model means that the quality of performers at the higher levels is dependent on the experiences and resources offered to those at the lowest levels: a poor foundation undermines the whole system.

Bailey (2005a) has suggested three problems with pyramid thinking:

- **The problem of prediction**
Pyramid models presume successful progression from one level to the next is indicative of later or emergent ability, while, in most cases, this is not accurate. Abbott et al (2002)

⁵. Other popular metaphors that seem to presume the same basic process are ‘foundation stones’ and ‘trickle down’ (Kirk and Gorely, 2000).

present a wide range of evidence, effectively, undermining confidence in the notion of 'talent spotting', especially in during childhood.

- **The problem of participation**

Pyramid models presume that selection for progressively higher levels within the system are based on merit, while in practice, participation is mediated by a host of psychosocial and environmental factors, such as the ability to take part in the first place. This seems to be the case for all contexts of participant development: PRE; ERE; and PPW. Consider, for example, the role of the family in high-level sports performance (see Table 3.1). Alongside the family as a key variable on participation, we might also add factors like availability and quality of coaching and facilities, access to funding and choice of sport. Since young players can hardly be held responsible for the quality of their families, schools, cities and so on, it seems fair to say that, to some extent, their sporting achievement (or simply engagement) is mediated by 'blind luck' (Bailey, 2007), irrespective of their ability in a sport.

Table 3.1: Some family-based variables associated with participation in sporting and other domains at high levels (adapted from Bailey and Morley, 2006)

Variable	Source
Parents achieved high standards in domain	Rotella and Bunker, 1987; Radford, 1990; Feldman and Goldsmith, 1986
Relatively high socioeconomic status	Rowley and Baxter-Jones, 1992; English Sports Council, 1997; Duncan, 1997
Ability and willingness to financially support participation and specialist support	Rowley and Baxter-Jones, 1992; Kirk et al, 1997a; Kay, 2000a
Ability and willingness to invest high amounts of time to support the child's engagement in the activity	Lin-Yang et al, 1996; Kirk et al, 1997b; Kay, 2000a; Holt and Morley, 2004
Parents as car owners	Rowley and Baxter-Jones, 1992
Relatively small family size	English Sports Council, 1997
Two-parent/carer family	Rowley and Baxter-Jones, 1992; Kay, 2000a
Attendance at independent school	Rowley and Baxter-Jones, 1992

It is worth noting that many of the variables associated with participant development, in all its forms (which directly affect an individual's ability to play sport), have been identified for many years. It seems reasonable to suggest, on the whole, in the UK they have not been significantly addressed by subsequent policy initiatives and substantial financial investment (cf Bailey, 2005b; Bailey, et al, 2004; Collins, 2004; Collins and Buller, 2003; Rowley and Graham, 1999).

- **The problem of potential**

These models take it for granted that current performance in a domain represents a player's ability, while there are numerous reasons to doubt this is, in fact, the case. Some have highlighted the subjective nature of talent assessment procedures (Burwitz et al, 1994), whereby players find themselves removed from a system for rather

arbitrary reasons. A striking example of such arbitrariness is the effect of relative age on performance (Musch and Grondin, 2001). Numerous studies have shown that players born early within a selection year have a considerable advantage over those born later. This seems, in part, because of the relative physical size and strength and further matured coordination of players who can be up to one year older than their peers (Helsen et al, 2000). Those with the benefit of extra months of development are more likely to be identified as talented and progress to the next level of the pyramid, where they would be expected to receive better coaching, play with a higher standard of teammates and opposition, compete, and train more frequently (Gladwell, 2008).

These problems with pyramid thinking might explain two perplexing findings, which seem to raise doubts about its efficacy: the majority of young people identified as talented do not go on to elite, or even sub-elite, careers (Abbott et al, 2002); and, conversely, many adult elite performers were not identified through the standard talent pathways, nor were they precociously gifted as young children (Bloom 1985).

Participant Development as Talent Development

Closely related to the pyramidal model, is the equation of participant development with talent development. Indeed, it is noteworthy how little attention has been paid in the past to approaches to sports development that do not focus on ERE. Balyi's LTAD model certainly does not follow the consensus in representing development in pyramidal form. However, its focus, at least during its earlier formulations (Balyi, 2002; Balyi and Way, 1995) on a progression towards performance and winning, implies its primary concern is elite performance, rather than sports participation, *per se*.

Following Siedentop (2002a), we might conceptualise sports participation in terms of three primary goals: the public health goal; the educative goal; and the elite-development goal. Focusing on youth sport, Siedentop argued there was an inevitable tension between these goals: 'One can legitimately question the degree to which elite-development goals of a junior sport system can be served as part of a comprehensive system and still direct sufficient resources to achieve the educative and public health goals that are more fundamental to the system as a whole' (p.396).

In this report we suggest this need not be the case. Specifically, we advocate an approach to understanding development that enables a flow between different, but interrelated, motives for involvement. Our framework of objectives of participant development was devised without awareness of Siedentop's framework, but the parallels seem clear (see Table 3.2, below).

Table 3.2: Siedentop's primary goals of sport

Siedentop's Goals of Youth Sport		Possible parallel with the model suggested in this report
Elite performance goal	'to allow the most talented and interested young athletes to pursue excellence' (p. 395).	Elite-referenced excellence (ERE)
Educative goal	'supported primarily for the educational and developmental benefits...If the educative goal was to dominate...it would be as inclusive as possible...' (p. 394)	Participation-referenced excellence (PRE)

Public health goal	'to contribute to the public health of a nation...it would emphasise playful activity above all and would specifically target for inclusion those...who are most at risk.' (pp. 394–95)	Participation for personal wellbeing (PPW)
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So, there is a certain similarity between the two approaches, which may be because both models have a strong degree of face validity and broadly reflect the types of interests people have when they enter a pathway in sport. However, it is worthwhile making a few points at this stage to help articulate our own position:

- It is entirely possible, even likely, that individuals will be attracted to different objectives at different points of their engagement with sport; they may also have different objectives in mind at the same time, when playing different sports (a player may be a competitive golfer and recreational swimmer, while learning t'ai chi)
- The objectives are not mutually exclusive. Achievement in one area can be accompanied by achievement in the others; although, as Siedentop (2002a) makes clear, in policy terms, one tends to dominate
- Finally, and most importantly, we do not accept Siedentop's equation of elite performance with the pursuit of excellence; it is perfectly possible for a player to engage in sport with seriousness and a striving for personal excellence for the whole of his or her life without ever seeking elite representation.

Unitary Development

Traditionally, researchers and policy makers have tended to conceptualise the development of ability as unitary, genetically inherited and measurable (Abbott and Collins, 2004; Bailey and Morley, 2006). This is in contradiction of contemporary theorists who almost universally favour multidimensional models of high development (Simonton, 1999; Ziegler and Heller, 2000), cognisant of a wide range of factors. Domain-specific theories of education make distinctions between different, relatively independent forms of ability, which frequently relate to specific areas of achievement (see Table 3.3, below)⁶.

Table 3.3: Multidimensional models of ability

Areas of Achievement or Ability (Marland, 1972)	Multiple Intelligences (Gardner, 1983)	Munich Model of Giftedness and Talent (Perleth and Heller, 1994)	Differentiated Model of Giftedness and Talent (Gagné, 2000)
General intellectual ability	Linguistic intelligence	Intellectual abilities	Intellectual
Specific academic ability	Logico-mathematical intelligence	Creative abilities	Creative
Creative or productive thinking	Spatial intelligence	Social competence	Socio-affective
Leadership ability	Bodily kinesthetic intelligence	Practical intelligence	Sensorimotor
Visual and performing arts	Musical intelligence	Artistic abilities	

⁶ To which we would suggesting add meta-cognitive abilities (cf Toward, 1996).

Psychomotor ability	Intrapersonal intelligence	Musicality	
	Interpersonal intelligence	Psychomotor skills	
	Naturalistic intelligence		

There is wide-scale acceptance among researchers that performance in all forms of sport is multifactorial, requiring the performer to develop a range of skills and abilities (such as physiological, biomechanical, psychological and physical). Simonton (1999) proposes that multiple components contribute to the development of ability within any area and these components interact in a multiplicative, rather than an additive way. He offers four implications of this multiplicative model (cited and interpreted in Abbott and Collins, 2004):

- The area in which an individual displays ability will not be determined by any highly specialised component, but rather by the “specific weighted multiplicative integration of the contributing innate components” (Simonton, 1999; p. 438)
- Individuals talented in an area will all have some value of each necessary component, but individual values within any area will vary (unidimensional models are unable to account for such diversity)
- Many young people will not have exceptional talent in an area because of the absence of one of the components, even if they excel in another component (unidimensional models are not capable of making this distinction)
- The number of innate components necessary for performance will vary from area to area and some will be extremely complex (contrast, for example, open and closed sport skills).

Potential and Performance

One of the most common versions of the unitary conception of development in sport occurs when the assessment of ability in an area is reduced to levels of current performance. Abbott et al (2002, p. 26) argue ‘there is a need to distinguish between determinants of performance and determinants of potential/skill acquisition’. It seems more plausible that individual development is the result of an interaction between inherited abilities, social and cultural learning (Scarr and McCartney, 1983; Oyama, 2000), and it is this interaction of processes that undermines simplistic correlations of ability and performance. Current performance can be a poor indicator of ability, since it is mediated through a host of other influences, such as training, support, parental investment and societal values (Bailey and Morley, 2006; Holt and Morley, 2004).

Development as a Continuum

Traditional models (such as the pyramid) present sports development as a relatively linear progression along a continuum, from childhood to retirement. Many theorists suggest that developmental pathways in sport are non-linear and that players pass through discrete, but idiosyncratic stages as they develop from novice to expert (Abbott et al, 2004; Côté and Hay, 2002a; Vaeyens et al, 2008).

The influence of Bloom’s (1985) studies of expert sportspeople, musicians and academics can be seen today in the increasing frequency of stage-based models of development (most clearly in Côté’s [2002] framework, which is discussed below, but also in the work of Balyi, 1999). Bloom was led to distinguish three stages in the careers of 120 talented individuals:

- the 'early years' (the first stage, or 'Initiation'), when the individual is drawn into the area
- the 'middle years' (the second stage, or 'Development'), when the individual becomes committed to the area
- the 'later years' (the third stage, or 'Mastery'), when the individual makes the domain the centre of his other life.

The hypothesised existence of stages of development suggests individuals need to learn to deal with the distinctive challenges inherent within each stage. It also means that they need to be able to make and deal with the changes required to successfully transfer between stages, which can be significant events in their lives (Pickard and Bailey, in press). Therefore, alongside the evident challenges of participating in a sport, the player also needs to negotiate the transitions encountered during his or her sporting career, and every participant follows unique pathways (Tebbenham, 1998).

A degree of corroboration for Bloom's staged approach has come from some North American studies (eg Scanlan, Stein and Ravizza, 1989). However, its applicability in other contexts (such as the UK) has been questioned (Moore et al, 1998; Toms and Bridge, 2008). Further research in this area is clearly required, but it ought to be noted that significant variation in participation experiences tends to undermine narrow biological or psychological deterministic explanations of development. Some writers, like Abbott et al (2005), have also argued these difficulties are made more problematic by the non-linear nature of participant development.

Formal Models of Participant Development

The discussion now turns to four models⁷ that have been particularly influential in recent discussions of sports participation and development in the UK:

- Istvan Balyi's Long-Term Athlete Development
- Jean Côté's Developmental Model of Sport Participation
- Abbott et al's Psychological Characteristics of Developing Excellence
- Bailey and Morley's Model of Talent Development in Physical Education.

The aim at this stage is simply to present an outline of each model and its background. In subsequent sections, we will examine the theoretical and empirical foundations of these and other models. However, before we complete this section, we offer one further approach to participant development model-making that seems to take a different course and, as such, is offered by way of comparison and contrast.

Balyi's Long-Term Athlete Development (LTAD)

LTAD, associated with the ideas and theories of Istvan Balyi, has probably been the most influential model of participant development in the UK in recent years. All of the main governing bodies for sport have been asked to adopt and adapt a version of LTAD and promote it among their members. Stafford (2005) acknowledges the model's primary aim to produce greater numbers of performers who are capable of achieving at the highest level, but also claims it provides a platform for coaches and participants at every level 'to fulfil their potential and remain involved in sport' (p. 1).

⁷ These are also the models highlighted in the sports coach UK Invitation to Tender.

Balyi (2001b), like almost everyone who writes about developing excellence, quotes Herbert Simon: 'It takes ten years of extensive training to excel in anything', as a way of introducing and justifying his model. Long-term development, he argues, is the basis for realising and optimising potential. This development is conceptualised in terms of a series of stages through which players pass and the precise timing and nature of these stages is determined by the type of sport in question. Balyi distinguishes between 'early' and 'late'-specialisation sports. Early-specialisation sports refer to those sports that conventionally require their players to begin to specialise and seriously train from a relatively early age, such as gymnastics, diving, figure skating and table tennis. Late-specialisation sports include practically all other sports and Balyi's model prescribes a more generalised approach, with an emphasis in the early stages on fundamental movement skills. Table 3.4 outlines LTAD's stages and progressions for early- and late-specialisation sports.

Table 3.4: LTAD stages (Stafford, 2005)

Early Specialisation	Late Specialisation
FUNDamental	FUNDamental
Training to Train	Learning to Train
Training to Compete	Training to Train
Training to Win	Training to Compete
Retaining	Training to Win
	Retaining

Translating these stages into practice, players are presented with a series of progressively more challenging experiences as they get older (what follows is based on late-specialisation sports, and is based on information in Stafford, 2005).

Phase one – FUNDamentals

This phase is appropriate for boys aged 6–9 and girls aged 5–8. The main objective should be the overall development of the athlete's physical capacities and fundamental movement skills. The key points of this phase are:

- Participation in as many sports as possible
- Speed, power and endurance are developed using FUN games
- Appropriate and correct running, jumping and throwing techniques are taught using agility, balance, coordination and speed (the ABCs of athletics)
- Introduction to the simple rules and ethics of sports
- Strength training with exercises that use the child's own body weight, plus medicine ball and Swiss ball exercises.

Phase two – Learning to train

This phase is appropriate for boys aged 9–12 and girls aged 8–11. The main objective should be to learn all fundamental sports skills. The key points of this phase are:

- Further develop fundamental movement skills, strength and endurance
- Learn general sports skills
- Introduce basic flexibility exercises
- Continue to develop speed with specific activities during the warm-up, such as agility, quickness and change of direction
- Develop knowledge of warm-up, cool-down, stretching, hydration, nutrition, recovery, relaxation and focus
- Competition is structured and a ratio of 70:30 training/practice to competition is recommended.

Phase three – Training to train

This phase is appropriate for boys aged 12–16 and girls aged 11–15. The main objective should be the overall development of the athlete's physical capacities, with a focus on aerobic conditioning and fundamental movement skills. The key points of this phase are:

- Further develop speed and sport-specific skills
- Develop the aerobic base
- Learn correct weightlifting techniques
- Develop knowledge of: how and when to stretch; how to optimise nutrition and hydration; mental preparation; how and when to taper and peak
- Establish pre-competition, competition and post-competition routines
- A 60% training to 40% competition ratio (including competition and competition-specific training) is recommended.

Phase four – Training to compete

This phase is appropriate for boys aged 16–18 and girls aged 15–17. The main objective should be to optimise fitness preparation, sport/event-specific skills and performance. The key points of this phase are:

- Fifty per cent of available time is devoted to the development of technical and tactical skills, and fitness improvements
- Fifty per cent of available time is devoted to competition and competition-specific training
- Learn to perform these sport-specific skills under a variety of competitive conditions during training
- Special emphasis is placed on optimum preparation by modelling training and competition
- Fitness and recovery programmes, psychological preparation and technical development are now individually tailored to the athlete's needs.

Phase five – Training to win

This phase is appropriate for boys aged 18+ and girls aged 17+. The main objective should be to maximise fitness preparation and sport/event-specific skills, as well as performance. The key points of this phase are:

- Athletes train to peak at major competitions
- Training is characterised by high intensity and relatively high volume, with appropriate breaks to prevent overtraining
- Training to competition ratio in this phase is 25:75, with the competition percentage including competition-specific training activities.

Phase six – Retirement and retainment

The main objective should be to retain athletes for coaching, officiating, sport administration and so on.

Balyi's work has been primarily addressed to coaches and coach educators and not published in mainstream academic, peer-reviewed journals. In itself, this does not raise doubts about the veracity of his claims, nor their relevance to practical coaching. But it does mean that LTAD has not undergone the usual quality-assurance procedures associated with scholarly work. Moreover, many of the sources he quotes as offering support for LTAD's central claims are either difficult to access or read, as many originate from the former Soviet Union.

The types of sources Balyi cites suggest LTAD has its origins in the biological or physiological tradition. Overall, LTAD can reasonably be described as a physiologically orientated development model, as is evidenced by Figure 3.2, from Stafford (2005), which outlines relevant factors related to adaptation to training and optimal training.

While the figure refers to mental-cognitive and emotional development, all of the structural and constraining variables come from biology theories, such as peak height velocity, critical periods of accelerated adaptation and growth spurts. LTAD can be interpreted as Balyi's interpretation of biological ideas like this and the result is a framework of guidance that integrates ages, stages and training principles (Table 3.5).

Table 3.5: LTAD ages, stages and training principles (From Stafford, 2005)

Stage	Approximate Age Range (Years)	Key Points
FUNdamental	6–8 (girls)/6–9 (boys)	<ul style="list-style-type: none"> • Need to sample a wide range of movement activities in fun, playful and creative environments • No sport-specific specialisation – a multi-skills approach to be adopted • Emphasis on development of basic movement skills, not formal competitive events • Parents involved and supportive, encouraging participation in as many different activities as possible • Speed, power and endurance developed using fun games and challenges • Opportunity for optimum development of speed • No periodisation and lots of FUN!
Learning to train	8–11 (girls)/9–12 (boys)	<ul style="list-style-type: none"> • Begin to introduce basic skills and fitness to preferred activities • Start to reduce number of sports/activities but recommend at least three • Focus on mastery of basic sport skills through regular practice in fun-based environments, using discovery learning • Emphasis on learning to train and practice, not on performance outcome, but element of appropriate competition introduced (eg 25% of training programme).
Training to train	11–15 (girls)/12–16 (boys)	<ul style="list-style-type: none"> • Individualised programmes based on individual development • Progressive development of technical, tactical and mental capacities • Squads split into groups of early, average and late maturers for physical conditioning and fitness work • Girls and boys may or may not train together depending on nature of activity • Regular height checks to identify key periods for appropriate training and optimum benefit • Regular, but appropriate and sensitive, medical monitoring and musculo-skeletal screening (care must be taken here as bodies are changing and young people may be very sensitive) • Excessive, repetitive weight-bearing aerobic activities should be avoided.

Training to compete	15–17 (girls)/16–18 (boys)	<ul style="list-style-type: none"> • Focus on diagnosing individual strengths and weaknesses for selected event/position and devising programme accordingly • All-year-round training that is high in intensity and specificity • Structure of training activities should simulate realistic variety of competitive event conditions • Key support structures, such as those relating to fitness, psychology and nutrition, are individualised and integrated • Performers strive to win at carefully selected competitive events, but emphasis on learning from those experiences, rather than on winning.
Training to win	17+ (females)/18+ (males)	<ul style="list-style-type: none"> • Assumes all relevant capacities have been developed • Focus of training on optimising performance or peaking at specially selected competitive events • Importance of planned rest breaks to avoid burnout and injury • General training decreased but significant increase in sport-specific training loads • Multi-periodisation approach developed.
Retaining	Varies depending on the individual and the sport	<ul style="list-style-type: none"> • Performers take up alternative activities after withdrawing from competitive sport (eg coaching, administration, mentoring, other sports/hobbies, competition at masters level) • Performers should consider <i>training down</i> if used to competing at a high level.

Côté's Developmental Model of Sport Participation (DMSP)

If Balyi's LTAD model can be described as a biologically or physiologically orientated framework, then Jean Côté's DMSP model is a predominantly psychological one. Côté and colleagues (Beamer, Côté and Ericsson, 1999; Côté, 1999; Côté and Fraser-Thomas, 2007) extended Bloom's earlier work with talented individuals through qualitative interviews with elite Canadian and Australian gymnasts, rowers, and players of basketball, netball, hockey and tennis. Similar to Bloom, Côté identified three stages of development:

- **The sampling phase (6–12 years):** When children are given the opportunity to sample a range of sports, develop a foundation of fundamental movement skills and experience sport as a source of fun and excitement.
- **The specialising phase (13–15 years):** When the child begins to focus on a smaller number of sports and, while fun and enjoyment are still vital, sport-specific and emerge as an important characteristic of sport engagement.
- **The investment phase (16+ years):** When the child becomes committed to achieving a high level of performance in a specific sport and the strategic, competitive and skill development elements of sport emerges as the most important.

Progression from the sampling phase can take one of three forms. Children can become involved more seriously in one or two sports in the specialising phase; they can choose to stay involved in sport as a recreational activity; or they can drop out of sport. Likewise, at the specialising phase, players have three options available to them when they aspire to a high level of performance in one sport: recreation; drop out; or progress to the investment phase. Those players who have reached the investment years can subsequently progress to ever higher levels of performance, move to recreational sport, or simply drop out.

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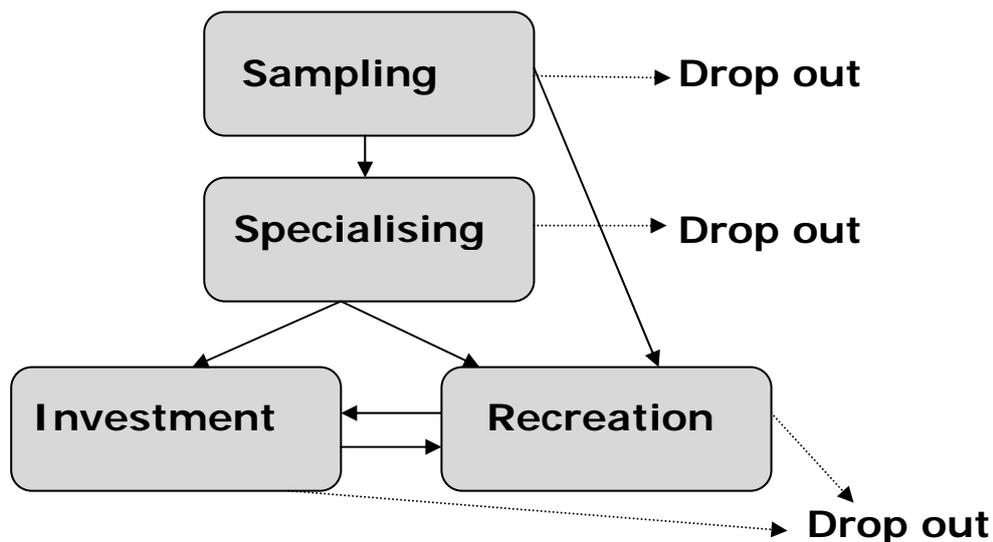


Figure 3.3: Côté’s Developmental Model of Sport Participation

The DMSP contains another important distinction, between ‘deliberate play’ and ‘deliberate practice’. Ericsson, Krampe and Tesch-Römer (1993) concluded their comprehensive review of the literature into skill acquisition and expert performance with the finding that the most effective learning occurs through participation, in what they called ‘deliberate practice’. This form of practice requires effort, is not inherently enjoyable and is specifically designed to improve performance. Ericsson and his colleagues demonstrated expert performance was the result of extensive deliberate practice (for at least 10 years). Subsequently, sports researchers have corroborated aspects of Ericsson’s conclusions (Deakin and Cobley, 2003; Helsen, Starkes and Hodges, 1998; Hodges and Starkes, 1996). Côté (1999) introduced the term ‘deliberate play’ to describe a form of sporting activity that involves early developmental physical activities that are intrinsically motivating, provide immediate gratification and are specifically designed to maximise enjoyment. Deliberate play usually involves a modified version of standard rules, requires minimal equipment, flexible contexts and challenges, and allows children the freedom to experiment with different movements and tactics.

Table 3.6 summarises the differences between deliberate play and deliberate practice in terms of disposition, context and behaviours for engagement in sport.

Table 3.6: Differences between deliberate play and deliberate practice (Côté, Baker and Abernathy, 2007)

Deliberate Play	Deliberate Practice
Done for its own sake	Done to achieve a future goal
Enjoyable	Not the most enjoyable
Pretend quality	Carried out seriously
Interest on the behaviour	Interest in outcome of the behaviour
Flexibility	Explicit rules
Adult involvement not required	Adult involvement often required
Occurs in various settings	Occurs in specialised facilities

Figure 3.4 (below) represents the relationship between deliberate practice and deliberate play at different stages of participant development.

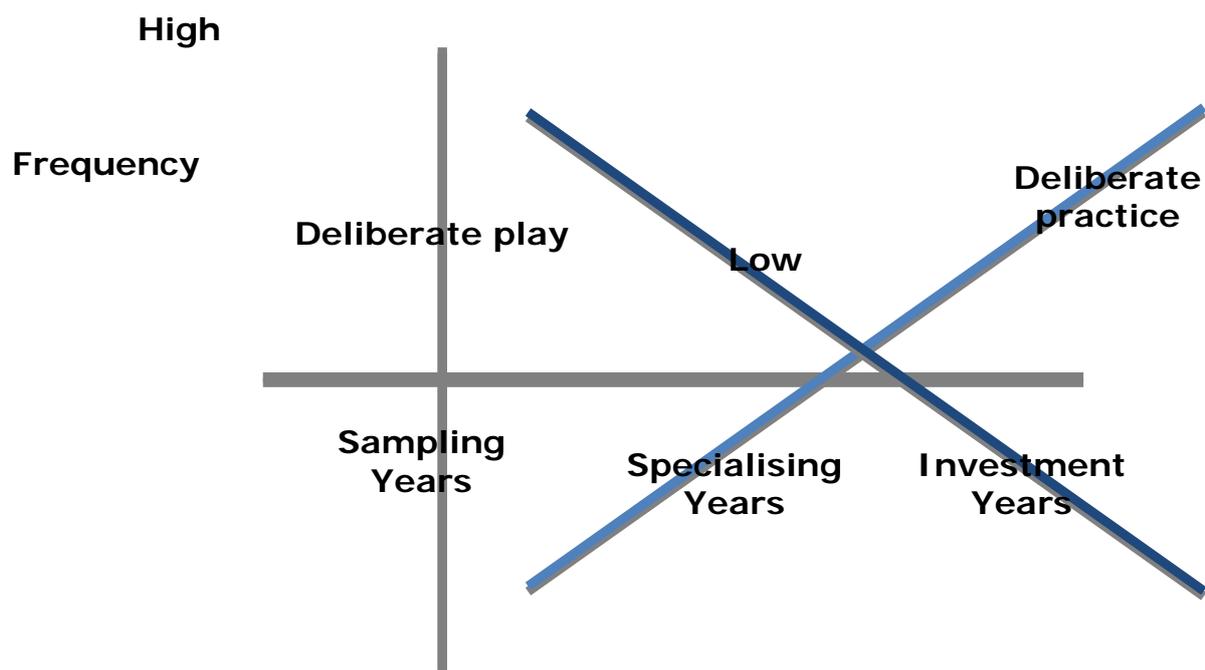


Figure 3.4: The relationship between deliberate play and deliberate practice and Côté's levels of sport participation

Abbott et al's Psychological Characteristics of Developing Excellence (PCDE)

Based on the descriptions offered earlier, the work of Angela Abbott (now Button) and colleagues (Abbott and Collins, 2002; 2004; Abbott et al, 2005; Abbott et al, 2007) should be described as a prescriptive model. This work does not offer a comprehensive description of all facets of participant development, as a model should arguably aspire to. What it does offer, however, is a well-evidenced case for the pivotal role of psychology in the development process (Abbott and Collins, 2004). This approach questions the pre-eminence of anthropometric or performance/physiological measures as 'snapshot' identification tools, stressing both the complex, non-linear pathways to elite success, while also trying to tease out (prescribe) characteristics that both predict and facilitate the pathway to elite success. These characteristics, which they term the Psychological Characteristics of Developing Excellence (PCDEs), show a considerable overlap with those factors shown to be associated with/causative of achievement across a wide range of domains (these ideas are covered in more detail in Section Five). They also offer an operationalisation of the principles espoused by Dweck (2006).

Another crucial element of Abbott et al's work is its emphasis on the successful negotiation of transitions between stages as the major factor in progression along the performance pathway, as opposed to the focus on stages that characterise many of the other models. The extent to which these transitions and, hence, the deployment of skills, are idiosyncratic is unclear with trends apparently based on societal, domain, background and age factors.

For a variety of reasons, the early work of this group focused on talent development towards eventual performance in senior sport. Lately, however, these ideas have been broadened to encompass dance and music; the latter domain offering a particularly valuable 'laboratory' owing to the 'from the outset' importance of PCDEs in both formal (eg MacNamara, Holmes and Collins, 2008) and informal settings (eg Kamin, Richards and Collins, 2007).

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More crucial for this review was the applied intervention built on the principles of PCDEs and the promotion of real and perceived motor ability (once again, this receives a more comprehensive coverage in Section Five). Based on a taught intervention with primary-school-age children, the 'Developing the Potential of Young People through Sport' project (Abbott et al, 2007) demonstrated statistically significant changes in attitude towards and actual participation rates in a broad range of physical activities. Abbott and colleagues saw changes in key psychological constructs, such as perceived ability and self-determination (cf Chatzisarantis and Hagger, 2009) as the mechanisms through which the combined impact affected behaviour.

In summary, the PCDE concept could be better described as a philosophy or approach rather than a model *per se*. Implicit within the development and application of the approach is a coherence of multi-agency action that, it is suggested, must characterise any effective participant development work in the future. Furthermore, the approach 'enshrines' the necessary skills by incorporation into compulsory education processes at secondary and tertiary level. While at an early stage of development, the fact this approach is both theoretically grounded **and** empirically evaluated must count in its favour.

Bailey and Morley's Model of Talent Development

The fourth formal model of participant development was derived from substantial empirical research into the processes of talent development in school physical education (eg Bailey, Tan and Morley, 2004; Bailey, Dismore and Morley, 2009; Morley, Bailey and Coble, 2006; Morley, 2008). Bailey, Morley and colleagues sought to understand the perceptions of teachers, students and policymakers, and the strategies they used to identify and provide for the most able young people. Based on the findings from these studies, they progressed to develop guidance (eg Bailey, 2005; Bailey and Morley, 2005; Morley and Bailey, 2006). So, rather like Côté, this group began with a descriptive presentation of processes and strategies and then moved to a prescriptive account of effective practice.

The model highlights a set of main hypotheses, which, it is maintained, are crucial for an adequate understanding of talent development. The first hypothesis is a differentiation between potential and performance. Following Abbott et al (2002), it is argued that the common reduction of talent identification procedures to levels of current performance is flawed. Since individual development is the result of an interaction between inherited abilities and social and cultural learning (Oyama, 2000), it is an error to assume correlations of ability and performance. Therefore, from the point of view of talent development, current performance is a poor indicator of ability, since it is mediated through a host of other influences, such as training, support, parental investment and societal values.

The second hypothesis is that development is multidimensional. Following some educational theorists, Bailey and Morley distinguish between the expression of abilities and the progressive emergence of these abilities into certain formalised outcomes (eg Perleth and Heller, 1994). These abilities are developed within certain domains that are (sometimes) refined, combined and elaborated into particular behaviours, such as sporting success. These abilities are:

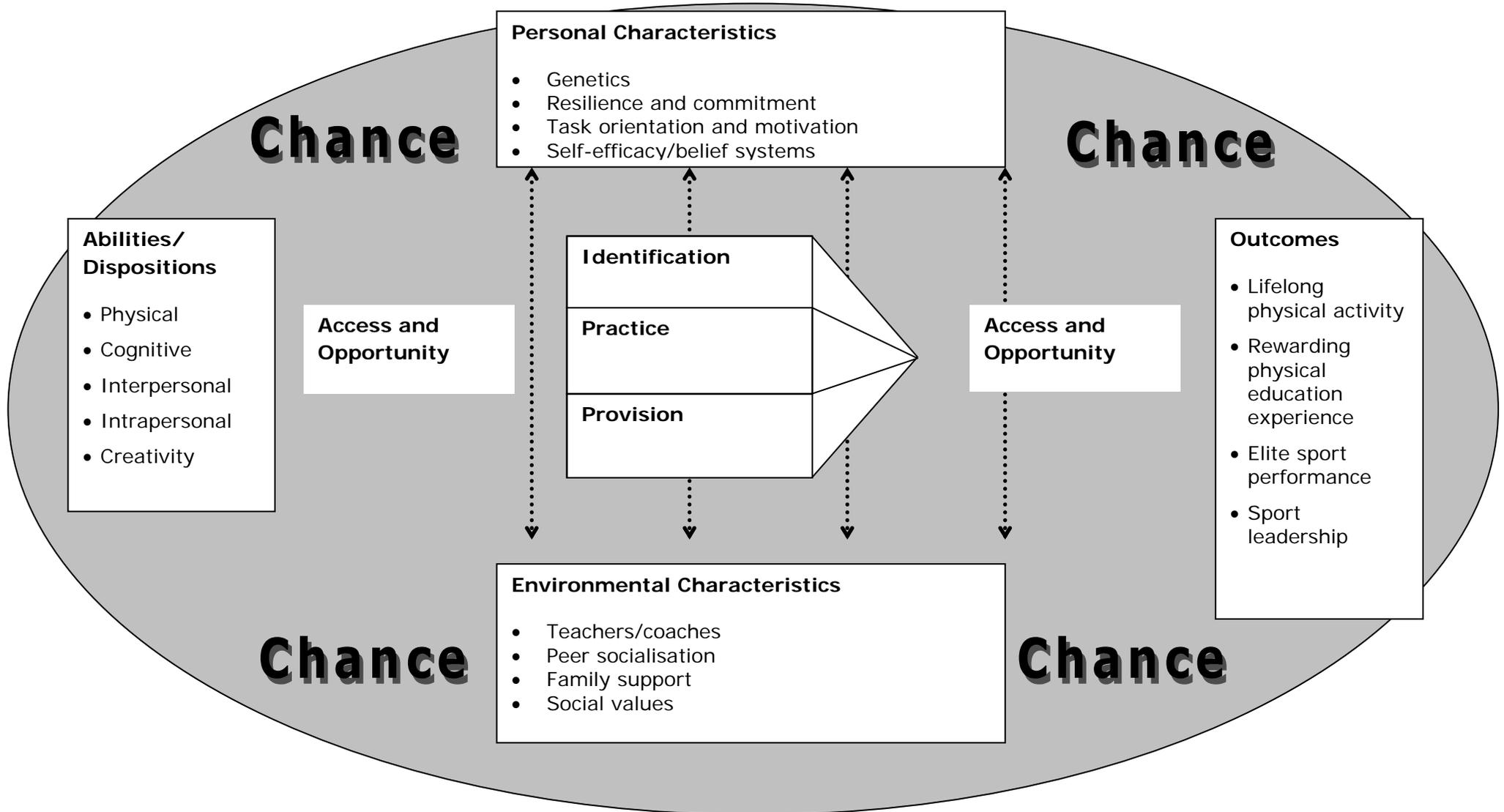
- physical ability (revealed through movement and the physical performance of skills)
- interpersonal ability (exhibited in social contexts and is the basis of leadership, teamwork and similar concepts)
- intrapersonal ability (underpins an individual's capacity for self-control, self-efficacy and emotional intelligence)
- cognitive ability (shown in tactical settings, as well as knowledge and understanding of central physical educational concepts)
- creative ability (evidenced when learners respond to challenges and tasks with fluency, originality and sensitivity to problems).

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Underlying this multidimensional framework is a claim that success in physical education (and sport, in general) needs to be understood in terms of the emergence of a wide range of abilities rather than simply physical prowess, which has tended to dominate talent development practices.

The third major hypothesis is that practice is of vital importance in the realisation of talent. In this respect, Bailey and Morley were explicit in their acknowledgement of earlier models (especially those of Abbott et al and Côté) and empirical research. Work by Ericsson and others (cf. Ericsson et al, 1993; Howe, 2001; Baker et al, 2003; Starkes and Ericsson, 2003) has highlighted the role of practice in high-level performance. Of course, not all practices are equally valuable and mere quantity of practice is unlikely to result in expert performance; quality of practice is also required. Thus, Ericsson came to talk of 'deliberative practice' (Ericsson, 2003) to refer to structured, goal-orientated activities that require effort and are not always inherently enjoyable, with an average of 10 years elapsing between first and best work. Bailey and Morley acknowledge the fact studies of this sort demonstrate correlation, not causal relations. However, it does seem reasonable to conclude that deliberate practice is a necessary (if not sufficient) condition of the realisation of talent.

Figure 3.5: Bailey and Morley's Model of Talent Development in physical education



Key Elements of the Models

	Balyi's LTAD	Côté's DMSP	Abbott et al's PCDE	Bailey and Morley's Model of Talent Development
Aim	To present 'an all-embracing coaching philosophy that puts the needs of participants/athletes at the centre of decision-making about sports system development' (Balyi, Ross and Duffy, 2010)	'to understand different pathways of sport involvement from childhood to adults' (Côté, per. comm., 23/09/2009)	'to explore prerequisites to success in sport, and the comparative efficacy of employing these prerequisites within talent identification schemes' (Abbot and Collins, 2004)	'to make explicit theorising about the nature, content and character of the talent development process in physical education' (Bailey and Morley, 2006)
Primary disciplinary background	<ul style="list-style-type: none"> • Exercise physiology • Anatomy (especially biological maturation) 	<ul style="list-style-type: none"> • Social psychology • Developmental psychology 	<ul style="list-style-type: none"> • Performance psychology 	<ul style="list-style-type: none"> • Education • Philosophy
Research methods	<ul style="list-style-type: none"> • Analysis of literature • Empirical observations of practice 	<ul style="list-style-type: none"> • Retrospective recall with elite performers, recreational participants, and dropouts from sports • Analysis of literature 	<ul style="list-style-type: none"> • Analysis of literature • Retrospective recall with elite performers in various performance domains • Sliding populations tracking with developing elites in various performance domains • Pilot interventions in schools 	<ul style="list-style-type: none"> • Qualitative research with teachers and young people • Quantitative research with schools • Analysis of literature • School-based case studies
Key sources	<ul style="list-style-type: none"> • Mainly eastern European sources – physiology and training methods 	<ul style="list-style-type: none"> • Bloom's stages • Ericsson's research on deliberate practice 	<ul style="list-style-type: none"> • Orlick and Partington's 1998 work on characteristics of excellence • A 'complex systems' perspective on determinants of performance, learning and development • Cross-domain studies on metacognitive skills 	<ul style="list-style-type: none"> • Abbott et al's critique • Ericsson's research on deliberate practice

Main theoretical framework	<ul style="list-style-type: none"> • Non-linear biological maturation 	<ul style="list-style-type: none"> • Expertise theory • Developmental theories 	<ul style="list-style-type: none"> • Psychological concomitants/precursors of effective development 	<ul style="list-style-type: none"> • Munich Model of Giftedness and Talent
Core constructs	<ul style="list-style-type: none"> • Stages of development (FUNdamental, Learning to Train, Training to Train, Training to Compete, Training to Win, Retaining) • Critical periods 	<ul style="list-style-type: none"> • Stages and trajectories towards elite performance, continued participation, and personal development in sport • Sampling • Deliberate play • Deliberate practice 	<ul style="list-style-type: none"> • Psychological characteristics of developing excellence (PCDEs) • Effective talent development environments (TDEs) • Systematic development of PCDEs to address challenge in the pathway, particularly transition • Stressing talent development over identification 	<ul style="list-style-type: none"> • Multi-abilities • Personal and environmental influencers • Deliberate practice
Practical applications	<ul style="list-style-type: none"> • Use of biological maturation measurements to inform individual training and competition loading rather than chronological age classifications 	<ul style="list-style-type: none"> • Broad foundation of sampling sports and involvement in deliberate play during childhood • Progressive involvement in deliberate practice from childhood to adulthood • Developmentally appropriate training patterns and psychosocial influences • Holistic approach to sport participation 	<ul style="list-style-type: none"> • Teaching 'characteristics of excellence' as cross-domain facilitators • Developing and refining optimum TDEs • Catering for the non-linear and dynamic pathway to excellence • Recognition that these applications also impact on participation – a continuum approach 	<ul style="list-style-type: none"> • Strategies for talent identification • Strategies for talent provision • Multi-skills practices

Mechanism-based Models

Models, at least in the social sciences, are supposed to enable the explanation, prediction and modification of behaviour. We would contend that few, if any, of the models examined to date fulfil all of these useful purposes. Instead, many are more descriptive and often delimited/limited in scope by use of small or specific sample groups. For example, it would seem both difficult and inappropriate to transfer findings from the old eastern European sports systems to Western contexts. Such suggestions are often embedded with the evidence base claimed by models as appropriate for our society. Couple this descriptive bias with statements often so 'face valid' that they are beyond challenge, and the practical utility of some models seems even more questionable.

In an attempt to counter these concerns, MacNamara, Button and Collins (2010a) employed a more mechanistic approach. As seen, this work is driven by attempts to identify characteristics that can facilitate the realisation of potential, then deploy these in an action-research style to see if a positive contribution can be made. As such, the emphasis is more on providing theoretically and empirically based guidelines for practice, than in modelling the full process *per se*. A typical investigation, reflecting the strengths and weaknesses of the approach, is the two-part study of MacNamara, Button and Collins (2010b). In the first part, a retrospective examination of elite performers yielded a set of characteristics and experiences that had facilitated their own progress to world-class status. In the second part, a survey of purposefully sampled subgroups of elites (track/field athletes, team sports players and musicians) showed that these characteristics were differentially employed according to domain and developmental stage. The applicability of these ideas is a strength, while the need for longitudinal examination is a weakness that is being addressed. Most pertinently to this review, there is also a clear requirement for consideration of progression patterns in non-elites (PRE and PPW) participants.

Other exemplars of this 'mechanisms to guidelines' approach is the work of Martindale and colleagues, who used a triangulation of measures to discern the characteristics of optimum TDEs as part of the pathway to ERE. For example, the triangulation between literature (Martindale, Collins and Daubney, 2005), coach perception (Martindale, Collins and Abraham, 2007) and developing athlete experience (Martindale and Mortimer, in press) provides robustness to the guidelines, while also keeping the theoretically generated guidelines grounded. This 'reality' is a feature often missing from some authors who tend to get a little idealistic or esoteric in their suggestions for practice. Once again, however, the lack of a longitudinal intervention-driven study and the essential extension to the other sections of the 'Three Worlds' Continuum await completion.

Summary

Models can be useful means for capturing a wide range of evidence related to a topic. But the value of these models is significantly determined by the quality of the evidence being represented and inevitable interpretations of that evidence by the model builders. This section has discussed the value and limitations of models in sports participation research and introduced four influential models. It is important now to examine the empirical base, to ascertain the veracity of existing models and consider lines of further development. We shall do this over the next three sections.

Section Four: The Biological Domain

This section offers an evaluation of the implications of physical growth and maturation, in conjunction with external stimulus (training), upon athletic development and health. It will draw upon fundamental paediatric and adult research, including primary sources and review articles, which have addressed the ontogenetic development issues relating to the potential enhancement of athletic capabilities and participation in sport, exercise and physical activity. An evident source of information related to this will be the implications of the long-term planning of athletic training. Similarly, the section seeks to inform debate as to the existence of 'critical' and/or 'sensitive' periods and 'windows of trainability' of physical fitness components during childhood and adolescence. It will also address the extent to which ineffective employment of these opportunities may limit subsequent attainment. Moreover, it will endeavour to relate the potential dangers of attempting certain modalities and/or volumes of physical training to psychological consequences highlighted in preceding sections, and relate physical development with the PPW, PRE and ERE⁸ involvement concepts also introduced previously. Though the primary application of the growth and maturation changes will be focused on the enhancement of athletic ability to directly achieve ERE, there will be associated examples along the continuum as well.

Within this section, it seems pertinent there needs to be a clear understanding of the development processes of maturation. Focus will be placed on the notions surrounding puberty and principally concentrate on the differences between gender, as well as that between chronological age. Malina and Bouchard (1991) highlight that during growth there are measurable changes in body shape and structure in different stages. Moreover, these changes relate to an integrated natural development of genes, hormones, nutrients and environmental factors that will affect the physiological systems of the body (see also Tihanyi, 1990). Indeed, Scammon (1930) also documents an 's-shaped' pattern of general post-natal growth (Figure 4.1). It appears (though there are differences with gender-specific neural, lymphatic and genital changes) the most rapid period of growth of the human organism is between infancy and early childhood (0–6 years old), with constant growth during middle childhood (7–11 years old), rapid growth during the adolescent spurt (11–16 years old) and slow increase up to the completion of adolescence (16–20 years old) (Balyi and Hamilton, 2004). For a further discussion on the stages of puberty, Tanner (1978) describes the progressive stages of puberty (pp 1–5) in greater detail.

⁸. See pages 7–8 for definitions of these terms.

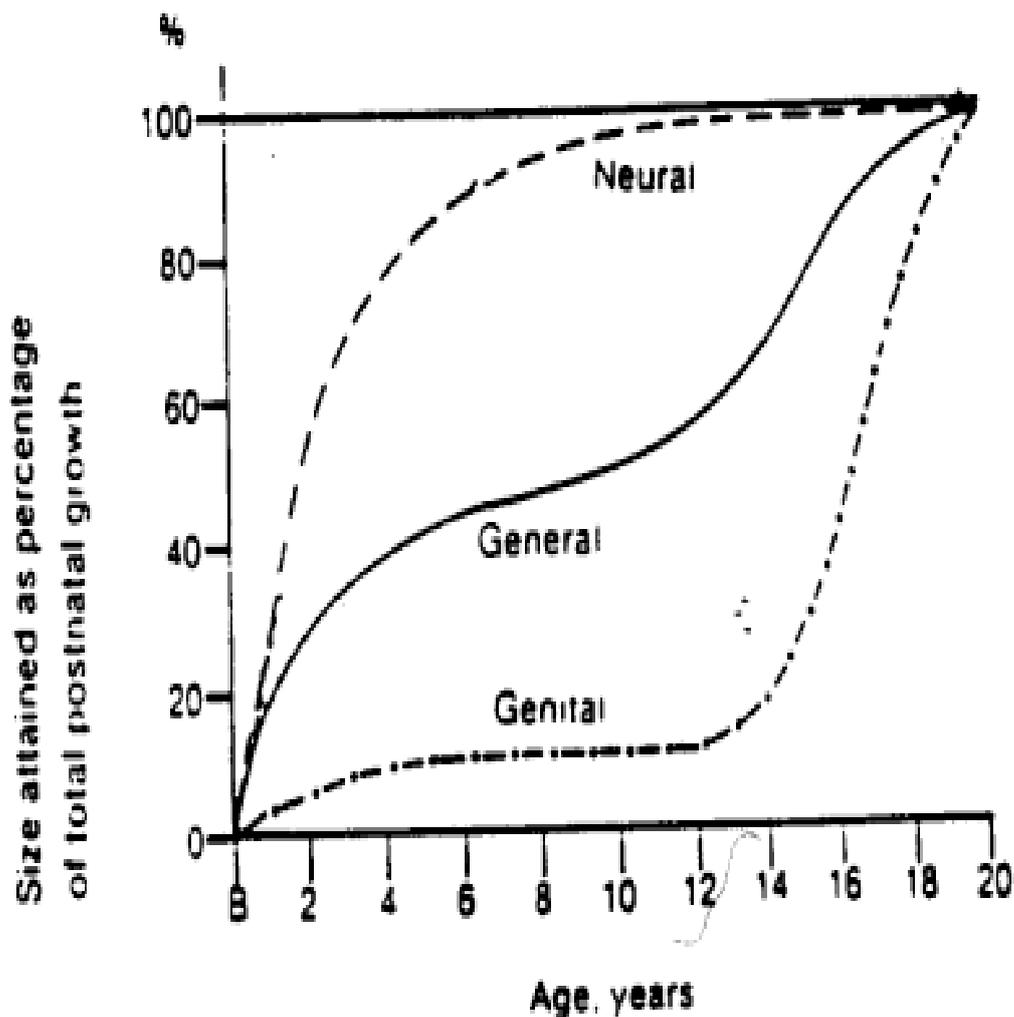


Figure 4.1: Generalised post-natal human growth pattern (Balyi and Hamilton, 2004)

Structural Breakdown of Physical Development

Anatomical

The most evident change that can be observed during growth and maturation is the increase in human stature. During the stages of transition, from infancy to adulthood there is a progressive increase in standing body height. But, it is apparent there are certain periods in which there are accelerated periods of growth as well, which primarily can be attributed to the non-linear changes in endocrine development (Naughton et al, 2000). Based upon this, there are obvious effects upon athletic performance, with changes in skeletal total body and limb length that can change energy expenditure during movement (Schepens et al, 2004), as well as force and power output generation (Virus et al, 1999). Furthermore, these changes in the rate of stature can help to act as a non-invasive marker of changes in the endocrine system (see further commentary throughout this section; Balyi and Hamilton, 2004). There is also a need to consider the health and adherence issues associated with maturational effects upon the structural integrity of bone for an individual.

For example, the condition Osgood Schlatters Disease is seen as an overuse injury with accelerated growth spurts. The condition is largely attributed to bone growth being much faster than soft tissue growth, which leads to muscle tendon tightness across the joint. This consequently results in a partial avulsion fracture through the ossification centre, as well as a heterotopic fracture through the tendon where the insertion occurs (Nigg and Herzog, 1995; Dunn, 1990). In summary, this may limit or even prevent athletic participation at highlighted key phases of development and consequential long-term 'Three Worlds' Continuum positioning.

Further to skeletal structure, Naughton et al (2000) reviews the impact of maturation upon body fat storage during the progression from infant to adulthood and highlights an average increase in storage from 11 to 15% and 14 to 25% between the ages of 6–17 years in boys and girls, respectively. Although this increase in storage of body fat in girls is parallel between extremity and truncal sites, it is more common to store body fat at the truncal site in boys during maturation (Malina and Bouchard, 1991). Such information may have central implications upon athletic performance for weight-bearing activities in addition to sports that require physical aesthetic structure of the athlete; for example, diving and dance (Naughton et al, 2000). Additionally, although subjective, Naughton et al (2000) suggests girls who experience premature body fat gain, due to early puberty, may stop or modify their sporting aspirations, because of the associated negative implications of fat gain upon their athletic performance.

In summary, there is little doubt that these anatomical changes during growth and maturation will impact on the performance and, possibly, the motivation of developing athletes and continue through to adulthood. In simple terms, those involved in youth sports must both be aware of (and cater for) the performance consequences of physical development through accelerated growth-rate periods through, and in advance of, the known developmental phases. Certainly during youth sport it seems those children who experience rapid growth in relation to their peers may have increased athletic capacity and associated ERE during a short period of time. However, due to the constant dynamic nature of growth rates among children and adolescents, such heightened ERE states are often acute, causing regular fluctuations along the 'Three Worlds' Continuum. Based upon this, its long-term impact remains undecided due to the insignificant impact body size has in relation to skill for the majority of sport-and-exercise-related activities throughout life.

Neurological

In an athletic performance context, changes in neurological function during maturational development will have an impact upon physical competence and skill acquisition and the control of both fine and gross motor abilities. This is a distinct, but additive, factor to the challenges resulting from structural changes, and one that will have an equal influence on the selection of the degree of participation in a sport-and-exercise-related activity, with particular reference to the 'Three Worlds' Continuum. When assessing neurological development, Cratty (1986) identifies that coordination mechanisms improve extensively between 0–7 years old, resulting in enhanced motor unit recruitment potential (muscular control) and subsequent motor (skill) performance during this time. Similarly, Morris et al (1982) have highlighted that motor performance is linked to age increase (with a significant advance in motor performance at around six years old) and chronological age is a more important variable than gender. Likewise, both Rabinowicz (1986) and Thatcher et al (1987) have reported that, like anatomical growth, there are accelerated and decelerated periods of brain maturation, with peak development periods in both genders at 15–24 months old, 6–8 years old, 10–12 years old and 18 years old. Consequently, the development of motor performance is, in part, restricted during these periods (Viru et al, 1999). For example, Okk (cited in Viru et al, 1999) suggests that the greatest levels of skill acquisition for fast, precise foot movements and hand movement skills occur in girls during ages 11–12 and 13–14 years old, respectively. Based upon such investigations, Higgs et al (2008) have reviewed associated literature, focusing on the practice and performance of key motor skills, including running, throwing and jumping and prescribed coaching advice in relation to general and specific sport methods and phased training models. Fundamentally

though, the authors highlight the importance of doing such whole body movements throughout childhood and adolescence in order to maximise development opportunities.

Muscular

Clarkson and Going (1996) highlight a significant increase in lean body mass during maturation, with large increases in muscle mass from 42% to 54% of total body mass for boys and 40% to 45% for girls, as assessed through creatine excretion, between the ages of 5–17 years. Similarly, Viru et al (1999) draw on the large increase in cross-sectional area of muscle fibres from 500 micrometres² (μm^2) to 2500–10000 μm^2 from childhood to adulthood, based on the work of Collin-Saltin (1980) and Saltin and Gollnick (1983). As above, researchers have proposed that this rate of muscle mass development is not linear, with Malina (1969) having calculated a 0.6% increase per year in muscle mass from ages 0–13.5 years in males, but a rate of $\sim 29\%$ per year thereafter for the next two years. However, in females it has been observed that there is a linear increase in muscle mass during maturation (Viru et al, 1999). Nevertheless, this staged developmental pathway will mean the restriction of an individual's maximal athletic trainability and performance during growth until sexual maturation has been achieved, because the muscle function and force production potential will be constrained by incomplete development (Naughton et al, 2000).

As highlighted previously, the performance/motivational implications of such non-linearity must also be considered, especially when such changes are stage/phase-related while young athletes are grouped by chronological age (see Section Five). Moreover, like structural growth, the enhanced strength and muscle-endurance capabilities will naturally help to support ERE. But, due to the importance of these facets throughout life (eg mowing the lawn, playing games with children), such developments will help advance PPW and PRE as well. This suggests that, although it will probably influence lifelong sport and physical activity participation, it will not necessarily govern 'Three Worlds' Continuum positioning.

Metabolic and hormonal

During growth and maturation the development of key hormones within the endocrine system will have a significant physiological impact upon how the total body functions, directly controlling anatomical and muscular development issues introduced above. Firstly, during the onset of puberty there is a dramatic increase in the release of growth hormone (GH), insulin-like growth factors (IGFs) and steroid sex hormones (SSHs), which principally drive the process of increased bone and muscle maturation. Such changes, previously documented by authors, include the 'growth spurt', peak height velocity (PHV) and peak weight velocity (PWV) (Tanner, 1978; Malina and Bouchard, 1991). Similarly, during adrenarche (development of adrenal glands) and gonadarche (development of sexual organs) periods there are increased secretions of hormones that will influence physical development in later puberty, including the release of gonadotropin-releasing hormone, testosterone, estradiol, progesterone, follicle-stimulating hormone and luteinising hormone (Sizonenko and Paunier, 1975; Lac et al, 1992; Viru et al, 1998; Boisseau and Delamarche, 2000; Naughton et al, 2000). In addition, there are several other hormones and enzymes, which have been highlighted to develop and circulate at greater levels following the release of the aforementioned SSHs, including phosphofructokinase (PFK), lactate dehydrogenase (LDH), catecholamines, serum leptin and insulin (Boisseau and Delamarche, 2000; Naughton et al, 2000). When trying to maximise an individual's athletic potential and ERE performance, the changes in hormonal levels will have a significant influence upon the training stimulus and adaptive/maladaptive responses during recovery as they will regulate metabolic and growth processes (Boisseau and Delamarche, 2000; Naughton et al, 2000).

Consequently, the implications of hormonal change with evolving training load must be a key and, inevitably, individual consideration, especially in 'young' sports such as gymnastics (Viru et al, 1999). But, in practice, the majority of sports participants will always tend to train as a group/squad, meaning that such individualistic considerations are not accounted for. Nevertheless, though such information has been applied to specific physiological development and training practices for children and adolescents (eg testosterone increase

upon muscle size), it appears there is a lack of definitive consensus opinion on the impact of such hormonal and metabolic changes within review articles (Boisseau and Delamarche, 2000; Naughton et al, 2000). Perhaps this is because there are some apparent practical issues surrounding the research, including inaccurate assessment of hormonal secretion (Boisseau and Delamarche, 2000), invalid paediatric pulmonary gas exchange assessment (Fawkner and Armstrong, 2003), the expensive and cumbersome nature of phosphorous nuclear magnetic resonance spectroscopy (PMRS; Boisseau and Delamarche, 2000), as well as ethical considerations regarding invasive muscle biopsies and blood sampling (Jago and Bailey, 2001).

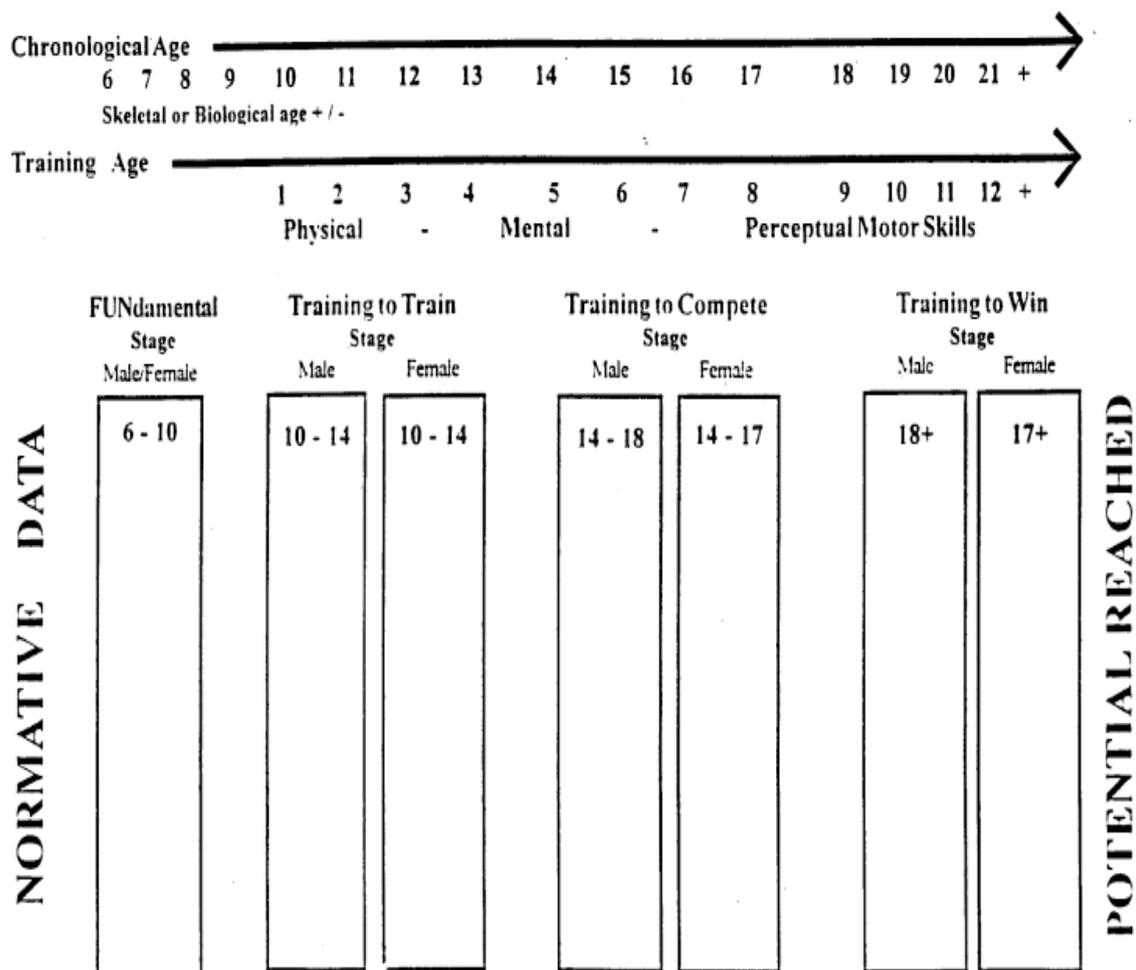
A useful source of information for further commentary on physical development is Rowland (2006).

Developmental Pathways and Stages

Configuration stages/phases of development

Though there are numerous articles identifying the anatomical, neurological, muscular and hormonal changes during childhood and adolescence, Harre (1982) and Norris and Smith (2002) conclude that, at present, the application of such information by practitioners for enhancing athletic performance is poor. Prior to the last decade, it seemed population-specific considerations were still not accounted for, and adult-based training prescription was implemented, which is widely accepted as being inappropriate (Balyi and Hamilton, 2004). To date, the most appropriate and forefront model to include these paediatric developmental considerations is held to be the LTAD model (Balyi and Hamilton, 2004). Though such a model is not novel (Riordan, 1977; Brokchin, 1978; Gilbert, 1980), it has been constructed on the basis that it combines the successful training ethos employed within ex-USSR countries alongside a greater scientific basis to inform children and adolescent development (Balyi and Hamilton, 2004). An evident improvement of these models is they acknowledge the physiological factors related to growth and maturation in addition to correcting the previous ideology of focusing on early athlete specialisation (Harre, 1982; Balyi and Hamilton, 2004), albeit against a backdrop of literature focused on evaluating gains at that age, as opposed to a longer-term agenda. As the long-term periodised models have been advanced, governing bodies of sport have adopted such applied concepts in terms of developing children into elite athletes, encompassing prescription, and application details for practitioners (Biathlon Canada, 2006a; 2006b; Canadian Sports Centres, 2008), which had previously been attempted by several authors independently (Holm, 1987; Thumm, 1987; Sanderson, 1989; Touretski, 1993; Bompa, 1995).

These authors have acknowledged the need for balanced training load and competition during childhood and adolescence as, previously, too much focus was placed upon results rather than assisting optimal development processes (Balyi and Way, 1995; Bompa, 1995). Directly related to this, Balyi (1996) and Balyi and Hamilton (2004) identified that organisations should actively work with coaches during competition scheduling and preparation of junior athletes, based around relevant supportive literature and particularly the 's-shaped' modified-developmental growth curve (Figure 4.1). These authors focused upon the idea that training programme design should account for enhancing general athletic capabilities during childhood and sport-specialisation after pubertal changes. Platonov (1988) highlights the number of hours required to maximise each development stage from initial basic training through to adult maintenance. Principally, Balyi and Hamilton (2004) distinguish the following four stages of training development: the FUNdamental, training to train, training to compete and training to win phases (see Figure 4.2).



Ancillary Capacities - Nutrition, Hydration, Stretching, Warm-up, Cool-Down, Acclimatization, Regeneration, Taper, Cultural.

Figure 4.2: Four stages of training development (Balyi, 1996)

It is suggested that, through objective physiological assessment and using tools such as PHV and PWV, coaches can account for the individual maturation rates of each athlete to apply the relevant training protocols depicted in each phase of the model (see Figure 3.2). Such practice brings an advancement of chronological age classification that is inherently flawed due to previously noted variation in growth and maturational rates between individuals (Bompa, 1995; Balyi and Hamilton, 2004). An additional factor from this model is the concept there are critical opportunities to accelerate and enhance physical development using appropriate training stimuli linked to the natural growth and maturation processes.

In terms of the limitations of this literature, there is a distinct lack of longitudinal-based empirical data supporting such a long-term model. Much of the evidence used to justify the design of the model lacks any significant longitudinal 'cause and effect' research and includes animal-based literature to rationalise its structure (Szmodis, 1991). Balyi and Hamilton (2004) actually highlight their work is based on 'empirical observations', which, although apparently well-informed, lacks scientific validity due to bias and individual misinterpretations. It appears the triggering need for such a long-term training design is to facilitate the development of children and adolescents to achieve ERE, rather than 'mediocrity' of performance towards the opposite pole of the 'Three Worlds' Continuum. In addition, it appears there is no evidence that failure to exploit these critical periods with appropriate training will result in inhibited development and ceiling limitations later on.

Beunen and Malina (1996) clearly show a variance in the rate of athletic performance development associated with growth and maturation, but there seems to be a lack of clarity on the training stimulus required to facilitate these developmental spurts. A fundamental question is whether these critical periods are included to help develop ERE to an extent above an individual's 'pre-ordained' natural genetic make-up, or merely achieve optimal ERE performance faster? Similarly, will the misuse of the critical periods bring an increased likelihood of fixed, or more disturbingly, detrimental athletic effects upon 'Three Worlds' Continuum positioning for an individual during adulthood? For example, an individual moving from ERE to PPW, or even drop out, as commonly seen from excessive participation during junior association football.

After acknowledging this, it seems appropriate to examine the development of the physiological variables directly related to fitness components (primarily aerobic and anaerobic performance) to a greater extent. This might help readers to distinguish if this may have an influence upon training prescription that has not been addressed in the original methods noted above. As a final consideration and, once again, reflecting the longitudinal weaknesses established above, there is a need to examine whether a lack of specific developmental activities at one stage (eg developing joint integrity and/or sound movement patterns) is an essential precursor to smooth, uninterrupted and effective preparation later (eg during pre-adolescence to late adolescence). By focusing on these areas it should help to show the impact these approaches have in terms of sport, exercise and physical activity involvement more clearly. For example, if it is found an individual does not develop anaerobic athletic competencies until late adolescence or he or she fails to maximise training opportunities to enhance these, resulting in poor levels during middle age, then it may explain low participation rates or PPW positioning on the 'Three Worlds' Continuum.

Physical Fitness Constructs

Aerobic performance

Aerobic fitness is a process of synthesising energy or adenosine triphosphate (ATP) for a prolonged duration with the use of oxygen. It is influenced by an individual's central and peripheral cardiovascular system, muscular function, cellular capacity, body composition and metabolic capability (Rowland, 1985). It seems the degree of influence these components have upon aerobic fitness varies with maturation; for example, in childhood there is a greater reliance on increased heart rate to sustain increased blood flow during exercise compared to adulthood, stemming from underdeveloped cardiac tissues and lower stroke volume to support more intense workloads (Turley, 1997). Peak oxygen uptake, as it is more appropriately termed for paediatric participants (Rowland and Cunningham, 1992), is acknowledged as a criterion method of assessing an individual's maximal aerobic fitness (Jones and Carter, 2000; Naughton et al, 2000). It increases from infancy into adulthood, possibly in a linear pattern with body size increase (Armstrong and Welsman, 1994). Some may postulate this might be directly related to the development of heart size, as though during early childhood the heart is very small and there is a reduced aortic pressure (Viru et al, 1999), by the age of eight years old the heart volume to body size ratio is the same as that observed in adulthood (Bouchard et al, 1977).

Nevertheless, several authors have suggested there are accelerated and decelerated periods of peak oxygen uptake development during maturation (Viru et al, 1999; Baquet et al, 2003). This can, in part, be rationalised based upon the fluctuating rates of development in functional cardiac changes outside of total heart size, in addition to the anatomical, neurological, metabolic and muscular changes during growth and maturation as highlighted previously (Viru et al, 1999; Naughton et al, 2000). Kobayashi et al (1978), Payne and Morrow (1993) and Baquet et al (2003) suggest there is an exponential rise in peak oxygen uptake following PHV and puberty and appropriate training will enhance this rate of change

in line with growth, in what Katch (1983) and Rowland (1997) discuss as the 'trigger hypothesis'. Naughton et al (2000) summarises that the growth-related improvements in aerobic trainability in well-trained male adolescent athletes compared with well-trained pre-adolescent males may be associated with the interactive effects of leaner body composition, proportionally higher muscle mass, higher blood oxygen carrying capacity and larger maximal cardiac output. These adaptations relate to increased testosterone, GH and other hormone secretions that occur with maturation, directly related to post-PHV.

In support, the findings of George et al (2005) suggest that without the increased release of testosterone during maturation, any kind of cardiac muscle training adaption is limited and, consequently, will inhibit aerobic fitness training gains in boys; although there are other hormones, such as IGFs and GH, that will play a significant role. Further accelerated and decelerated period observations includes Weber et al (1976), who suggested a decreased sensitivity to aerobic fitness training response that occurs in the middle of PHV when compared with the years surrounding it. Moreover, some authors have indeed suggested most receptive training adaptations to aerobic fitness actually occur prior to PHV. For example, Rowland (1985) suggests a 10.1% and 8.8% improvement in peak oxygen uptake during pre-pubertal and adolescence in both boys and girls, respectively. In summary, both Naughton et al (2000) and Baquet et al (2003) conclude that the findings are obscure throughout the literature as genetic background and training load is never the same so attributing any adaptive response, in line with physical development, is flawed due to the variation in the size of stimulus.

In addition, it appears research has focused on participants during pre-pubertal years rather than adolescents, and has not accounted for initial peak oxygen uptake values (Tolfrey et al, 1998). Such knowledge limits application of critical period training prescription. Therefore the application of a 'window of trainability' concept, which includes lack of cohesive agreement, may indeed be inappropriate at this time. However, it is of particular interest for practitioners to identify if 'windows of trainability' do exist because it bears implications for lifelong 'Three Worlds' Continuum participation. For example, training aerobic fitness when there is reduced training-adaptation-response capability may be detrimental to the development opportunity of other physical traits (where there may be enhanced progression periods) or bring unnecessary stress for an individual. As a consequence, this may potentially contribute towards overtraining and drop out for young participants and low adherence rates during older age, which relates to commentary in the coming chapters.

Further to this, there are alternative markers of aerobic fitness, including economy of locomotion, blood lactate threshold and oxygen uptake kinetics (Jones and Carter, 2000). Results from studies suggest children and adolescents are significantly less efficient in energy expenditure during movement than adults, as children consume more energy per unit of body mass to walk at a given speed, and this difference becomes greater the higher the speed and the younger the subject (up to 12 years) (Cavagna et al, 1983; De Jaeger et al, 2001; Schepens et al, 2004). Although a possible explanation for the difference is that body size affects the positive muscle-tendon work performed. Cavagna et al. 1983 attribute these inherent disparities to kinetic differences in the ankle, associated with a lack of neuromuscular maturity and children's inability to effectively deliver oxygen to the required muscles (cf De Jaeger et al, 2001; Ebbeling et al, 1992; Ganley and Powers, 2004; and Schepens et al, 2004). Though this discrepancy between children and adults will be removed naturally over time, as chronological age can explain 77% of the variance (Ebbeling et al, 1992; Frost et al, 2002), it seems the potential for improving economy of movement and physical performance is more than likely influenced by training as well.

However, there appears to be limited investigations that specifically address appropriate training prescription or critical periods to enhance this in line with physical development (Naughton et al, 2000). It might be postulated that overall economy of locomotion will be enhanced continuously with physical activity and exercise through childhood and

adolescence (Baquet et al, 2003), but until there is some direct research to assess if this is true, or indeed there are accelerated or decelerated periods of change, its position within longitudinal periodised training models as such, remains unknown. Certainly, age-related differentials mean any specific sporting challenge will be met through different systems for the child as opposed to the adult performer. Implications could include the modification of age-appropriate sports to better reflect the adult version, or careful consideration of these differentials when 'talent spotting' based on current performance, itself an already flawed approach (Abbott et al, 2005). For example, having shorter periods of play and more regular rest intervals during team sports may be more appropriate for individuals with lower 'fitness' levels. It seems sensible to match the physical demands of sport and exercise to the physical development of individuals to help facilitate skilled performances that are not restricted due to physical incapacities and thus 'Three Worlds' Continuum progression.

In addition, the other aerobic fitness assessment methods of blood lactate threshold and oxygen uptake kinetics are not actually appropriate in the context of tracking change from childhood to adulthood. Although similar responses to moderate-intensity exercise are seen, its inappropriateness is because the natural fluctuation in anaerobic metabolic pathway usage with maturation will invalidate longitudinal observation of such tests (Boisseau and Delamarche, 2000; Naughton et al, 2000), which can be attributed to its link to hormonal maturation (Tanaka and Shindo, 1985). Due to the advanced scientific nature of these concepts and lack of discussion within the literature as to their impact upon lifelong participation development, further commentary is beyond the scope of this academic review.

In summary, there is a large amount of supportive literature to suggest that from a young age children do have a well-developed aerobic capacity to support ATP re-synthesis to perform exercise of varying workloads (Boisseau and Delamarche, 2000). Nonetheless, there is evidence to show aerobic fitness capacity will improve during childhood and adolescence and there are peaked periods of advancement. Subsequently, it might be expected that this will influence an individual's 'Three Worlds' Continuum activity status (eg a heightened ERE opportunity supported from a superior aerobic capacity). Though there is discrepancy in the literature, Viru et al (1999) draws on several longitudinal studies to show peak development of aerobic capacity will occur between 12–16 years old in both boys and girls. But they also highlight cross-sectional investigations actually showing that the peak development periods for aerobic capacity occur during 10–16 and 7–13 years old in boys and girls, respectively. The latter is slightly different and aligns itself with the LTAD model (Balyi and Hamilton, 2004). However, due to the lack of causality associated with these cross-sectional studies and potential inaccurate assessment of training stimulus required to elicit such peak development (Baquet et al, 2003), any inference of longitudinal periodised training design based upon these investigations should be viewed with caution. What is required is a long-term study that maps changes in aerobic capacity during growth and measures the influence physical activity or training may also have; though, logistically, this is very difficult to achieve. Until such evidence emerges, there seems to be no sufficient experimental basis that even pre-pubescent children fail to respond normally to aerobic fitness training (Shephard, 1992), though Tolfrey et al (1998) and Williams and Reilly (2000) suggest it will have to be relatively high-intensity and for a prolonged period to produce significant gains.

Anaerobic performance

Unlike aerobic capabilities discussed already, it is commonly accepted that children have a poor anaerobic performance capacity compared to adults, meaning a restricted capacity to perform short, very high-intensity explosive activities. This is potentially due to physiological constraints linked to underdeveloped endocrine and muscular components, which do not develop until the onset of sexual maturation (Viru et al, 1999). Subsequently, this has an effect upon the fitness components of muscular strength, speed of movement and explosive power, which are associated with superior athletic performance.

It seems a primary reason for young people having poor anaerobic performance capabilities is reduced muscle cross-sectional mass compared to adults. In part, this may be related to a hormonal limitation of anaerobic performance, particularly to any kind of training adaptation in children compared to adults. Viru et al (1999) largely relates the significant development increase in muscle mass and strength in males due to the ten-fold increase in testosterone secretion that occurs during sexual maturation. Likewise, Viru et al (1998) has identified the post-exercise release of GH is greater in girls in the latter stages of sexual maturity, which aids the developmental increase in muscle mass and strength. Thus, it might be speculated there is limited worth to conducting a high-intensity exercise stimulus (such as resistance training) to elicit an increase in muscle size in childhood until the appropriate hormones can be secreted to facilitate growth. However, such a statement potentially neglects the worth of resistance training for pre-adolescent participants to enhance strength. Several authors have identified the positive effects of such training regimes to enhance strength (Blimkie, 1993; Falk and Tenenbaum, 1996), attributing enhanced neurological activation as the primary mechanism (Falk and Tenenbaum, 1996; Christou et al, 2006). Though pre-adolescents are probably less trainable prior to hormonal maturation (Blimkie, 1993), such a speculation holds substantial implications for training regimens with young performers; once again relating to immediate performance (eg gymnastics) and aspects of appropriate development.

Another consideration for enhancing anaerobic performance is specific muscle fibre type development. For example, if a specific accelerated period of fast-twitch fibre growth was observed, it might be appropriate to plan a specific training stimulus to help optimise development (Boisseau and Delamarche, 2000). However, Bell et al (1980) and Mero et al (1991) suggest children have a greater proportion of type I (slow twitch) muscle fibres than adults, though the majority of evidence indicates there is no difference in fibre type proportions during growth and maturation (Boisseau and Delamarche, 2000). Nevertheless, more supportive evidence using techniques such as magnetic resonance imaging is required to clarify this subject area prior to achieving a definitive conclusion. In terms of eventual (ie adult) performance and 'Three Worlds' Continuum activity, the long-term influence of early training on fibre typology and trainability would appear to be a particularly important line for investigation.

Further to this, it seems several review articles have highlighted that even when accounting for this difference in muscle aetiology, there is still a progressive increase in anaerobic function during growth and maturation. This is primarily supported by novel techniques, such as PMRS to quantify energy metabolism (Boisseau and Delamarche, 2000). Zanconato et al (1994), Kuno et al (1995) and Barker et al (2008a; 2008b) identify that children have a significantly lower capacity for ATP re-synthesis using anaerobic metabolic pathways compared to adolescents. Likewise, Naughton et al (2000) report an improvement during adolescence in anaerobic metabolism as marked changes in enzyme activity, blood lactate and post-exercise oxygen consumption can be seen during physical activity and exercise (Berg and Keul, 1988; Paterson and Cunningham, 1985). A plausible reason for this is during high intensity activities, although functional anaerobic capacity is not limited by stored phosphocreatine (PCr) levels (Eriksson et al, 1971; Colling-Saltin, 1978), the anaerobic glycolytic pathway energy system seems to be restricted. This can be primarily attributed to the lower circulating levels of rate-limiting enzymes PFK and LDH during childhood (Naughton et al, 2000). For example, Eriksson and Koch (1973) have reported the levels of PFK in 11-year-old boys being one third of a mature male's.

In addition to this, Lehmann et al (1981) suggest there is also a reduced glycolytic metabolic capacity due to a restricted release of adrenaline (which facilitates anaerobic glycolysis), stemming from an underdeveloped sympatho-adrenal system. Studies have also suggested increased levels of succinate dehydrogenase and isocitrate dehydrogenase in children compared to adults (oxidative enzymes), enhancing the aerobic metabolic pathways that will resultantly reduce anaerobic capabilities (Eriksson and Koch, 1973; Boisseau and Delamarche, 2000). Therefore, high-intensity activities will not be

metabolically limited if they are less than 10 seconds in duration; however, hormonal restrictions upon anaerobic glycolysis will limit the performance of high-intensity activities longer than 10 seconds. Based upon this (as with restricted muscle aetiology) conducting training of strength, speed and power until sexual maturation is complete may be unessential since maximised exercise stimulus and resultant compensation may not be achieved (Boisseau and Delamarche, 2000). It is hoped future advancement in the area of PMRS will help to clarify this change in anaerobic metabolism during adolescence and align it with non-invasive markers and optimal training stimulus recommendations (Naughton et al, 2000). However, Van Praagh (1998) disagrees with this notion, since several investigations have brought anaerobic advancement in high-intensity performance prior to sexual maturation. Perhaps this may be associated with improved neurological motor performance control as highlighted previously (Falk and Tenenbaum, 1996; Christou et al, 2006). Saltin (2005) reports that motor nerve action potential increases prior to puberty and suggests training can facilitate a faster and controlled activation of the muscle alongside natural development. Additionally, Fournier et al (1982) has suggested that resistance training may enhance the development of anaerobic glycolytic metabolism during adolescence, perhaps in a form of 'activating mechanism'. Therefore, the prescription of anaerobic training of muscular strength, speed of movement and explosive power from a young age should be considered; although, notably, for different reasons to its usage with adults.

In light of the preceding discussion, it seems appropriate to underline the observed growth-related changes in anaerobic performance again, in terms of enhancing strength, speed and power fitness components, as they may be a precursor or resultant of a critical period of training stimulus (Balyi and Hamilton, 2004). Viru et al (1999) have identified that the peak change in muscle strength occurs between the chronological ages of 13–16 in boys and 11–15 years old in girls, based on both cross-sectional and longitudinal investigations. In addition, an observation is that there are localised specialisations for certain muscle groups, with upper-body strength development coming earlier than lower limb (Blanksby et al, 1994; Viru et al, 1999). Unlike strength, speed is seen to develop earlier within the process of maturation, as peak change occurs during ages 5–7 and 12–14 years in boys and during the ages of 5–7 years in girls, based upon longitudinal evidence (Viru et al, 1999). This is, potentially, more meaningful than the accelerated development period suggested from cross-sectional data (13–15 years old), due to the inherent lack of causality; ie there is no direct evidence tracking these changes during this period as it is based on observations of independent groups (Viru et al, 1999). When combining the physical development of an individual and the strength and speed of muscle contraction, Viru et al (1999) suggest accelerated development of explosive power occurs between the chronological ages of 7–11 and 13–16 years old in boys and 6–9 and 10–12 years old in girls, based upon both cross-sectional investigations. However, when reviewing the limited number of longitudinal investigations, Blanksby et al (1994) and Viru et al (1999) suggest accelerated change of power in girls is similar to that in boys between 14–16 years old.

Yet, as with both muscle strength and speed of movement, to the above authors' understanding, it seems no direct evidence exists to support the optimal power training stimulus required, in line with the appropriate peak development period, to bring maximal advancement of athletic performance in this physical fitness construct. Similarly, any inference of critical period for enhanced training benefit lacks scientific integrity at present. Crucially, studies to date have failed to delineate between neurologic and myologic consequences and have certainly not shown subsequent levels of achievement being limited or enhanced by different training loads and typologies applied at this age. As such, this area would benefit from more studies because of its direct impact on long-term sporting participation; although, meaningful studies must employ longitudinal designs and/or indices with proven developmental implications if anything worthwhile is to become known.

Critical Periods of Development and Trainability

It is commonly accepted that training consists of systematically performed exercises in order to bring changes in the organism, based on exercise-induced adaptive protein synthesis (Viru, 1994). Norris and Smith (2002) discuss the importance of designing an appropriate programme and, in conjunction with the work of Viru (1995), highlight the significance of recovery to maximise the adaptation brought on by the stimulus and resultant performance. Training programme design and, more specifically, the concept of annual periodised models, based around competition, have been well documented by many experts (Harre, 1982; Wilke and Madsen, 1986; Pyne, 1996; Bompa, 1999; Norris and Smith, 2002). Undeniably, this is the actual basis of the LTAD model as highlighted previously, although the uncritical and generic application of these principles has been vigorously challenged (Verkhoshanky, 1999). Such individual concerns notwithstanding, it seems there are benefits to a variety of exercise training regimes, during childhood and adolescent years, to augment both aerobic and anaerobic athletic capacities in addition to the physiological adaptations associated with growth and maturation (Daniels et al, 1978; Rowland, 1985; Ramsay et al, 1990; Falk and Tenenbaum, 1996). Moreover, there is a small amount of research to suggest some accelerated development of motor abilities from conducting training in young people at appropriate maturational time periods (Guzalovsky, cited in Viru et al, 1999). But, this is restricted by lack of direct evidence tracking these changes because it was a cross-sectional investigation using independent groups, which limits the actual specific investigation of such 'windows'.

Viru et al (1999) highlight that the evidence for critical periods of development, as introduced previously, can be placed into four categories:

- Ontogenetic changes that influence growth, maturation and development
- Periods of accelerated growth
- Increased sensitivity to factors stimulating development
- Enhanced vulnerability.

To summarise the critical period developments in the first two categories, it appears there is an accelerated improvement in overall athletic performance in young people during the ages of 5–9 years for aerobic and anaerobic capabilities (strength, speed and power), but there are specialised developments during sexual maturation for each physical fitness component (Viru et al, 1999). Although much of the peak developmental periods are similar to that shown previously in the LTAD model, the review by Viru et al (1999) suggests there is also more additional accelerated adaptation periods not accounted for (Balyi and Hamilton, 2004). However, the critical development periods related to increased receptiveness to factors stimulating development (ie training and exercise), as well as the potential negative implications, require further exploration. It seems the appropriate application of training, in accordance with the physical maturation development, highlighted above, may have a significant influence on peak ERE performance through cell, tissue, organ and whole system super-compensation of the organism (Wenger et al, 1996; Balyi and Hamilton, 2004). Certainly in the applied literature, it has been documented that conducting a training intervention outside of this critical period will bring little or no effect in training gains and it may actually be detrimental to future adaptations (Zaichkowsky et al, 1980).

Table 4.1: Occurrence of physical fitness component peak development in years old (adapted from Viru et al, 1999)

	Boys		Girls	
	Pre-Adolescent Spurt	Adolescent Spurt	Pre-Adolescent Spurt	Adolescent Spurt
Aerobic performance				
Longitudinal studies	5-9	12-14/14-16	5-9	12-14/14-16
Cross-sectional studies	-	12-15	7-10	11-13/13-16
Anaerobic performance				
Strength				
Longitudinal studies	5-9	13-16	5-9	10-15
Cross-sectional studies	-	13-15	-	11-15
Speed				
Longitudinal studies	5-9	12-14	5-9	-
Cross-sectional studies	7-11	13-16	6-9	13-16
Power				
Longitudinal studies	5-9	12-16	5-9	9-13
Cross-sectional studies	7-11	13-16	6-9	10-12

While it is plausible there may be critical periods when developmental response is greater related to a controlled training stimulus and may enhance ERE chances, there is a clear lack of supporting population-specific evidence. Suslov (2002) identifies the complexity in quantifying physical activity and training in young participants, as well as controlling this during an investigation; hence, literature lacks agreement as to the influence of the optimal training loads during critical periods to maximise final athletic capacity. Moreover, Suslov (2002) highlights coaches should be aware of the importance of training to advance all fitness components throughout childhood and adolescence during non-critical periods as well, principally because of individualised development rates of anatomical, neurological, muscular and metabolic parameters. Additionally, Saltin (2005) questions the mentality behind specialised training of young people, with direct reference to critical periods, asking if the coaches are trying to enhance development to increase performance at the same age? If so, does this actually enhance total end-performance or merely speed a child towards a predetermined genetic limit of athletic performance and optimal 'Three Worlds' Continuum selection during older years?

Loko et al (1996) summarises evidence to suggest the best effect of training and the development of performance capabilities is achieved when natural growth is at its peak. However, as a paradox, there is a consequence that the full potential of the individual is not achieved when early specialisation and intensive training occurs during these critical periods. Moreover, the implications upon long-term 'Three Worlds' Continuum position may be restricted if such negative results occur. Without objective data to help confirm/reject these ideas, inferring any training recommendations for successful athletic pathways for participants could be perceived as unethical. Indeed, as mentioned in the preceding section, the term 'critical' actually suggests that if individuals do not utilise these periods they will never reach maximum athletic potential. The 'strength-critical window', in relation to testosterone increase in males during maturation, is certainly a plausible trainability opportunity. But whether it will affect end-athletic performance seems unclear to date.

Alternatively, the term 'sensitive period' has been commonly used, which implies an opening when additional training gains may be brought from the same level of stimulus. This is, perhaps, more appropriate and is of significant interest for practitioners and subsequent interest for associated stakeholders related to the 'Three Worlds' Continuum.

An additional question, though, is whether these periods close at all after opening, as the term 'window' might suggest? For example, testosterone levels are maintained throughout adulthood once they have met the late-adolescent plateau, suggesting these hormonal induced adaptations may not be a long-term restriction. Therefore, perhaps a more appropriate term when incorporating the fundamental training principles (which are primarily researched in an adult population to date) should be deemed 'training emphasis period' at present, surely until more empirical data have been evaluated to help analyse this subject area. Likewise, perhaps there are more non-invasive markers to help reflect the metabolic and hormonal changes that occur throughout maturation outside of the simple biological PHV indicator (such as fat-free mass and heart size change) that can help to redefine specific evidence-based training prescription to optimise performance advancement (Janz and Mahoney, 1997; Beunen, 1990).

Additionally, the concept of early specialisation has been promoted by some as a means of allowing an individual to obtain a higher performance capacity, due to deliberate practice for a longer period (Ericsson et al, 1993). Certainly, Balyi and Hamilton (2004) have addressed the positive aspects of such concepts, with direct reference to sports such as gymnastics, since the maturational changes in flexibility tend to favour athletes achieving optimal performance during late adolescence, meaning full skill acquisition must be obtained as early as possible (Beamer et al, 1999). However, such early/intensive specialisation is negatively related to the concepts of overtraining and athlete burnout (Dalton, 1992; Bompa, 1995; Balyi and Hamilton, 2004) and could have a noteworthy influence on the 'Three Worlds'. Consequently, the long-term periodised concepts of the LTAD model account for this, by incorporating generalised sport/exercise training during maturational progression, up to more advanced specialisation occurring during adolescent maturation. However, Rutenfranz and Singer (1980) have suggested even generic physical activity increase between the ages of 15–17 years in boys is associated with sports performance improvement, suggesting any form of specialisation training may be unnecessary for generic improvement in athletic capabilities and it, perhaps, requires more advanced investigation.

Additional Considerations

Genetic pathways and training receptiveness

To further complicate this subject area, successful performers and coaches often attribute athletic ability and habitual 'Three Worlds' Continuum positioning to genetic inheritance (Hamel et al, 1986; Bouchard et al, 1997). For example, an elite high jumper must be tall and lean to be successful, as this body composition produces a higher centre of gravity and increased strength to weight ratio, which in turn leads to better jumping output (Paish, 1998). Consequently, although there is disagreement (Abbott et al, 2005), it seems nature may prevail over nurture because it is senseless for an individual who has a completely different genetic make-up and body composition to attempt particular sports. But the size of the genetic effect upon athletic performance depends on the phenotype trait assessed. Bouchard et al (1986), Rice et al (1993) and Comuzzie et al (1994) suggest a 30% genetic effect on muscle mass phenotype, contrasting with Komi et al (1977) and Lortie et al (1984) who suggest muscle fibre phenotype is almost exclusively genotype dependent. In addition, genetics is identified as important in the biomechanical and psychological traits of successful performance (Bouchard et al, 1997), although this is contentious and very difficult to conclude due to the early stages of research and complexities in measuring genetic information (Malina, 1986; Malina and Bouchard, 1986). Nonetheless, Simoneau and Bouchard (1998) have argued that 50% of the individual variation in the athletic

performance is associated to genetic status, though once again this is contentious (Abbott et al, 2005; Ericsson, et al, 1993).

Training will never erase individual variances, but exceptional performance cannot be achieved without appropriate deliberate practice throughout life (Malina and Bouchard, 1986). Sklad (1977), Balyi and Hamilton (1996) and Loko et al (1996) highlight that training stimulus alone can bring ~30% increase in athletic performance, which supports the training focus in line with growth and maturation highlighted above. Nevertheless, such changes can occur only within the fixed limits of heredity due to cellular genetic regulation (Simoneau et al, 1986; Thibault et al, 1986; Bouchard et al, 1989). Several authors have highlighted that the effect of hereditary causes a further 40% variation on training adaptation response itself (Bouchard et al, 1992; Simoneau and Bouchard, 1998). Certainly, when relating this to the concept of 'training emphasis periods', it suggests such an opening may be highly variable and individualised, bearing large genetic constraints; although, once again, there is valid literature to suggest otherwise (Abbot et al, 2005). However, it seems this concept has not been clearly acknowledged within the earlier literature. Therefore, until any studies show a significant scientific identification as to such effects and associated impact upon participation rationalisation, it would be inappropriate to definitively conclude on such topic.

Lifelong physical activity impact and long-term health implications of training

An additional factor to be considered within this area is the health implications of an extensive training regime for young people throughout childhood and adolescence, because of the associated negative impact this may have upon physical development. Though there are limited data to corroborate the notion, several authors have identified that excessive physical activity and intensive exercise during childhood and adolescent years can inhibit physical development and bring negative outcomes during adulthood (Malina 1994; Naughton et al, 2000). Demorest and Landry (2004) highlight that faulty equipment, poor technique and excessive external stress/pressure placed upon a child during excessive training schedules are highly associated with overuse injuries. Likewise, it appears that the occurrence of epiphyseal fractures and avulsion injuries are more common during childhood than adulthood. This is because ligaments are two to three times stronger than bone (Bruckner and Khan, 1993), which may potentially limit growth-plate development and therefore actual physical development (Collins and Evarts, 1971). Naughton et al (2000) summarise that paediatric participants who complete in high volume training do have a greater risk of micro-traumatic injuries, particularly due to a continuing ossification process. Though there is limited evidence to identify a long-term risk, sport and exercise practitioners are advised to complete repeated screening to observe any significant trauma or negative effects on performance and normal life.

Nevertheless, several authors maintain the potential gains from performing physical activity and training during childhood and adolescence are much greater than the risks, with focus on skill acquisition, psychosocial benefits, bone mineralisation and energy balance maintenance. Borer (1995) highlights physical activity and exercise throughout life promotes numerous positive physical adaptations in human organisms, which is seen as being more important in comparison to any potential injury risk associated with such activities. Likewise, Rowland (1993) stresses that the available scientific evidence regarding the risks and benefits of early intensive training is reassuring, with little evidence of the human body suffering adverse long-term effects of regular training, and negative evidence is limited to cross-sectional investigations that fail to differentiate genetic conditions with training effects. Of particular note is the application of supervised resistance/weight training during such years to facilitate neurological and motor skill development (Demorest and Landry, 2004). Coaches and practitioners are starting to understand that, providing the activities are well-planned and monitored, there is minimal injury risk for participants. Moreover, as coaches improve their abilities to quantify training loads and incorporate the concepts of regular breaks within a suitable periodised model, it should help to monitor the amount of stress being placed upon a developing athlete to help minimise the chances of

injury. The incorporation of novel concepts when performing prolonged training regimes over several years, should theoretically further help to reduce such risks occurring. However, the implications of such a controlled periodised training concept for long-term physical activity and associated physical and mental health status, remains to be seen at present and is an area of required research. Moreover, how this will influence lifelong participation rates is of significant value for all 'Three Worlds' Continuum stakeholders.

Summary

It is apparent there are numerous sources identifying the physical developmental processes occurring during childhood and adolescence (Virus et al, 1999; Boisseau and Delamarche, 2000; Naughton et al, 2000; Baquet et al, 2003) and numerous conceptual models that encompass training prescription with such developmental processes to potentially help optimise future athletic performance (Riordan, 1977; Brokhin, 1978; Gilbert, 1980; Holm, 1987; Thumm, 1987; Sanderson, 1989; Touretski, 1993; Bompa, 1995). However, Norris and Smith (2002) correctly state the most essential component of an effective training programme is the concept of individualisation, which appears to be a limitation of these generalised models. It has been highlighted throughout this section that each participant in sport, exercise and physical activity will experience a different rate of individual development throughout life and if people want to optimise development, this should be duly accounted for. Moreover, Virus et al (1999) concisely state the lack of evidence between athletic performance and trainability against ontogenetic development makes any conclusions inaccurate, particularly for the notions of critical/sensitive periods of development. Unquestionably, these unique, individual, specialised rates of athletic performance development will bring dynamic fluctuation of 'Three Worlds' Continuum selection for subjects. Therefore, although researchers can accept the 'phenomenon' of 'trainability emphasis', there are many unexplained/supported variances as to why athletic performance changes so much during physical growth and maturation. It seems a large amount of preliminary research, helping practitioners to understand better the fundamental development of children and adolescents is required. There needs to be an evaluation of the application of such models, before future recommendations can be made, to help facilitate physical athletic performance from infant to adult (Beunen and Malina, 1996). Additionally, such preliminary future research should look to account for the flaws in prior training studies acknowledged throughout this section.

It should be noted that some of the literature cited during this section is primary sourced, with a direct longitudinal/intervention evidence base. However, other elements are based upon core textbooks and cross-sectional material that may lack causality, in addition to literature that is observational and subjective and has been translated into English; thus, its validity may be questioned. Therefore, as always, caution is necessary in any interpretation of research into practice.

Section Five: The Psychological Domain

The purpose of this section is to examine the psychological factors concerning participant development in sport. While there is no doubt environmental factors and social interactions play a crucial role in participant development in sport and physical activity, this section focuses on the role of intrapersonal factors as determinants of development. The literature is discussed in relation to both psychomotor and psychobehavioural factors, and how these evolve within current and proposed participant development processes. The ultimate objective of this section is to highlight the psychological factors that contribute to either top-level performance or prolonged participation (or ideally both) in sport, throughout an individual's life span. As with other sections of this document, our aim is to provide an informed overview rather than a comprehensive and all-encompassing review. Accordingly, the reader is referred to other topics or blocks of literature as and when pertinent.

Dual Pathway versus Continuum Approaches

Section Two provided operational definitions of key terms (PRE, ERE, PPW) and it is important these 'categories' are not considered in isolation or as implicit within agency and initiative in the UK, as dual and distinct pathways. Instead, consideration must be given to the 'Three Worlds' Continuum and how participants can move along the continuum and between the three types of activities. For example, Miller and Kerr (2002) argue that excellence at elite levels can only be obtained through optimal personal development. As highlighted by Abbott and Collins (2004), such development is a necessary, but not exclusive, precursor to elite achievement. Critically, however, if sport is delivered in a developmentally appropriate manner, both ERE/PRE and PPW are promoted, with the two goals considered as a continuum between which performers should be able to move as they change age, sport, social circumstance or simply preference. In fact, given the inherent difficulties of predicting who is going to achieve ERE (Abbott and Collins, 2004)⁹, an approach that specifically facilitates PRE and PPW seems a sensible foundation for both elite and recreational engagement in physical activity. This approach suggests limited funds may not be utilised optimally by investing in small groups of potentially talented athletes who may fail to achieve at the highest level or even drop out of the sport completely. Instead, many authors (eg Abbott and Collins, 2004; Baker and Horton, 2004) propose programmes must be put in place that enable children to develop the knowledge, motivation and skills they need to engage in lifelong physical activity. They acknowledge this will have significant 'carry-over' benefits to wider aspects of sport and physical activity.

Of course, this dual approach should not be considered as the whole answer, as several other models have been presented. While equipping young people with appropriate developmental skills (namely, but not limited to, self-motivation, self-determination and perceived and actual motor competence) will not *necessarily* result in elite performance (there is a wide range of other characteristics required, as shown in other sections of this review) it will certainly give young people the capacity and competencies to choose to be physically active for PRE and, if their capabilities and motivation permit, to strive for ERE.

There is already some understanding of the continuum approach to participation development in the literature. Côté's DMSP (1999), for instance, suggests participants may progress towards either elite sport participation or may, instead, choose to maintain involvement through the recreational years. The lifelong involvement in sport and physical activity (LISPA) model (National Coaching and Training Centre [NCTC], 2005) is an applied example of this philosophy that addresses the interrelationship between sport, physical activity and health. Positively, the model aims to encompass all levels of participation (eg ERE or PRE) *and* lifelong

⁹. Useful sources of information about Talent Identification are Abbott and Collins (2002) and Vaeyens et al. (2008).

involvement in sport and physical activity. Even here, though, there are still signs of the philosophically orthogonal dual-pathway approach. For example, the LISPA model expands Balyi's LTAD (NCTC, 2003) approach by proposing two main pathways: a recreation pathway that allows individuals to stay involved in sport and physical activity and achieve excellence in personally referenced terms; and an athlete development pathway that allows individuals to systematically move towards ERE.

An obvious limitation of these approaches is the manner in which they view each excellence pathway as distinct entities, a distinction which may have emerged from a misapplication of the orthogonal constructs that underpin achievement motivation theory (ie scores on task and ego orientation are assumed to be uncorrelated; cf Duda, 2004). In fact, against the goal of lifelong participation, which should desirably follow elite achievement, the design of any effective system must adequately allow for a continuum between these two goals. Such a consideration is missing from the stage models suggested thus far (eg Côté's DMSP and Balyi's LTAD models) since they propose linear models of development, which account for neither the many non-linear pathways inherent in development nor the 'return routes' that are characteristic experiences for many of the path to excellence. For example, while these development models (eg LISPA, DMSP and LTAD) describe appropriate participation at different stages of development, they offer little insight into how individuals move through and/or between different development pathways. At the very least, this is unfortunate as a development system should prepare each individual for informed choices about the challenges with which they engage across the lifespan, be they elite achievement in one context or another, personally satisfying participation or, ideally, both.

At the elite end of the continuum, such choice is exemplified by the recent emergence of talent transfer. The 2008 Olympic Games and Paralympic Games offered a number of examples of talent transfer between elite environments, with Great Britain's Rebecca Romero following up a silver medal performance in rowing from the Athens Games in 2004, with a gold medal in track cycling in Beijing. It is also important to note the activities of previously elite performers who now pursue more personal goals; for example, Sir Steve Redgrave's completion of the London Marathon. In an ideal world, the elite performer of tomorrow must be prepared, in a sufficiently generic sense, to enable personal choice **and** be equipped and motivated towards the personally referenced challenges of post-elite achievement, in the same or, more commonly, another activity. In some cases, this development may flow in the other direction when, for example, a recreational (PPW) or national-level (PRE) athlete develops into a very competitive international athlete at a later age. Tracey Morris and Mara Yamauchi (both Olympians and international medallists) are good examples of these categories. However, a commitment to lifelong physical activity is often lacking in former elites as inspection of a few former international rugby and football players may demonstrate. Unfortunately, there is little empirical evidence in the literature supporting this contention; although, the evidence of this occurring and its obvious desirability warrants an investigation of the factors that might enable former elite players to re-engage with physical activity and sport at the PRE ends of the participation continuum.

Ability

The stage models presented by Côté and Bloom outline how athletes pass through various stages of development as they progress from novice to elite (Bloom, 1985; Côté, 1999; Durand-Bush and Salmela, 2002), together with the requirements to achieve change within each stage. This stage approach clearly highlights the evolutionary nature of development; as such, the ability to perform to any degree of excellence is not an 'all or nothing' phenomenon, but rather requires a prolonged engagement with the development process (van Tassel-Baska, 2001).

While ability can be seen as the building block or defining feature of talent, the process of talent development occurs through a period of structured learning (Bailey and Morley, 2006).

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Logically, therefore, identification of potential must address both the 'ability to get there' as well as the 'ability to be there'. However, despite this 'clear and common' understanding, talent identification processes in sport have persisted with attempts to identify talented athletes, based on a limited range of discrete, outcome-based variables (eg performance at age 12) that are tacitly assumed to underpin senior success (Davids, Lees and Burtwitz, 2000; Abbott, Collins, Martindale and Sowerby, 2002). For example, many traditional and popular talent identification models (eg Scotland's Sport Interactive and Australia's Talent Search) use testing protocols based almost entirely on current performance (ie how well an athlete performs at **that** particular moment in time) as opposed to an individual's capacity to develop in the future (Abbott and Collins, 2004). As a result, these approaches fail to recognise the dynamic nature of talent, due to selection being based on a limited range of discrete variables (typically performance or anthropometric), apparent (perhaps opportunely) in a particular combination at a particular moment in time within a linear performance model (Ericsson and Charness, 1999), rather than identifying those characteristics which enable individuals to successfully cope with the 'ebb and flow' of the road to excellence.

The one-dimensional and static view of talent that underpins the majority of these talent identification models falls short in a number of ways. For example, it fails to appreciate the dynamic nature of the variables being measured (eg speed, flexibility, performance), which are highly unstable due to the influence of physical maturity and experience during development (Helsen et al, 2000; Helsen, Starkes and Hodges, 1998; see also Section Four of this review). For instance, the dynamic approach to human behaviour (cf dynamic systems theory; Davids, Lees and Burtwitz, 2000) speculates that behaviour involves the cohesive interaction of different subsystems (Baker and Horton, 2004). In this manner, even if some athletes have certain physical or anthropometric qualities that place them at an early advantage in particular sports (eg height and basketball), they must also have the desire and motivation to train at high levels (as well as other appropriate characteristics) to realise their potential (Baker and Horton, 2004; Schoon, 2000). As such, the unidimensional and static performance snapshots, central to many talent identification measures, fail to capture the capacity for those processes athletes must satisfy to eventually achieve excellence. A comprehensive evaluation of approaches to the identification and development of talent can be found in the academic papers of Abbott and Collins (2002) and Vaeyens et al (2008).

Other Precursive Factors in Talent Identification and Development

Of course, luck is another factor that may well play a role in participant development (Bailey, 2007); unfortunately, its role is too often dismissed as hard-pressed agencies strive for the illusion of complete control. It is important to identify, acknowledge and allow for these serendipitous influences, however unpalatable the implications may be. As physicist Niels Bohr observed: 'prediction is always difficult, especially when it involves the future'. The most effective styles of prediction are described effectively by Tetlock (2005), albeit in another field. Crucially, it is only dynamic and organic systems that seem to offer acceptable or even successful levels of predictive power. Thus, consideration for frequent evaluation and adjustment at an individual level emerges as the process of choice over the more systemic aspects that typify most sporting structures.

Interestingly, such apparently peripheral yet actually powerful factors permeate each of the domains reviewed in this report. For example, many (Perleth, Schatz and Monks, 2000; Côté, 1999; Helsen et al, 2000; Côté, Baker and Abernethy, 2007) suggest a range of environmental factors (eg family, schooling, date and place of birth) can all influence the likelihood of a child being identified as talented in the first place. One such factor, fortunately now recognised and acknowledged (eg Helsen et al, 2000; Musch and Hay, 1999), involves the individual's birth date with regard to the age grouping system in any particular activity – their relative age. A young athlete 'lucky' enough to be born in the first half of the selection year is likely to be identified as talented because he or she is relatively

older and more physically mature than his or her peers (Helsen, Starkes and Van Winckel 1998). Conversely, and reflecting other aspects of opportune experience, a child who is relatively younger, has never been exposed to certain activities, does not have access to appropriate facilities or the social or familial support to engage their ability, may remain undetected (Côté, 1999; Martindale, Collins and Daubney, 2005). For these reasons, many researchers in talent identification increasingly disregard the effectiveness of early identification processes in sport and, instead, place the emphasis on the development of the multidimensional factors that underpin the capacity a young athlete needs to realise their potential (Abbott and Collins, 2004; Bailey and Morley, 2006). This line of research neutralises (or at least minimises) the role of luck by systematically developing all the components of talent so individuals have both the ability and capacity for choice to engage in sport and physical activity targeted at either PRE or ERE or, typically, at earlier ages (Abbott and Collins, 2004; Holt and Morley, 2004; Martindale Collins and Daubney, 2005).

Emphasising Development Over Identification

Recently, literature has stressed the need for an understanding of the processes and associated characteristics that facilitate the development pathway of players (Abbott et al, 2007; Bailey, Tan and Morley, 2004). This marks a move away from the early identification of talent towards an inclusive talent *development* model. Abbott et al (2007) point to the importance of considering, identifying and developing factors which, over the course of time, may limit development. In the same manner Thelen (1995) suggests certain behaviours only emerge when the supporting subsystems and processes are ready. For example, in their 2007 study Abbott et al offer the example of lack of mental focus (Gould et al, 2002) as a factor that might hinder the development of a young, but otherwise 'talented' athlete. In fact, they question whether, in the absence of such a key characteristic as a positive work ethic, such an individual should be considered talented at all. Certainly, the subsequent development and deployment of this characteristic can result in unexpected and non-linear changes in development and performance (Abbott et al, 2002), reflecting the dynamic conception of talent advocated thus far. Simonton (1999) offers further support for this and proposes talent is not a static entity, but emerges over time both endogenously and in reaction to environmental factors (Simonton, 2001). Simonton's model of talent development also accounts for the multiple factors influencing talent and suggests these factors (eg innate ability, environmental factors, motivation and learning strategies) interact in a multiplicative manner. Even if a young athlete has the physical attributes to succeed in sport, his or her potential to develop is also dependent on other determinants of success such as commitment, motivation and the availability of developmental opportunities (Abbott and Collins, 2004; Baker and Horton, 2004).

Recognising that talent involves multiple factors, Simonton's emergenic model suggests individuals who possess heterogeneous profiles can still exhibit the same level of talent as long as no component of talent is entirely missing. This perspective clearly suggests there is no single genetic endowment underlying a talent domain (Simonton, 2001). From an applied perspective, this understanding of talent as multiplicative and dynamic highlights the limitations of unidimensional talent identification models, since these are based on linear and additive talent development models. Instead, Simonton (2001) suggests genetic traits are not manifest at birth, but instead develop according to epigenetic trajectories. Within this dynamic perspective, talent may manifest itself early or late in the performer's career and is constantly transforming throughout the maturation process. This perspective suggests the traits composing talent emerge with variable growth curves and with diverse fits and starts (Simonton, 1999). A critical point here is that talent may be identifiable in different ways at different stages of the development process. Therefore, talent development must be a dynamic process so an individual's talent can transform over the course of the lifespan. Recognising the importance of environmental factors (cf Ericsson, 1996), talent development is amenable to acceleration or retardation according to appropriate environmental incentives and stimulation. Simply, even though Simonton's model proposes that epigenetic trajectories are under genetic control, the exploitation of

these is not. As such, the optimal talent domain may not be stable over time but will change due to the multidimensional components that compose an individual's growth trajectory. Given these developments, Simonton proposed that as individuals develop, they may discover a greater inclination for a related, but distinct, activity. For example, a young sprinter might choose to transfer to a sport like rugby at a later age. Therefore, opportunities must be given to individuals to move between and within development pathways (and along the 'Three Worlds' Continuum) to meet their needs at particular points during their development.

In order to cope with the dynamic and complex 'pathway to excellence' and exploit the developmental opportunities afforded, an individual must employ a variety of skills to optimise development opportunities (eg first-time appearances at a new level of competition, significant wins and losses), adapt to setbacks (eg injury, slumps in performance) and effectively negotiate key transitions (eg selection, demands for increased practice) encountered along the way (Abbott and Collins, 2004; Côté, 1999). As a result of this complexity, it seems reasonable to tease out and deliberately promote the individual skills and characteristics required to meet these steps, as these may well be the key determinants of participation (Baker and Horton, 2004). Without these important skills and no matter how much ability an individual possesses, he or she may not maintain the motivation to achieve excellence at any level of participation.

All of this evidence supports the need identified earlier for dynamic, organic and individualised pathways based on regular evaluation and considered refinement (cf. the different styles of predictive thought espoused by Berlin, 1997). While these developmental characteristics of excellence are supported by strong empirical evidence as causative factors for achievement at elite levels of performance, the ultimate and broader aim must be to promote lifelong physical activity participation, PPW and PRE. Unfortunately, the descriptive development models currently available in the literature (eg LISPA, LTAD) fail to fully consider those individual factors that facilitate the realisation of excellence. In tandem with this weakness, views of talent underpinned by anthropometrics or physiology are more reflective of potential, rather than a capacity for future achievement (Ericsson and Charness, 1999). For instance, while height in basketball, or fast-twitch fibres in sprinting are significant precursors for elite performance and may well be signposts of potential ability (Abbott and Collins, 2004), an individual's capacity for future achievement is dependent on an array of factors, not least how they cope with the demands they face at different junctures of development. Current performance is, therefore, a poor indicator of ability since it is mediated by a range of other factors, such as training, support, parental investment (Bailey and Morley, 2006; Holt and Dunn, 2004). As such, while physical skills and anthropometric qualities are necessary precursors, it is important to consider the other factors that distinguish between potential and the ability to translate that potential into performance (Abbott and Collins, 2004; Bailey and Morley, 2006; Freeman, 2001).

Determinants of Participation in Sport and Physical Activity

Descriptive motives for participation

In order to maximise the potential of participant development models, it is important to consider the multiple reasons that individuals cite for participation in sport. Unsurprisingly, much of this literature has focused on children and could (perhaps cynically) be described as a theory-rich, but clarity-poor environment. It may be motivation is such a multidimensional construct, with substantial opportunity for individual differences to occur that, informative nomothetic data are hard to come by. In one typical investigation examining participant motivation in younger performers, Seefeldt et al (1992) surveyed over 8000 children and identified a variety of reasons underpinning involvement in sport, including to:

- have fun
- do something that I am good at

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- play as part of a team
- learn new skills
- improve my skills.

Interestingly, these motives are largely concerned with positive developmental outcomes such as skill development and enjoyment or with social interaction. In fact, most children cite multiple reasons for participating, reflecting an interplay between skill development, physical development and social interaction. As a notable challenge to the importance placed by some systems on early winning (eg tennis selections based on early tournament success), comparative success and winning were ranked lowly or not at all as a motive for participation, suggesting that young children place little value on these outcome measures of performance (Seefeldt et al, 1992). Instead, it seems children strive for opportunities in sport and physical activity where they can experience challenge, fun and enjoyment, which, in turn, increases their self-esteem and confidence (Weiss and Williams, 2003). This 'chaining' of variables, where one set seems to lead to internally moderated emotions, which then generate observable behaviours, such as adherence, is typical of the complexities underpinning this area. It seems, even with the use of sophisticated path analytic statistics, the best answers may be gleaned at an ideographic level.

Further to this, Carpenter and colleagues demonstrate that having fun is highly correlated with the desire to continue to participate in sport (Carpenter and Scanlan, 1998; Carpenter, Scanlan, Simons and Lobel, 1993), but fail to close the loop by defining what 'fun' actually is. In fact, this is a common problem with much of the work in this field. Siedentop (2002a) suggests fun is one of the most misunderstood concepts in sport and a comprehensive understanding of what constitutes fun is still rather elusive. Notwithstanding this, somewhat, fundamental issue, there is a large body of research advocating fun and enjoyment as key motives of sport participation (Weiss, 2000; Coakley, 2001; Siedentop, 2002a). These findings are subsumed within the participation motivation research that cites fun as one of the most important reasons for sport participation (Weiss and Amorose, 1992; Wang and Wiese-Bjornstel, 1997; Kolt et al, 1999; Weinberg et al, 2000).

It would seem sense to check for differences in how 'fun' is operationalised, especially since the concept is likely to be somewhat group-specific on the basis of ethnicity, gender, social setting (cf Section Six of this report) and age. In a useful attempt to examine one of these mediating variables, Dismore and Bailey (in press) conducted a comparative study of primary and secondary school children's understanding of fun and suggested the younger cohort equated fun to hedonistic values, such as excitement and pleasure, while their older counterparts described fun in terms of achievement and satisfaction. Similar evidence is available elsewhere in the literature with Streat and Holt (2000) suggesting children strive for activities that are fun, but this might not always be linked to outcome success, such as winning. In fact, while objectively defined success may be linked to fun, Wankel and Sefton (1989) suggest it is the child's perception of whether he or she performed well that leads to experiences of fun and enjoyment; an interesting distinction, which must be considered against the task and ego orientations for involvement espoused by some authors (eg Duda and Nicholls, 1992; Duda, 2004; Duda and Hall, 2001). As such, concepts like game involvement and perceptions of control appear to be among the factors most highly associated with fun experiences in youth (Bengoeschea, Spence and McGannon, 2005).

In attempting to apply the benefits of this research, the pursuit of fun is central, with authors stressing its early initiation and maintenance throughout the developmental pathway. For example, Côté suggests early participation in sport should be in the form of deliberate play as engagement in these developmentally appropriate activities fosters fun and enjoyment (Côté and Hay, 2002a). Scanlan and Simons (1992) posit fun in sport reflects both achievement and non-achievement factors and, therefore, can be both intrinsic (eg experience of participation) and extrinsic (eg winning) in nature. If children can experience this early in participation, these positive early experiences should underpin their

desire to maintain participation towards either PRE or ERE, depending on their ability and motivation (Curtis et al, 1999; Baker et al, 2003).

Given the increasing emphasis on 'effort' as a feature of progress towards elite achievement (eg Ericsson's deliberate practice construct or the recent work of Carol Dweck, 2006), there is a real need to explore the apparent (at least to some authors and practitioners) dichotomy between hard work and fun. 'Making it enjoyable' is a common mantra in youth sport for some environments, but the highly individualised conceptualisation of fun, which is perhaps the clearest outcome of the participation motivation literature, suggests this needs more careful consideration. Critically, we would recommend fun should not be considered as something removed from skill development or deliberate practice, even though engaging in deliberate practice may not always be enjoyable (Durand-Bush and Salmela, 2002). Durand-Bush and Salmela (2002) also suggest future work is needed, in line with other developments in the broader psychological sphere (eg Deci and Ryan, 2002), to understand the role of fun and enjoyment within deliberate practice.

There are also important interactions within the social setting here as young performers can gain 'fun' from social interactions within achievement settings. Social status in a group, feelings of belonging and the associated factors of coach praise and recognition have been shown as key factors for some individuals (Allen, 2003) and reflect the PPW definition highlighted in Section Two. In fact, the social milieu may be an important mediator of behaviour, sometimes promoting, but sometimes also limiting, the positive developmental experiences that are 'expected' to accrue (Stuntz and Weiss, 2003). In simple terms, the social setting can grow cheats and losers as easily as morally tough, 'Waterloo winners'. The role of the social environment is exemplified in the work of Martindale and colleagues (2005a; 2005b; in press), which is focused on identifying and promoting the characteristics of an optimum TDE. Reflecting these issues, our comments here should be considered in tandem with the social section of this review.

It is equally important to understand the motives adults have to participate in sport as these may well be different from those of younger participants. For example, Smith (1998) found a distinction between the motives of elite runners in comparison to recreational adult joggers. Whereas the elite runners were motivated by competition and winning, the recreational joggers offered more mastery-oriented motives for participation. For instance, they ranked the health benefits and the status afforded to them by non-exercisers as important motives for participation. These findings, once again, demonstrate the complex interactions between individual and socially mediated motives for participation. A sense of achievement and skill development were also cited as important factors for participation in sport during adulthood (Allender et al, 2006). Unfortunately, large scale population studies (eg Allied Dunbar National Fitness Survey [ADNFS] Activity and Health Research by the Sports Council and Health Education Authority, 1992) dominate the data collection associated with adult participant motivation and have precluded much theoretical work taking place. Although useful, the ADNFS does not offer a replicable instrument that is psychometrically validated. Nonetheless, these large samples do provide valuable descriptive data concerning the beliefs, attitudes and motives underpinning physical activity involvement in adulthood. The most important motivational factors for physical activity, cited in the ADNFS, were 'to feel in good shape', 'to improve or maintain health' and 'to feel a sense of achievement'. Adults are also likely to report 'independence' as an important motive for participation. Continuing this multi-factorial theme, Hardcastle and Taylor (2001) examined the motives of older adults and suggest a complex interplay of physical, psychosocial and environmental factors influencing participation during older adulthood. This cohort highlighted the social and health benefits of participation as critical factors underpinning their participation¹⁰.

¹⁰. Sport England's report *'Understanding Participation in Sport'* (2005) is a useful reference point for understanding the motives underlying participation in sport, especially for adolescent females.

With regard to our earlier comments, the centrality of perceived control and self-determination are common, if neglected, themes in the adult participation research. These areas are 'begging' for investigation and, if appropriate, exploitation through developmental (eg school-based skills development such as 'Developing the Potential of Young People in Sport' [DPYPS; Abbott et al, 2007]) and 'here-and-now' initiatives.

Descriptive motives for discontinuation in sport

Unsurprisingly, the picture of demotivation is as complex as its more positive counterpoint. The reasons offered by Seefeldt et al (1992) for dropping out and discontinuing participation in sport are equally as varied and include:

- 'It was no longer fun'
- 'No longer interested in the activity'
- 'I didn't like the coach'
- 'I want to participate in other activities'.

Critically, the majority of reasons for discontinuation are negative and this is likely to have a significant impact on future participation decisions (Butcher et al, 2002). It is estimated a significant proportion of children drop out of sport each year and, while some drop out of one sport and continue participating in an alternative, others discontinue participation completely (Gould and Petlichkoff, 1988). Adolescence is a period where discontinuation from sport and physical activity is at its peak (Hedstrom and Gould, 2004). Seefeldt et al (1992) sampled youth sport participants and noted that while over a quarter of children were participating in sport at 10 years of age, this dropped significantly to just over 3% at age 18. Females, in particular, noted that negative physical and emotional experiences in sport led to their decision to discontinue participation (Gilbert, 2001). This parallels other findings in the literature with Biddle et al (2005), for instance, suggesting females drop out of sport because it is too competitive and because they do not see themselves as competent¹¹. In a similar manner, males suggested that the competitive nature of participation led to their withdrawal (eg when they were unsuccessful; Seefeldt et al, 1992). Adolescents and young adults also describe transitions within education (and from education to employment) as having a negative impact on participation in sport (Cox, Sherriff, Coleman and Roker, 2006). However, self-motivation, self-efficacy and self-concept were described as differentiating factors between those who maintain participation during these transitions and those who drop out and discontinue participation. For example, the young women in Cox et al's study who 'never participate' suggested the transition to secondary school and beyond negatively impacted their participation since they had less time, less energy and their social groups had changed. They also noted they felt more self-conscious during this period and this led to their discontinuation in sport. Conversely, while the young women who 'always participate' experienced similar transitional challenges, they acknowledged that their self-motivation and commitment to sport enabled them to successfully negotiate these key periods of development. One key factor to emerge from this and similar work is the central mediating role played by self-concept and self-schemata (subjective cognitive generalisations about the self that are developed from the information we are constantly receiving about ourselves in different contexts, such as feedback from others or mastery attempts; Kendzierski, 1994) in developing the emotional responses of each individual to very similar challenges. In short, self-confidence appears to be a buffer to many of the factors often proposed as those which 'kill off' participation. We return to this theme later in the section on self-determination.

¹¹. Interestingly, the literature sees these two motives as overlapping. This certainly merits further investigation as the developmental literature would suggest they are directionally related; ie 'if I don't feel competent, I don't want to take part in (overly competitive) events that demonstrate this'. The fact non-competitive activities suffer an almost equal drop off supports the role of perceived competence as the causative factor.

For the moment, however, there is a clear need to track groups of youngsters longitudinally through adolescence in an attempt to discern and promote those factors that 'inoculate against drop out'. Of course, it is also important to consider the differentiating motives for ceasing participation in adulthood. The ADNFS categorises the barriers to preventing adults from taking more exercise into five main types: physical; emotional; motivational; time; and availability. Although time barriers appear to be important for both men and women, women are more likely to report emotional barriers to exercise (eg 'I'm not the sporty type'). This is likely to be related to perceptions of competence with individuals avoiding participation in activities because of self-presentational concerns (Biddle and Mutrie, 2007). These issues are discussed in more detail later in this section, but it is clear how self-presentational concerns can mediate involvement in sports where competence levels are clearly displayed. A lifespan approach is considered within these descriptive population studies, with suggestions that physical and emotional barriers increased with age, although time barriers decreased for those over 55 years of age. One major omission in the age-participation research continuum is specific consideration of those who 'return to exercise'. Consideration of this group and an understanding of the cognition-behaviour pathways leading to both drop out and 'drop back in' would seem to offer a fruitful potential for research.

Once again, a long-term view would seem both appropriate and potentially powerful, since lifelong physical activity is the aim, rather than a daily dose through secondary school curriculums. The literature suggests physical activity habits developed in childhood and adolescence may be associated with physical activity levels in adulthood (Curtis et al, 1999; Baker, Horton, Robertson-Wilson and Wall, 2003). Accordingly, an emphasis on early participation that promotes key developmental factors is vital (Kirk, 2005). In fact, an overemphasis on competition, resulting in frustration with lack of opportunity to play and improve skills, has been cited as a salient motive for drop out from competitive sport.

These motives for discontinuation indicate that the participant pathways generally available in sport (primarily ERE focused) do not cater to the needs of all young participants, particularly those striving for PRE. From the individual perspective, understanding the reasons underlying continuation and discontinuation in sport and physical activity is critical and encompasses factors, such as skill competence and psychobehavioural factors, as well as social factors, such as motivational climate. The following sections will discuss these concepts, focusing on how sustained participation and involvement can be encouraged.

Fundamental Movement Skills

It is well accepted that the development of a range of fundamental movement skills (eg running, jumping, catching, throwing) is a prerequisite for participation in sport and physical activity (Payne and Issac, 1995). Children who fail to develop this motor competence are unlikely to become involved in sport because they have inadequate skills to successfully engage in these activities. Even those who **do** initiate participation are likely to quickly drop out if they do not possess these fundamental skills because of the frustration associated with failing to successfully engage in specific tasks. Research clearly indicates that individuals tend to maintain their participation in sport if they value this participation as positive, if the activities are fun and if they allow for skill development and achievement (Jess, Dewar and Fraser, 2004).

The motor development literature highlights the basic movement skills acting as 'building blocks' for future, more specialised movement participation (Gallahue and Ozmun, 2002). As such, children should be provided with experiences to develop a range of fundamental skills, such as jumping, hopping, catching and throwing, as these basic skills facilitate both successful early involvement in sport (a prerequisite for prolonged engagement), as well as subsequent development in sport, either at elite levels or for personal accomplishment and participation. The significance of fundamental skill development is reflected in many of the

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development models previously discussed. For example, Balyi's LTAD model includes a fundamental stage of participation that occurs before any specialised skill development. In a similar fashion, Côté's (1999) DMSP suggests a sampling stage of participation is important for future participation as it will not only allow the individual develop a range of fundamental movement skills, but also gives them a broad 'skill set' that allows for diverse participation choices at later stages of participation. Unfortunately, the extent to which the relationship between fundamental movement skills and participation is genuinely causal is yet to be demonstrated; the argument limited by the paucity of empirical work in this field (Bailey and Morley, 2006). For example, Okely, Booth and Patterson (2001) found that while fundamental movement skills were associated with adolescent participation in organised physical activity, they only predicted a small portion of it. Despite this limitation, it seems implausible that an individual will achieve either PRE or ERE without a foundation of fundamental movement skills.

As Balyi's LTAD model has formed the foundation of many participant development policies employed within sport in the UK, it is worth offering a specific critique of this approach. While the LTAD model incorporates some valid and worthwhile recommendations, it is inconsistent and reports little evidentiary basis or academic scrutiny. A major component of the model is the suggestion that there are 'windows of opportunity' where the biological stage of development is crucial in identifying when most benefits will be gained from different aspects of development. Balyi also purported if a young athlete missed a 'window of opportunity' then those potential benefits could never be regained. Similar considerations have also been applied to the development of fundamental motor skills. In the LTAD model, Balyi argues that 'if the fundamental and basic sport specific skills are not established before ages 11 and 12 respectively, athletes will never reach their optimal or genetic potential' (Balyi and Hamilton, 2003, p.8). Evolving from this contention is the argument that young athletes must be identified at an early age if they are to engage in the requisite training to perform at an elite level and not miss crucial developmental windows. This is in contrast to much of the literature (Jess and Collins, 2003) arguing for late specialisation, with a focus on general stimulation and fundamentals during the early years for "'background" development of capacities for flexible maximum responses in the later years and higher performance categories, of participation' (Rushall, 1998, p 27). In fact, recent and growing research in talent identification suggests this early identification is misguided, ineffective and potentially unethical (eg, Abbott and Collins, 2004; Baker, 2003; Bloom, 1985; Côté, 1999; Durand-Bush and Salmela, 2002). As such, the continued existence of early specialisation is in contrast to the growing literature on the many psychosocial issues of long-term development, such as burn out and motivation (eg Côté, 1999; Gould et al, 1996; Fraser-Thomas and Côté, 2006). Furthermore, it is also apparent that fundamental movement skills can successfully be achieved in adulthood through participation in focused and specific programmes (eg Speed Agility Quickness (Polman et al, 2004).

Given recent data on growing levels of obesity and physical inactivity (Louv, 2005), a concentration on the factors that underpin movement along the 'Three Worlds' Continuum is long overdue. Participation development models should, therefore, ensure children are offered worthwhile activities from young ages that develop a solid foundation for the future. Wall and Côté (2007) provide a strong argument for the importance of early diversification and youth sport programmes that foster fun and enjoyment. In fact, they further postulate children who experience early involvement in sport that is not enjoyable drop out from the activity because they lack the intrinsic motivation to continue. This mirrors reasonable (Perkins et al, 2004; Scott and Willits, 1989), though by no means conclusive, evidence that physical activity and sport participation during childhood and adolescence is a significant predictor of physical activity in adulthood. However, Taylor et al (1999) argue this finding comes with a caveat. Specifically, children who have negative experiences in sport are less likely to participate as an adult (Gilbert, 2001). This reflects ample evidence attesting to the importance of positive early experiences to the development of high levels of expertise (Kirk, 2005; Côté and Hay, 2002a; Perkins et al, 2004; Wall and Côté, 2007). Unfortunately, few current procedures in sport and physical activity concentrate on the

systematic development of those factors underpinning prolonged engagement in a comprehensive and detailed manner. Kirk (2005) is a useful starting point for considering the importance of early experiences for lifelong involvement in sport.

Perceptions of Competence

While the development of a range of fundamental skills is an obvious precursor to successful sport participation, the benefits of this approach may be even more far-reaching when their influence on the self-schemata of an individual is considered (and hence his or her emotional response to experiences). An individual with a positive schemata for sport and physical activity would describe themselves as someone who likes being physically active and for whom sport and physical activity is important. The presence of a positive schema is considered critical for future participation in sport and physical activity (Cross and Markus, 1994). The motivation literature stresses the importance of perceived (as well as actual) competence in an individual's decision to both engage in and maintain involvement in an activity (Bandura, 1997; Fox, 2000; Horn and Harris, 2002). Therefore, if a broad range of psychomotor skills have been successfully developed from a young age, the literature suggests these will act as a basis for subsequent involvement as well as equipping individuals with the ability to make appropriate participation choices. Without the opportunity to successfully engage in fundamental activities from a young age, the child will lack the self-efficacy beliefs necessary to maintain participation in physical activity (Abbott and Collins, 2004). As such, actual competence enables choice, but perceived competence provides the drive to take the steps and persist in the face of difficulty.

There is increasing recognition of the important role played by the individual's perception of, and confidence in, his or her own motor skill. Jess, Dewar and Fraser (2004) argue that the importance of basic movement competence cannot be overestimated as it allows children to confidently pass through the proficiency barrier between simple activities during childhood and the more complex activities of adulthood. Without adequate psychomotor ability, children will not have the basic competence that acts as a foundation for lifelong physical activity participation (Jess, Dewar and Fraser, 2004). Thus, individuals with inadequate fundamentals and lower levels of perceived and actual competence engage in a vicious cycle where they tend to avoid social situations (like play) that foster skill learning. In turn, they have poorer relative skills than their peers, which leads to them avoiding subsequent opportunities for skill learning (see Figure 5.1). In this regard Seefeldt et al (1992) suggest 'Children who possess inadequate motor skills are often relegated to a life of exclusion from organised and free play activities of their peers and subsequently to a lifetime of inactivity because of their frustrations in early movement behaviour' (cited in Graham, Parker and Holt-Hale, 2004).

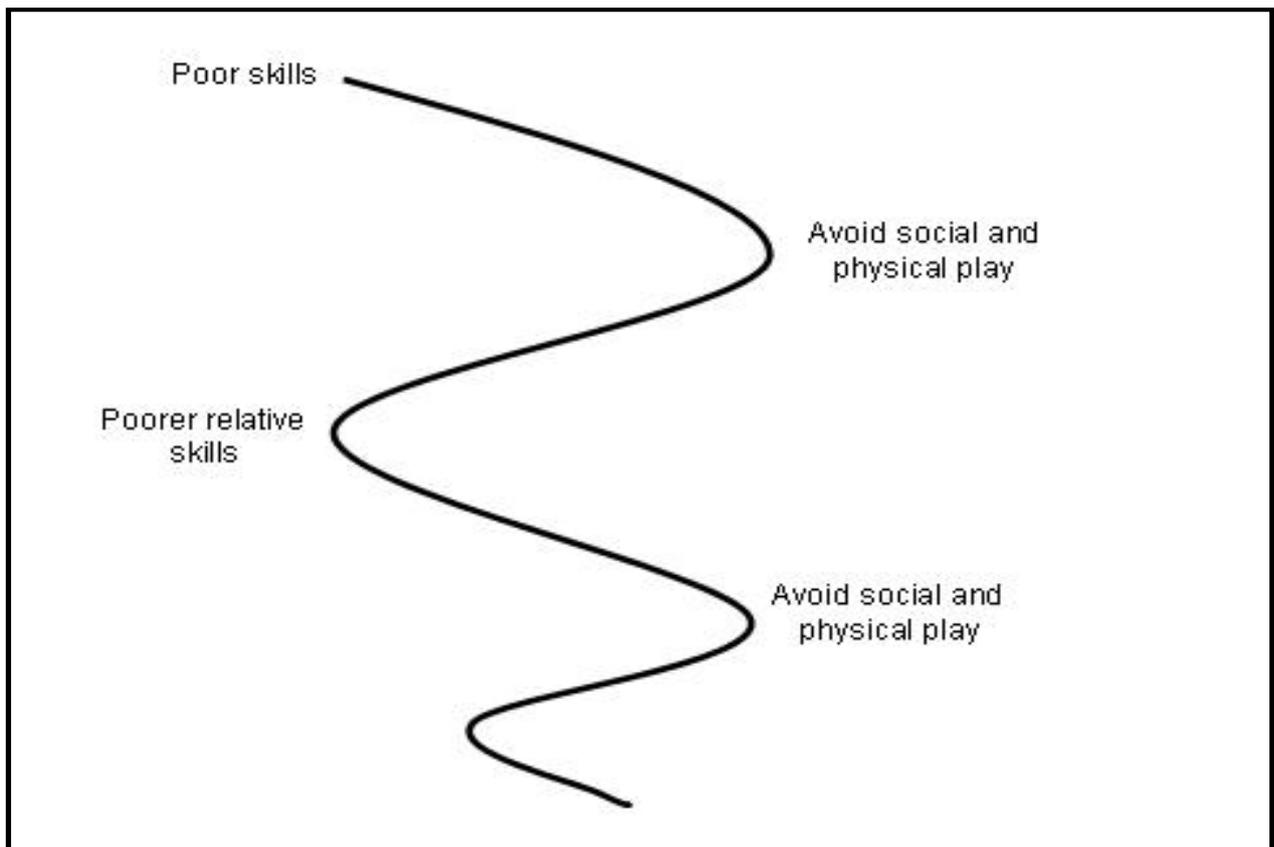


Figure 5.1: The negative spiral that results from poor actual *and* perceived skills

The Importance of Appropriate Early Involvement – Avoiding Drop Out and Staleness

The emphasis on fundamental skills is also in line with much of the literature discussing readiness for competition, especially with regard to psychological and cognitive readiness (Passer, 1996). Supporting the importance of perceived competence, several authors (eg Kirk, 2005) suggest quality early experiences through appropriate sampling and play activities develop high perceptions of competence that, in turn, lead to motivation for continued participation. Conversely, Wiersma (2000) argues development models not allowing for early diversification (eg the early-specialisation component of Balyi's LTAD model) actually limit development by reducing the number of opportunities for growth. For instance, the young athlete who is engaged in large amounts of deliberate practice from a young age misses out on the social opportunities sport and recreation can deliver (Wiersma, 2000). This process needs to be considered against the socially mediated consequences of an early, but overly narrow focus; namely identity foreclosure (Murphy, Petitpas and Brewer, 1996) and athlete identity (Brewer, Van Raalte and Petitpas, 2000). These social factors seem to 'kick in' at the later stages of development. It seems that early specialisers may use up their 'quantum of commitment' and, by the crucial transition age/stage of 18, may have just had enough of their sport. Certainly, the literature on staleness and burnout pertaining to adolescent dropouts can usefully be reconceptualised against such a 'too much too young' interpretation.

Social considerations notwithstanding, there is a growing literature base focusing on the negative outcomes associated with early specialisation (Côté, 2004). These, by contrast, seem to exert their major influence in the earlier stages of the pathway to excellence. Côté, for instance, suggests developmentally inappropriate early specialisation results in physical

(eg overtraining, staleness, failure to develop transferable skills), psychological (eg decreased enjoyment, sense of failure) and social (eg limited social opportunities) disadvantages. In fact, Wiersma (2000) argues the limited range of skills performed during early sport specialisation has the potential to limit overall motor-skill development and, with this, long-term physical activity involvement, by decreasing the likelihood of participation in alternative physical activities. In contrast, participation in a diversified range of preparatory activities during the early stages of development can augment the physical and cognitive skills needed to be successful in the participant's chosen activity (Côté, 2004).

As seen previously, those who drop out of sport cite a lack of fun and enjoyment as their primary motive for discontinuation (Ewing and Seefeldt, 1996; Weiss and Petlichkoff, 1989; Butcher et al, 2002). As highlighted earlier, with regard to early intensive training, it is crucial to check whether this lack of enjoyment is an inevitable characteristic of deliberate practice. In fact, it appears some level of maturation may be necessary before deliberate practice may become enjoyable. Butcher et al (2002) found lack of enjoyment was the most important reason for either transfer to another sport or out of sport altogether. Simply, the intensity of training needed during the early stages within an early specialisation model may not facilitate the enjoyment and intrinsic motivation needed for continued participation in sport and physical activity. Furthermore, development programmes emphasising early specialisation are firmly focused on ERE and do not offer opportunities for all youth to engage in sport and develop their talent to its potential (Fraser-Thomas and Côté, 2006). This emphasis on early specialisation also appears to limit the participation choices and 'return routes' that a performer has at later stages of development, especially if he or she decides to transfer into other activities. For example, a young swimmer who has specialised from a young age may not have had the opportunity to acquire and develop the necessary fundamental skills to successfully engage in other sports at later stages, for either ERE or PRE. The key message emerging from these findings is getting the early stages of participation right is vital to ensure continued participation throughout the lifespan.

These considerations are especially important given the non-linear pathways evident in development, where individuals may not move logically or linearly along either the recreational or elite pathways proffered by Côté (1999). While some individuals may choose to maintain their involvement in physical activity at recreational levels, others may have the opportunity to move between participant pathways (ie from a high-performance pathway to a recreational pathway) at different points during involvement. Specifically, individuals who have ended their participation at a particular point should have the opportunity to re-enter the system and re-engage with their activity at a later stage. Support for this is evident in Simonton's model of talent development (2001). Simonton proposes the optimal talent domain may not be stable over time but rather, will change due to the multidimensional components that compose an individual's growth trajectory. Simonton further suggests that, as new components evolve over time, the developing performer may discover a greater inclination for a related, but distinct, domain. For example, a young child may begin his or her sport involvement in one area (eg athletics), but end up excelling as a team sport athlete (eg rugby player) at later stages of development. In sum, this view of participant development suggests talent can develop in different ways for genetically distinct individuals (Simonton, 2001). In other words, adults with the same mature talent may have developed that talent through different epigenetic routes, while adults with different mature talents may have had similar childhood experiences. Moreover, even adults with the same mature talent may have experienced contrasting spurt and lull periods during development. For this reason, participant development initiatives must reflect this complexity in their procedures if they are to be worthwhile endeavours.

There are a number of key developmental issues that must be taken into consideration with very young performers, a particular issue for early-specialisation sports. For example, Lee, Carter and Xiang (1995) suggest a child's understanding of the relationship between effort and ability is a key dimension of his or her perceptions of competence. Up until the age of approximately 10 years old, children equate effort with ability and believe they can

accomplish most tasks if they try hard and put in lots of effort. Reflecting this, children up to this age generally hold very high, but inaccurate, perceptions of their own competence. However, between 8–12 years of age children begin to realise that their ability to complete tasks successfully is limited to more than just the effort they put in so they start to differentiate between ability and effort (Horn and Harris, 2002; Fry and Duda, 1997). Lee et al (1995) suggest this cognitive change reflects environmental factors, such as entry into competitive sport, where normative judgements are made about ability through comparison of one child with another.

Identifying and Promoting Causation

Obviously, identifying and promoting prolonged engagement in sport and physical activity represents the 'lodestone' for practice in this area and is the key outcome aim of the whole review. In pursuing clear and simple guidelines, however, it is also important to recognise participation in sport at all levels is multidimensional, and an array of factors (physical, technical and psychological) contribute to prolonged involvement. This complexity notwithstanding, we hope the preceding sections have made a tenable case for a single pathway in the promotion of participation, ERE **and** PRE. Returning to the key question, however, the objective of this section is to see if a route can be piloted through the complexity to generate meaningful and practical guidelines.

Until recently, little attention has been given to the multiple factors that impact on an individual's performance and development in sport and physical activity (Bailey and Morley, 2006). One example of the new wave of attention is Bailey and Morley's model of talent development in physical education. Underpinned by a multidimensional understanding of ability and a differentiation between potential and performance, their model acknowledges that a range of factors impact on an individual's development of an ability. The list included psychomotor, interpersonal, intrapersonal, cognitive and creative abilities, and this multidimensional approach describes the fixed and changeable variables associated with the realisation of talent in physical education (Bailey and Morley, 2006). Most pertinently for the present purpose, the model acknowledges the multiple and complex interactions, which must be addressed to optimise development. Reflecting this need, the psychological emphasis in the next pages must be considered carefully in tandem with the other sections of this review.

Psychological Characteristics of Participation and Development

Of all the factors contributing to the realisation of potential, psychological factors are increasingly acknowledged as key. As Muhammad Ali said 'the will must be stronger than the skill'. Reflecting the role of psychological factors as characteristic of those who achieve the greatest success in sport, our attention also encompasses the role of psychology within participation development models; unfortunately, a much less-studied aspect of physical activity participation.

Psychological Characteristics of Excellence

Determinants of performance

The role of psychological factors as determinants of performance is well established in the literature with Orlick and Partington (1998), amongst others (Gould et al, 2002; Williams and Krane, 2001), offering a range of psychological 'success factors' that contribute to the manifestation of excellence at elite levels of performance. In fact, psychological characteristics such as goal setting, realistic performance evaluations, imagery, commitment and confidence appear to be discriminating factors between medal and non-medal winners and, as such, somewhat crucial causative features.

Supporting these findings, Gould et al. (2002) observed that successful Olympic athletes were more committed and focused, and engaged in more extensive mental preparation than less successful performers. By contrast, less successful athletes were not as effective in their planning and experienced problems related to focus and commitment. Further support for this contention comes from the work of Durand-Bush and Salmela's (2002) with Olympic and world champions. They identified self-confidence and motivation as salient personal characteristics of elite athletes. Not only were these athletes confident about their ability to succeed (cf our earlier comments on perceived competence), they were also motivated to invest considerable time and effort into training in order to be the best they could be. In addition, these elite athletes employed imagery and self-talk to both prepare for competition and to remain focused during high-level performances. Thomas and Thomas (1999) found successful athletes not only utilised a variety of psychological skills during competition, but also used a wider range of mental skills during training (eg goal setting, imagery, self talk, emotional control, relaxation) than athletes of a lower standard. Reflecting this, Kane stated that: 'The ultimate factors accounting for achievement are likely to be the unique personal and behavioural dispositions, which the individual brings to the actual performance' (Kane, 1986, p. 191).

Getting there and staying there

While much of the emphasis has been on the skills needed to achieve at elite levels of performance, psychological factors are also able to distinguish between athletes who are able to consistently perform at the elite level and those who fail to maintain these high levels of performance (Ericsson, 1996; 2006). Durand-Bush and Salmela's 2002 report should be consulted for further information on the difficulties associated with maintaining high levels of performance. For example, Kreiner-Philips and Orlick (1993) have suggested that psychological factors underpin a performer's capability to reproduce consistently high levels of performance. As such, the ability to attain and then maintain elite status appears to be, at least partly, governed by the capacity an individual has to consistently engage with the performance environment and manage the unique pressures associated with being at the top of their sport (eg high expectations of performance; feelings of being 'chased'; Gould et al, 2002).

Determinants of development

In contrast to elite performance, the role of psychological characteristics as key determinants of development is a more recent topic for attention. Importantly, however, a very similar set of ideas are gaining momentum in the literature (Abbott and Collins, 2004; Abbott et al, 2007; Baker and Horton, 2004). It appears likely a similar set of psychological characteristics that facilitate elite performance also facilitates the successful negotiation of the development pathway (MacNamara, Holmes and Collins, 2006; MacNamara, Holmes and Collins, 2008). In fact, this isn't a new idea in the literature. As early as 1971, Kunst and Florescu highlighted the balance of psychological factors, motor capacity and anthropometric qualities as determinants of elite achievement. Pertinently, however, they stressed the even more crucial role played by psychological factors in talent development, with this construct accounting for over 50% of the variance in development efficacy. Crucially and unfortunately, however, they saw psychological concerns reflected as less than 15% of most talent development models at that time. Our own suggestion is, with notable exceptions, that this picture has still to change despite Bompa's (1999) more recent support for this contention, with his suggestion that psychological capacity was the most important determinant of talent development: 'It is more important for someone uninitiated to wrestling to possess the main psychological traits and the desire to wrestle because you cannot expect a beginner to have developed the motor capacity.' (Bompa, 1999, p. 286)

The clear message is that psychological factors play a central role in the effective evolution of potential into achievement. As such, participation development models should stress the development of the psychological characteristics that enable individuals to maximise their dispositional tendencies (Abbott and Collins, 2004). Abbott and Collins's term, PCDEs, encompasses both the trait characteristics (the tendency to...) and the state-deployed skills (the ability to...when...) that have been shown to play a crucial role in the realisation of

potential. As such, PCDEs are not just mental skills, such as imagery or goal setting, but also include the attitudes, emotions and desires young athletes need to successfully realise their potential (Martindale, Collins and Daubney, 2005). Interestingly, the list of PCDEs offered by Abbott and Collins (see Table 5.1) is similar to those psychobehavioural factors found to facilitate performance at elite levels (eg Gould et al, 2002; Baker and Horton, 2004).

Given the need to invest considerable time into one's activity for both PRE and ERE, it is not surprising attitudes and behaviours facilitative of deliberate practice are associated with effective development (Bailey and Morley, 2006). For example, determination and persistence (Bloom, 1985; Renzulli, 1986), self-efficacy and autonomy (Schoon, 2000) have all been highlighted as characteristics necessary for the attainment of excellence. Thus PCDEs are thought to underpin effective *development* in a number of ways. For instance, focus, distraction control and quality practice facilitate the acquisition of skills, while goal setting and realistic performance evaluations help athletes get the most out of each coaching session. Motivation, in particular, has been viewed as a critical component within the participant development model (Ward et al, 2004;). In sum, PCDEs allow participants to stay on the pathway to excellence by enabling them to invest the requisite time to practice and stay committed to the development process.

Table 5.1: Psychological Characteristics of Developing Excellence (adapted from Abbott and Collins, 2004; cf Orlick and Partington, 1998)

Psychological Characteristics of Developing Excellence
<ul style="list-style-type: none"> • Goal setting • Realistic performance evaluations • Imagery • Planning and organisational skills • Commitment • Focus and distraction control • Coping with pressure • Self-awareness

Unfortunately, while the role of psychological characteristics as determinants of performance is well established in the literature, our understanding and application of these as determinants of participant development is far from comprehensive (Baker and Horton, 2004). At an applied level, psychobehavioural skills are rarely incorporated into development processes despite the evidence attesting to their role as critical components of development. One exception is the Developing the Potential of Young People in Sport project developed by **sportscotland** (Abbott et al, 2007).

A Psychological Exemplar: Developing the Potential of Young People in Sport

There are relatively few examples in the literature that recognise the parallel importance of incorporating both psychomotor skills and psychobehavioural factors into development models. One exception, the DPYPS programme, was developed by **sportscotland** (Abbott et al, 2007) and placed a significant emphasis on the holistic development of the individual. The DPYPS programme recognises development is dynamic and evolving, and a range of factors is necessary to enable individuals to participate in sport to the best of their ability. The design of the DPYPS programme was based on the contention that a child will only fulfil his or her potential if the key developmental skills are central to the development process.

Accordingly, the DPYPS approach utilised a dual curriculum, encompassing both psychobehavioural skills (similar to the PCDEs previously presented) and psychomotor skills (similar to the fundamental movement skills highlighted earlier in this report). This approach equips young children with the skills necessary to be successful at early stages of development, as well as those skills needed for subsequent development, either at elite levels of performance or for lifelong participation. Essentially, the skills offered within the DPYPS programme are those psychobehavioural and psychomotor fundamentals that underpin learning, development and performance across performance domains and along the 'Three Worlds' Continuum.

Further information on the DPYPS programme can be found in the report published by **sportscotland** (2007). Results were encouraging, with statistically significant differences in activity uptake and adherence. Most promising, however, were the positive and child-led transfers of skills acquired through the programme to other arenas. Thus, for example, participants used mental skills to help with other school (eg drama) and social settings. The improved physical competence, actual and perceived, seemed to support a new 'have a go' approach, which underpinned the increases in physical involvement.

From an educational perspective, it is important to note these initiatives, presented through a sport-performance lens, were also positive in influencing changes in non-sporting and non-competitive environments. This integrated developmental approach neither excludes potential through inappropriate early testing procedures nor ignores any crucial developmental factors. Of course, further research is needed to maximise the efficacy of such approaches.

Psychological Characteristics Underpinning PRE

Also significant are the long-term health benefits of promoting and developing psychobehavioural characteristics in children. Fraser-Thomas, Côté and Deakin (2005) have highlighted how effective development processes not only develop skilled participants, but also ones that are healthy and psychosocially competent. The psychobehavioural characteristics underpinning development in achievement domains also seem to be the same characteristics that promote a physically active lifestyle. For example, enjoyment of the activity (Motl et al, 2001; Dishman et al, 2005), self-efficacy (Bandura, 1985; McAuley and Blissmer, 2000) and a range of coping skills (Buckworth and Dishman, 2002) are all key determinants of exercise participation. Thus, these psychological factors influence an individual's capacity to be physically active and underpin the competence to make appropriate health and exercise choices; a significant benefit given the growing physical inactivity levels of youth and the health risks associated with this inactivity. In short, from both performance and participation perspectives, there appears to be substantial benefit from the systematic development and facilitated deployment of these psychobehavioural skills.

As we highlighted at the start of the psychological section of this review, our aim is not to comprehensively cover all relevant theory and research on the topics considered. Our approach seems particularly apropos in this area; conceptualisations of exercise behaviour are many and varied, reflecting, as stated earlier, the attempts to nomothetically describe an extremely complex interaction of factors, which determine uptake, participation and maintenance of a compound behaviour. Accordingly and reflecting the individual orientation of this section, we focus on one theory which fits well with the approach emerging from the other topics, while also offering both practical guidelines and parsimonious explanation.

Self-determination Theory

Despite the significant benefits of participating in physical activity (eg Physical, Blair and Connelly (1996); Psychological, Biddle et al, 2000), approximately 50% of individuals drop out of exercise programmes within six months of commencement (Berger et al, 2002), with

even more experiencing lapses in participation (Sallis et al, 1999). This drop out can be attributed to a number of factors, including motivation, self-esteem, social physique anxiety and enjoyment (Thøgersen-Ntoumani and Ntoumanis, 2006). Regarding motivation, Wankel (1993) suggests individuals who participate in physical activity for intrinsic reasons and enjoyment are more likely to adhere compared to those participating for instrumental motives. Self-determination theory (Deci and Ryan, 1985) can be used to understand motivation and adherence, and proposes behavioural regulation towards an activity can be amotivated (lacking any intention to engage in the behaviour), extrinsically motivated (controlled behaviour) or intrinsically motivated (self-determined behaviour).

Notably, these classifications of motivation differ in the extent to which they are self-determined (Thøgersen-Ntoumani and Ntoumanis, 2006). Deci and Ryan (1985) suggest it is only when individuals are intrinsically motivated that their behaviour can be considered self-determined. Furthermore, Vallerand, Fortier and Guay (1997) argue these self-determined regulations are related to more adaptive behavioural outcomes (eg adherence) compared to less self-determined regulations. In fact, a growing body of evidence in the literature suggests intentions to be physically active and adhere to these activities are positively correlated with intrinsic motivation and negatively correlated with demotivation and external regulation (Ntoumamis, 2001; Standage, Duda and Ntoumanis, 2003; Chatziananis et al, 2003). In simple terms, self-determination appears to be the characteristic of choice if one is to focus effort on an individual's development. Furthering this case, Deci and Ryan (1991) also argue individuals with high levels of self-determination have stronger perceptions of control over their behaviour that are positively associated with prolonged engagement in physical activity. Unfortunately, there are some limitations to this work, especially from a lifespan perspective of development. Specifically, Berger et al (2002) note the need to examine whether these findings apply to adults since much of the research has been conducted with children and youth populations. Given the propensity for drop out and inactivity during the adult years, this appears to be a crucial line of enquiry that, as stressed in other sections, should be longitudinal in nature so the exact contribution of high self-determination to lifelong physical activity may be determined. For the moment, however, we would contend this individual characteristic seems to offer much potential for applied interventions.

Social physique anxiety (SPA) is another construct that is important in terms of lifelong participation in physical activity (Hart, Leary and Rejeski, 1989). SPA is defined as the apprehension an individual has about displaying their body in public settings (Hart, Leary and Rejeski, 1989) and has been related to exercise motivation (Smith et al, 1998) and self-presentation (Crawford and Eklund, 1994). In fact, Lantz, Hardy and Ainsworth (1997) found that individuals with high levels of SPA are less likely to engage in physical activity in situations where their bodies may be evaluated negatively. Therefore, in order to encourage such individuals to maintain participation in physical activity, consideration should be given as to how the environment can facilitate positive physical self-perceptions as well as developing the coping skills to effectively manage SPA (Sabiston et al, 2007). For example, an individual may seek support from significant others (Kowalski et al, 2006) to cope with SPA or exercise in social contexts that are less threatening (eg ones that include friends; Carron and Prapavessis, 1997). It is also important to understand how SPA relates to the self-determined, controlling and amotivated behaviours previously discussed. For example, Deci and Ryan (2000) suggest SPA is the outcome of deficiencies in self-determination. For example, if individuals exercise or participate in sport and physical activity for enjoyment or because they value the benefits of participation, they are less likely to be focused on how their bodies appear to others. As such, exercise that is regulated by intrinsic motivation should reduce SPA. Conversely, if an individual is participating in the activity to gain social approval or avoid social disapproval (eg extrinsic motivation), they are more likely to experience SPA (Thøgersen-Ntoumani and Ntoumanis, 2006). Crucially, development models must be cognisant of these factors if they are to equip individuals with the psychological skills necessary to maintain participation.

For the present purpose, the mediating influences of other constructs on SPA are important considerations. Firstly, the tie-in between perceived competence, self-presentational concerns and SPA itself should be considered. There is emerging evidence that high levels of perceived competence can prevent, or at least moderate, the impact of socially mediated anxieties, such as SPA (Boyd, Weinmann and Yin, 2002). Even more crucially, high levels of self-determination can effectively 'wash away' road-blocking influences of SPA or low perceived competence (Markland, 1999), enabling individuals to pursue lifelong physical activity as they wish (Ryan et al, 1997).

Developmental Differences in PCDEs

While the psychobehavioural 'success' factors highlighted in Table 5.1 are the behaviours consistently shown to underpin successful performance, it is important to recognise that these behaviours may be deployed differently depending on the characteristics (eg type of activity, physical maturation, cognitive maturity) and context (eg age, level of participation) of the individual. MacNamara and colleagues (2006; 2008) explored the use of these psychobehavioural characteristics in developing performers and found their application was on a developmental continuum from 'others' (eg parents, teachers and coaches) promoting the behaviours during initial participation towards the almost universal self-application of these skills at later stages of development. Abbott and colleagues (2007) and MacNamara et al (2006; 2008) should be consulted for further information about the role of psychobehavioural characteristics during development.

It seems likely that developing performers will apply psychobehavioural characteristics differently compared to adults, due to stage-specific challenges (eg amount of deliberate practice required) as well as developmental differences in cognitive maturation (Abbott et al, 2007). Simply, even though it is important to encourage young performers to engage in these 'champion behaviours' (Abbott et al, 2007), differences in their application during development must be understood. Thus, when attempting to define and operationalise PCDEs, it is essential to recognise how the cognitive maturity of the individual performer will impact upon how they deploy PCDEs. Abbott and Collins (2004) suggest PCDEs should be presented to individuals cognisant of their level of growth and maturation. As such, these key PCDEs should be developed in line with the challenges athletes face at different stages of development. Abbott and Collins (2004) propose that the aims of the progressive levels are to encourage children to:

- realise their level of competence and to self-reinforce
- take responsibility for their own development
- aspire for excellence by achieving autonomous development.

For example, although the ability to set goals is important throughout development, it may be operationalised differently, depending on the age and maturation levels of the young performer. In the early years, it may be appropriate for a young performer to follow simple teacher or coach-led goals. However, as the performer gets older and gains autonomy over their development, self-driven goal-setting behaviours become appropriate. The argument implied by this research is a lack of consistent and coherent emphasis on all the components that facilitate development limits the ability of individuals to realise their potential at levels of excellence commensurate with their ability. Once again, this points towards the necessity for a development system that is flexible, individualised and clearly focused on the needs of its participants.

Developmentally, there appears to be a significant difference in how PCDEs are deployed, with a shift in responsibility from others (eg parents, teachers and coaches) promoting and reinforcing PCDEs in the early years, towards self-initiated and autonomous behaviours in the later years (MacNamara et al, 2008). However, it is important to understand this change of responsibility doesn't occur automatically with age, but in response to the challenges faced at different stages of development. For example, individuals who are on a

pathway towards high-level performance are required to invest in considerable deliberate practice and technical skill acquisition from relatively early in their involvement. In response to these challenges, young athletes are usually more committed, have clearer training plans and are more focused at a young age than those on a 'recreational' pathway. Since the literature suggests psychological factors characterise the means by which an individual interacts with the environment and, therefore, the extent to which they make the most of the opportunities they are afforded, there appears to be a justified argument for a continual emphasis on these key developmental attributes early within development (Abbott and Collins, 2004).

Essentially, these differences in deployment can be understood from a self-regulation perspective. Specifically, as participants move through the development pathway they must learn to self-regulate their own behaviour without the support of significant others. This ability to effectively cope with the stressors of development and adapt to the challenges faced (specifically, increased autonomy and responsibility over one's development characteristic of the specialisation and investment years) is a key component of successful development (Côté, 1999). A self-regulated learner has the skills to self-monitor progress, manage emotions, focus on self-improvement and seek help and support from others when necessary (Petlichkoff, 2004). Conversely, an individual without these skills does not take personal responsibility for his or her own development, but relies on others and attributes failures to maladaptive reasons instead. Unfortunately, and reflecting many of the previous assertions, few development models systematically encourage the development of self-regulated learners (Petlichkoff, 2004), despite the support for the benefits of developing self-regulation skills is available in the literature (Zimmerman, 2000; Zimmerman and Kitsantis, 1997).

It is important to stress these self regulatory factors are equally relevant for ERE and PRE, and even find resonance in many of the ideas pervading the sport and physical activity participation literature (cf Standage, Duda and Ntoumanis, 2003). These apparent similarities merit further investigation; but for the moment, they offer further support for the comprehensive impact of interventions built around this approach.

Transitions: A Critical Consideration?

While Côté (1999) and others (such as Bloom, 1985) offer comprehensive accounts of the challenges faced by participants within each stage of development, these can seem slight when compared with the barriers posed by crucial transitions *between* stages of development. Unfortunately, the majority of development models available in sport and physical activity (eg DMSP, LISPA, LTAD) have focused primarily on the activities individuals should be engaged in at particular points during development. These models are underpinned by stage approaches to development that ignore the non-linear stages and transitions often encountered along the development pathway (Cecic-Erpic, Wylleman and Zupincic, 2004; Tebbenham, 1998; Schlossberg, 1981). Research has shown this ability to successfully transfer between stages of development is facilitated and characterised by the individual developing and appropriately deploying a range of psychobehavioural skills. Interestingly, and in keeping with other ideas presented in this section, Rose (1993) has highlighted how these psychobehavioural skills (eg goal setting, imagery) can help an individual progress through different stages of development and adjust to key transitional changes (eg increases in deliberate practice). Accordingly, used in tandem with other crucial support mechanisms, such as group influences and self-efficacy (cf Martindale, Collins and Abraham, 2007) these skills (almost identical to the PCDEs proposed earlier) can form part of an optimised 'development environment', which will offer the best start to the pathway, irrespective of its eventual goal.

Wylleman and Lavallee (2004) proposed a model of developmental transitions in sport that encompassed a holistic, lifespan perspective that spanned both the sporting and non-sporting career. This model suggests transitions overlap and interact at four different levels: athletic, individual, psychosocial and academic. Simply, the reciprocal and interactive nature of this developmental model of normative transitions recognises, for instance, the athletic transition into the investment years coincides with academic (eg transfer university), psychological (eg transition from adolescence into adulthood) and psychosocial (eg development of stable relationships) developments. Therefore, transitions within sport should be viewed as a series of events where athletes have to cope with new demands by finding a balance between these demands and the resources available to them (Schlossberg, 1981). As such, transitional challenges have the potential to be perceived as a crisis, a rite of passage or another positive step on the ladder, depending on the individual's perception and skills (Sinclair and Orlick, 1993). Indeed, Cecic-Erpic, Wylleman and Zupincic (2004) suggest this model should alert practitioners and researchers to the 'developmental, interactive and interdependent nature of transitions and stages faced by individual athletes' (p.517).

Without the ability to make these transitions successful, an individual is unlikely to maintain their involvement in sport or realise his or her potential, whatever the chosen level of participation. Some transitions are predictable because of their structural or organisational nature (eg transfer from sampling into the specialisation stage of development or from junior to senior levels of competition) and might be related to, for instance, changes in the athlete's level of performance. Conversely, there are also transitions that are unpredictable and may occur unexpectedly or perhaps, even, not at all (eg injury, change of teacher or coach; Petitpas et al, 1997). However, if transitions can be anticipated and the necessary skills checked and developed in advance, the pathway to excellence (whether ERE, PRE or PPW) can be considerably smoothed and the individual prepared for future developments. Again, this lends strength to our proposal to systematically incorporate psychobehavioural skills into development processes as these may be the key feature in maintaining progress along the turbulent and dynamic participant pathway. This approach would ensure individuals on a pathway towards ERE possess these skills in advance of meeting the key transitions of development, thus smoothing their development pathways. Finally, teaching such generic life skills a priori may also aid the transition of athletes 'cut' from an ERE pathway by facilitating talent transfer (Vaeyens et al, 2008) or continued participation towards PRE or PPW. As such, further investigation of these factors is useful from both a specific (this sport) and generic (ability to transfer to other activities) performance perspective, together with a much broader agenda encompassing lifelong physical activity participation.

Interestingly, even though different activities have unique requirements (eg golf and boxing), there appear to be common psychological characteristics that are essential for high levels of performance and even participation across different sports, with significant empirical evidence suggesting psychological factors are consistent predictors of performance, regardless of domain (eg Orlick and Partington, 1998; Smith and Christensen, 1995). Furthermore, participation development models promoting PCDEs not only encourage and facilitate children to achieve their potential in their current performance domain, but also allow for the 'cross-fertilisation' of talent into other domains at later stages of development (Moore et al, 1998). The literature supports this approach since the psychobehavioural characteristics that underpin ERE appear to be common across performance domains. Reflecting the lifelong participation models presented previously, a range of psychological factors may also enable individuals to move along the 'Three Worlds' Continuum if their focus of participation changes. In short, these psychobehavioural characteristics help individuals adapt to the different situations and contexts inherent in sport and physical activity (Abbott and Collins 2004). Regrettably, there are a number of limitations to this body of research, most notably an over-reliance on autobiographical (eg Bloom, 1985) and retrospective (eg Côté, 1999) methodologies. Longitudinal research is clearly needed to establish whether these findings are similar for all sport types, in all

contexts and for all levels of participation. An understanding of the 'generalisability' of these findings will help us understand the means by which development models can facilitate both ERE and PRE through a common agenda.

Summary

This section of the review demonstrates a well-evidenced need for programmes to focus on the development of characteristics, which promote and maintain participation over the longer term, in contrast to the 'daily dose' of exercise espoused by some authors (Twisk, 2001). The contrast is rather like promoting adult literacy by ensuring a daily school reading session, but with the absence of lessons to establish adequate skills in reading. Such an approach will, inevitably, result in frustration and demotivation (Could this be part of the drop-out phenomenon which typifies current adolescent participation?) and is doomed to failure. Such contentions can be tested by longitudinal tracking of children from times when all are comparatively active (eg six years old) through to times when drop out really kicks in (eg aged 13–14 years for girls). Our contention, underpinned by much of the evidence provided here, is that such an approach would offer more potential for genuine behaviour change than the 'snapshot' investigations focused exclusively at the problem age alone. In similar fashion (and reflecting our earlier contentions on transition), skill development in individuals, which anticipates the challenges underpinning drop out would seem to hold more promise than trying to address the issue mid-crisis.

Reflecting these contentions, is a genuine necessity to consider the training of providers at these crucial early stages, ensuring (we would suggest) an educational/developmental orientation as opposed to an 'activity leader' protocol. Put simply, the process is about education for informed choice throughout life, **not** the satisfaction of some guideline-imposed activity quotient.

Recommendations specifically related to the psychological domain¹²

Many youth sport programmes are overly concerned with immediate success rather than employing a long-term agenda, whether the eventual objective is ERE, PRE or PPW. Reflecting the longer-term focus, development models should be primarily concerned with the capabilities, skills and behaviours that are requisites for learning and development. It is, therefore, recommended that participant development models include these crucial developmental factors (psychobehavioural and psychomotor skills) as a key part of their recommendations for practice.

Unfortunately, current developments still suggest an ongoing trend towards early selection and identification in sport (Côté and Hay, 2002a; De Knop et al, 1996; Ewing and Seefeldt, 1996), with many youth sport programmes now demanding ever earlier specialisation and high levels of investment. The evidence presented thus far suggests such programmes may not be providing optimal environments for young participants, who are often not physically, psychologically, socially or cognitively ready to cope with the challenges early specialisation entails (Fraser-Thomas and Côté, 2006). As previously suggested, structured diversification during the early stages of participation can lead to the physical competence and enjoyment that promotes prolonged engagement in sport (Côté and Hay, 2002a; Côté and Fraser-Thomas, 2007) and provides the movement vocabulary and confidence, which underpins later achievement. Conversely, the most salient evidence advocating against early specialisation concerns drop out (Baker, 2003). Wall and Côté (2007) found young athletes who had dropped out of a competitive ice hockey programme had participated in more 'off-ice' training and had begun 'on-ice' training at an earlier age than those who stayed involved in the activity. In a similar fashion, Barynina and Viatsekhovskii (1992) found that swimmers who had specialised at an early age took longer to reach international level and, on reaching this level, did not stay on the team for as long and retired earlier than late specialisers. Overtraining from a young age can also result in staleness and with it significant psychological consequences such as mood disturbance, depression and increases in perceptual effort during exercise (Hooper et al, 1997). Considering that a central aim of participant development programmes should be on continued participation in sport across the lifespan, it makes sense that participation models place an emphasis on providing early diversification rather than early-specialisation pathways.

While each participant development model (eg Côté's DMSP, Bayli's LTAD, Ericsson's theory of deliberate practice) has peculiarities, a common theme is that prolonged participation in sport and physical activity requires a long-term commitment to the development process and an array of factors (eg psychomotor, psychological, social) contribute to the realisation of potential. While physical, environmental, motor and psychological factors all contribute to the acquisition of excellence, it is recognised that the relative importance of these variables may be dependent on the stage of development of the athlete (Figure 5.2). As outlined in a previous section, early psychomotor development is critical to equip individuals with a broad developmental base. Not only will these basic movements (eg travelling, object control and balancing skills) aid the individual's potential involvement in high-level sport, but these fundamental skills also support sports participation at all levels of attainment (Jess and Collins, 2003). Furthermore, psychomotor skills are crucial during the early stages of involvement as they act not only as a base for future participation, but also influence the developing athlete's perceptions of competence. Thus, a solid foundation of basic movement skills is critical for future successful performance and involvement in specialised games and sport (Doherty and Bailey, 2003).

¹² The psychological domain seems to have an especially close relationship with actual coaching practice. For this reason, we offer this addendum, which explores some implications of practice with regard to this domain.

Psychobehavioural factors appear to play an increasingly important role as the athlete matures. Figure 5.2 shows how the relative importance of psychomotor and psychobehavioural factors change as the developing athlete progresses towards excellence. As the athlete moves into the specialisation years, he or she is both physically and psychologically involved in his or her activity to a far greater extent. The focus is on technical mastery, technique and sport-specific skill development. During this stage a high level of dedication is needed and self-determination, hard work and discipline are characteristic of success (Ericsson et al, 1993). Physical ability is no longer solely sufficient for success, but psychobehavioural characteristics appear to play an even more important role. Indeed, research has shown intense training, rather than innate abilities, better account for skill differences between expert and non-expert performers (Baker et al, 2003). Given the increasing demands placed upon athletes at later stages of development, it is not surprising that attrition is such a frequent occurrence during the transition from the sampling years to the specialisation years (Côté, 1999). This is, in part, due to the increased investment in the activity at a time when many other aspects of the performer's life is also changing (Schlossberg, 1981). It would appear psychobehavioural characteristics are the salient factor in pushing performers through the barriers of athletic development and towards successful attainment in sport.

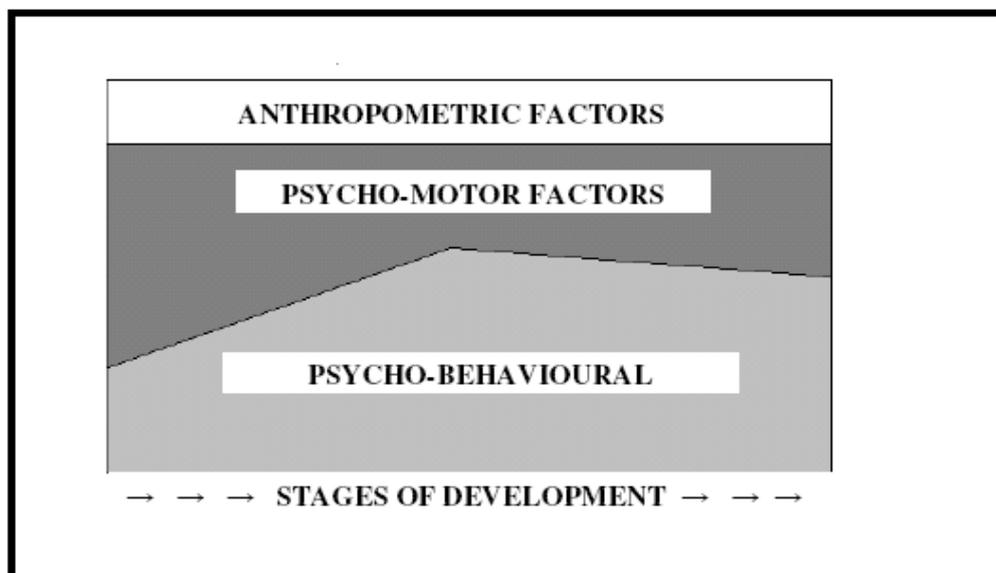


Figure 5.2: Relative importance of physical ability and psychobehavioural characteristics during development

Less well-researched, but completely consistent with the evidence presented, a focus on PCDEs may also serve to keep the young participant involved against the peer pressures that seem to underpin the young adolescent dropout. Specific investigation is merited but, given the well-demonstrated role of self-determination in activity choice, possession of personal psychological skills and self-confidence would seem a logical 'inoculation' against the socially mediated image-based challenges of puberty (cf Motl, et al, 2001).

Most models (eg DMSP, LTAD, LISPA) do not account for these key developmental skills, reflecting a significant gap not only in the literature, but also in applied practice. Moreover, these crucial psychobehavioural skills are often the preserve of support programmes aimed at performers competing at elite levels. A more effective approach, given the arguments presented thus far, would be to incorporate these psychobehavioural skills into development processes. From an ERE and PRE perspective, this ensures aspiring elites possess these skills in advance of meeting the key

challenges of development. While it would be advantageous to identify young athletes with both the physical skills to participate in a given sport and the psychological capacity to maximise the developmental opportunities afforded, the limitations of such approaches (eg unstable nature of the key factors) have already been discussed. Instead, Abbott and Collins (2004), among others (Bailey and Morley, 2006) suggest that all children should be encouraged (and equipped with the skills necessary) to strive towards their potential, irrespective of their current and, perhaps, short-term 'physical talent'. Serendipitously, this contention would also offer support to participation-oriented youngsters, providing them with the skills to pursue their own paths against the peer pressures, which characterise non-participation in later school years.

Once again, the need for careful consideration of systems to induct young performers into activity (at whatever level) emerges as a key construct. When designed and deployed correctly, these organisational structures quickly teach young children about where they fit into the hierarchies of peer ability in relation to specific tasks, such as sport, and contribute to the decisions that children make about their participation (Kirk, 2005). As such, participation development models must include early opportunities to develop sound levels of actual and perceived motor competence to ensure prolonged participation in sport and physical activity (Trudeau and Shephard, 2005). Monitoring the evolution of both and providing remedial steps as necessary, would also seem an obvious and essential feature. Without the fundamental movement skills and self-efficacy beliefs to compare favourably with peers, children are likely to lose the motivation to continue participation and often drop out of the activity completely. It would also be a worthwhile endeavour to provide support to participants during key transitions in their development, where their participation may be affected by changes in educational status (eg school to university) or changing relationships (eg moving out of the family home).

Unfortunately, as highlighted throughout this review, we need to explore further whether the interactive approach advocated within this section can cater for participation as well as excellence. While much research has focused on development pathways that lead to ERE (Law, Côté and Ericsson, 2007; Baker et al, 2003), less evidence is available on the factors that lead to PRE or just 'taking part'. While there is support in the literature for the benefits of participating in physical activity (eg health- and psychosocial-related benefits) there is less of an understanding about *how* to assure these positive outcomes can be developed and made available to all (Fraser-Thomas and Côté, 2006). This is especially important given that only a relatively small amount of people achieve excellence at high levels of sport compared to the potential for the majority of people to achieve PRE. As such, continued research is needed to ensure participant development pathways towards PRE and participation are understood. Such an educational and developmental approach would seem to offer greater potential for genuine behaviour change. In summary and, as a parting shot, reallocating the substantial resources currently focused *at* the problem to *anticipating and preventing* it would seem worth considering.

Section Six: The Social Domain

This purpose of this section of the review is to focus upon the 'social' variables that can affect participation development in sport. A wide range of evidence is provided and reviewed to cover the key areas that are inextricably linked to participant development and some key issues are focused upon in greater depth. While the existing empirical data tends to be focused upon young people, it cannot be forgotten that those of any age can be involved in participant development. Thus the heavy emphasis on adolescents/young people within this section is a natural consequence of the availability of data and studies to that effect.

More positively, however, it also reflects several pragmatic issues supporting such a focus. For example, school systems ensure initiatives aimed at this age group will have a guaranteed impact (as in 'they will experience them' as opposed to quality of these impacts). Furthermore, considerations within this and other sections of the review strongly suggest changes are best made, and the benefits maximally enjoyed, at younger ages. As such, it could be argued that the lion's share of resource and effort should be targeted at the younger ages.

Finally, it should be acknowledged that the interactions between the factors considered here (together with their interactions with biological and psychological factors, covered in other sections) are likely to be the most genuine causative factors. As such, while the present treatment is necessary for clarity, the reader must avoid the simple 'if...then' implications, which may seem obvious. In simple terms, solutions to improving participation almost inevitably *must* be multi-factored.

Identity

Before a review of the material on the family is undertaken, it is evident some discussion of the development of role and identity needs to take place. A key aspect of the social, psychological and moral development of (particularly) young people is the notion of identity and identity formation (Hendry et al, 1996). Sport is a well-known vehicle for the assimilation of these aspects through the socialisation process (Kirk and MacPhail, 2003) and this has been highlighted as a key part of the provision of opportunity and development of participation, particularly at a young age (Kirk, 2005). It is clear sports participation is important in the need to create, perpetuate and reinforce social identity, social capital and habitus (Bourdieu, 1978) within a given context, through the culturally symbolic nature and role of sport (Weiss, 2001). The development of such identity is achieved through the interaction of key variables (including gender, family, schooling and peers). In addition, the development of identity, role theory and, now, social positioning as tools with which to analyse sports participation is also increasing (Toms and Kirk, 2006).

The creation of identity and social capital (or shared belief and belonging) is important in sport (Bourdieu, 1978) and it has been noted young people with low social capital are less likely to participate in sport as adults (Swain, 2002). This creation of identity and cultural capital within education and sport as a requirement for lifelong participation has significant implications on models of participation development and sports policy at all levels. It has also been noted that the role of sport in creating these identities is vital, as children of junior age who do not have access to such activities use other means to assert their identity (Swain, 2002).

Family

Within the expansive literature on 'the family', encompassing parents and siblings, as well as acknowledging the wide and diverse nature of the family (Kay, 2003), there is considerable evidence that parents (in particular) have a significant effect upon their child's participation and development in sport. This can clearly have a positive influence through modelling (Toms and Fleming, 1995), providing opportunity (Kirk et al, 1997a) or reinforcement/psychological support (Carr et al, 2000) and these factors may underpin the advantages apparent for children from nuclear families in middle or upper classes. However, at the same time, there is also evidence that 'pushy' or disinterested parents can also have a negative effect. With regard to the existing empirical work, many studies tend to be focused on the psychological pressures placed on elite young sportspeople (Hellstedt, 1990; Hultsman, 1993; De Knop et al, 1995; 1998; Lee and Maclean, 1997; Kanters and Tebbutt, 2001; Lee and MacLean, 1997; Rowley and Graham, 1999; Kay, 2000a). With the family identified as the first point of socialisation into sport (and ultimately into society) it is clear this is a key and underpinning aspect to the entire sport experience of young people.

When assessing any sort of participation development model it is clear there is an urgent requirement that the role, impact and involvement of the family are a central focus. As such, there is evidence this is one of the key aspects that underpin participation, identification, development and retention of athletes within any model at any age (Côté and Hay, 2002b). To begin with it needs to be acknowledged that as 'the primary socialisation agency, the family governed children's activity in leisure as well as other domains of life' during the 1980s (Zeijl et al, 2001, p. 380). Since then, the focus has been on the consumption of life (as well as sport and leisure) by young people and there is a change in understanding from the socialisation process as a passive experience, to it being a more active, financially based choice for young people. This, in turn, impacts upon sports participation and development. As Zeijl et al (2001) identify, for young people it is now 'leisure capital' that focuses leisure experience and, ultimately, socialisation into both sport and adulthood. Thus, the family background (and socioeconomic status) can be seen as a direct link to sport, socialisation, opportunity and participant development.

The review by Kay (2003) goes some way to outlining the existing research with the family and sport, in both participation and policy. Kay (2003, p. 11) explains that within social research 'the family is recognised as a central social institution and a primary vehicle for social change'. As such, it would seem crucial for initiatives to work through familial structures at appropriate ages, rather than focus solely on the children themselves when they are older. Kay also claims that over the past three decades (one generation) there have been 'significant changes in the way families fulfil their two primary roles...their caring and economic functions...the most conspicuous changes affecting families have been changes in their structure, composition and development' (Kay, 2003; 11). An implication of this is the relative opportunity for young people to access sporting environments. These changes, compounded by the current economic conditions mean financial support for sport at grass-roots level within families is under increasing pressure.

The works of Kirk and MacPhail (2003) and MacPhail et al (2003a) highlight the way the roles and social positions undertaken by family members (particularly parents) have an effect upon the involvement of their children in sport. The social positions they practise impact directly upon the participation and continued participation of their children. The key point here being those who have family members involved in sport are more likely to be involved themselves.

With regard to how the family influences participation and involvement, Anderson (2001) points out there are social 'chains' (or, in other words, extended friendship groups) of children who pull one another into the sport scene with the aid and support of their parents. Zeijl et al's (2000) Dutch study identified that, of their sample of 927 young people, the majority of the younger age group (aged 10–12 years) spent their leisure time with their family and the eldest in the sample (aged 14–15 years) spent time with their friends. Zeijl et al concluded that no matter the age of the young person, parental involvement and influence was high and at its highest in the 10–12-year age bracket. They also point out a direct correlation (as Kay, 2003 also shows) between socioeconomic status and sports involvement at this age. Further to this, Zeijl et al (2000) indicate there was parental interference and pressure for the children to be involved in activities because the parents believed it would be good for them. Zeijl et al (2000) then suggested that, for children in Western families, the family unit governs children's leisure time and socioeconomic status now also governs participation, opportunity and expectations of what their leisure experience should be. Van Deventer (2000) comes to similar conclusions in his study of South African youths. While he also highlights the participation situation is reflected in the parental sporting lifestyle, he also concludes that the expectations of parents and young people is influenced by their ethnic background.

It is not just in sports participation that the family has a direct influence, since very often, before participation occurs, the family (normally the father) is vital to this initial interest. This also extends to the active supporting of teams at live games (as a spectator) and through the media. James, A. (2001), for example, notes that for children (aged 5–9 years) 'fathers were the most influential socialising agent into introducing children to sports teams and that the gender stereotyping associating sports with males was prevalent' (James, J., 2001, p. 233). This is also further highlighted by Whannel (1999; 2002), who asserts the inherent hegemonic masculinity of sport naturally leads to a father-son relationship in sports interest and, ultimately, sports participation; an important element to consider within any participant development model. In itself, this involvement helps to add both a moral influence on the child as well as an attributional one, both of which may impact further on the child's life/sporting habits in the future. This is also reflected by Moore et al (1996) who note that young people identifying their parents' roles do not always associate sport with their mothers.

Similarly, with the media Biskup and Pfister (1999) highlight young males' interests in role models in sport (which is greater than females) and is further reinforced by parents. Other studies have found a direct positive correlation between sports heroes and the parental motivational climate at home (Carr et al, 1999). In a study involving young female and male soccer players' mothers and fathers, it was found that the athletes who had higher perceived competence, enjoyment and intrinsic motivation had parents whom they perceived as positive role models (Babkes and Weiss, 1999). The fathers who were more involved in sport and their child's participation, also had children with more positive psychosocial behaviours. In a similar manner, Lin-Yang et al (1996) report that in their longitudinal study of young Finns (N=1881) the father's physical activity had a direct relationship with their child's activity and participation.

Inappropriate behaviour exhibited by parents in children's sports in the United States has also been examined (Kanters and Tebbutt, 2001). De Knop et al (1998) have conducted research into the attitudes of clubs to parents. However, they do not acknowledge the key issue of socioeconomic status through the notion of a purchase decision and the financial cost of parental support to become involved (Kirk et al, 1997b; Rowley and Graham, 1999; Kay, 2003). This throws up a number of theoretical issues about the quality of the experience and how this is measured from those who know the game to those who do not.

Yet, this is far more complex and the processes affecting a parent's decision is little understood (Green and Chalip, 1998; Babkes and Weiss, 1999). Kanter and Tebbutt (2001; cf David, 2005) acknowledge the increasing problem of inappropriate behaviour of parents in American junior sports leagues. This type of inappropriate behaviour in sport can create barriers to participation, whether it is in the form of psychological pressure (eg to perform), biological pressure (eg to develop/train at inappropriate ages), or social pressure (eg to emulate sporting role models). Although these inappropriate behaviours are not always easy to quantify, De Knop et al (1998) go some way further to identify similar issues found in voluntary club sport. The following types of parent were identified:

- the uninterested parent (who is never present at a sporting activity)
- the overcritical parent (who is never satisfied with the achievements of his or her child)
- the parent who yells from the sidelines (and often shouts louder than the coaches)
- the parent who coaches and gives instruction from the sidelines (often contradicting the coaches)
- the over-concerned parent (who is afraid of the dangers of the sport and threatens to take his or her child out of the sports club).

Each of these types of parent can have a negative impact upon the individual child, the coach, the team and, ultimately, the whole sporting experience at the club. It must be acknowledged that, in the dynamic structure of club sport, such a parent can disrupt participation to a level that can cause attrition. De Knop et al (1998) further argued 'little interest of the parents, low parental participation, sports clubs having the feeling of being used as a crèche, a shortage of executives and volunteers...these are some of the problems the average sports club more or less has to deal with' (p. 5). This is also noted by De Martelaer et al (2001) who discuss Hellstadt's Parental Involvement Continuum (from under-involvement through to over-involvement in the club) with a 'comfort zone' in middle range. They also provide evidence to say that 'parents are often willing to engage, but clubs fail to give necessary information about tasks, commissions etc' (p. 315). In fact it has been established that one of the ways parents become involved in sport is through becoming involved in coaching as volunteers (Cox, 1999; Cross and Brewer, 1999; Lyle, 2002; MacPhail et al, 2003a).

Obligation within leisure activity pursuits is also apparent when it comes to the influence of the family. This obligation, as a part of the leisure experience, can rob the participant of choice (Stebbins, 2000) and aspects, such as attending training sessions when all the participant wants to do is play (particularly if attendance is a requirement for match selection), can lead to drop out (as can a lack of skill and awareness through too much play and not enough training). Indeed, this idea of personal obligations from the parent's side, may actually be taking the child to the training itself or, conversely, using the sessions to babysit their children while they go and do their own forms of leisure pursuit (Stebbins, 2000).

Zabriskie and McCormick (2003) conducted an empirical study of 179 families in the United States and noted there were direct positive relationships between leisure participation and family satisfaction. They also conclude from their study that there is a conscious element of trying to strengthen the family unit through joint leisure involvement. Interestingly, they noted there is also a negative relationship between divorce and family satisfaction of leisure. To counter this Gilligan (2000) notes sport can have a positive effect on young peoples' lives in enhancing their resilience and self-esteem despite difficult home or other circumstances (eg divorce or familial death). Fallon and Bowles (1997) noted the structure and functioning of the family unit had an effect on the way young people spent time with their peers or their family. Clearly, the data suggest that a young person from a stable home is more likely to participate in sport and receive the support from their 'family' to do so and even more so if the family is already involved in that activity. This further supports the secondary analysis of Kay (2003).

Moreover, it should also be noted, as Fallon and Bowles (1997) highlight in their study, that the traditional family structure is more positively influential on sport and leisure participation than a non-traditional family structure. The suggestion here is a family with two adult parents can better support participant development than a single-earner family, as they have more time (and, possibly, a higher income) to manage the day-to-day reality of family life and also provide support for participation morally, financially and practically. An example of this practical support can be found in a study from the United States that looked at parental support through a sample of 1678 young people (712 male and 966 female, with an average age of 13). It was noted that parents transport their children an average of 2.13 times per week for sport, with boys transported more often than girls (Hoefler et al, 2001). This type of familial support (as Csikszentmihalyi et al, 1993 note with regard to music) also highlights families of high achieving children will often change their family lives to accommodate the needs of their offspring to practice.

Parenting styles also appear to have an effect on participation and development. A study of 1018 junior ice hockey players and their parents in Finland found that parenting styles (democratic or autocratic) reflecting the coaching style their children received, aided team cohesion and the children's continued participation (Juntumaa et al, 2007). This was particularly evident among those who had democratic parents and coaches; a finding that fits well with the construct of self-determination, presented in the Section Five of this review. Indeed, Wuerth et al (2004) note that fathers give a greater amount of directive behaviour than mothers, pressure on the athlete correlates with directive behaviour and successful athletes have more parental involvement than others. This is, clearly, a concept that deserves further consideration and has implications for any model of participant development. Indeed, this is especially relevant when it takes into account the triad concept of Jowett and Timson-Katchis (2005), which also involves the coach. On a sociological note, it is interesting to consider whether this concept accounts for the notion of the 'family club' (Toms, 2005), in which coaches are perceived as being like, and reflecting, the family environment from which the participant comes. In that respect there may be further evidence that it is the coaching environment that best reflects the home environment, which has an influence on participation and attrition. Research like this generates some important questions for those seeking to articulate an evidence-based model of participant development: Do like-minded people and those from similar backgrounds naturally gravitate to particular sporting activities? Does this perhaps provide some circumstantial evidence to link socioeconomic background and education to particular stereotypical sporting activities?

At the same time there are underlying agendas for those involved in the experience of club sport. These, more specifically, include issues such as expectations of what the club 'should' and 'does' offer the young people and what their underlying reasons for participating are. De Knop et al (1998) point out the issue of parental involvement and the expectations surrounding this. The expectations of the young people themselves, while appreciably being focused around the notion of 'fun, challenge and enjoyment' (Petlichkoff, 1993), tend to be further based around which developmental participation stage they are in (cf Côté and Hay, 2002a). In other words, those in the sampling stage look for fun and enjoyment and those who specialise tend to look for enjoyment of competition and winning (Côté and Hay, 2002a). There is also the element of adults' expectations on their children's ability, enjoyment and improvement (which come from both parents and coaches), and these may well vary. In alliance with this are the expectations of the coaches and parents who, as Côté and Hay (2002a; 2002b) highlight, can cause drop out and negative experiences of sport.

There is further evidence that 'parents do not necessarily view organised sport as an equivocally beneficial experience' (Green and Chalip, 1998, p. 96). Their suggestion (through a study of 157 parents with children enrolled in a soccer programme in the United States) is there is a significant element of 'purchase decision involvement' in youth sport. Clearly, this has implications for involvement, commitment and, ultimately, the experience and expectations of those involved (none more so than the parents who have made

financial commitments to the programme). Despite this having implications for organised sports programmes, the element of volunteerism and commitment to youth sport in the UK's grass-roots club system is also a key theoretical aspect to this study. Moreover, youth membership may be inexpensive and training sessions (for the majority of clubs) free of charge. The purchase decision made by the parents is, therefore, likely to be made in a number of very different ways and involving different criteria. Nichols et al (1998) explain there is a significant shift in the appearance and nature of voluntary sports organisations (under the umbrella of the voluntary sector). While this is relational to the notion of volunteers and participation, it is also linked to the idea of quality and experience and, crucially, Zeijl et al's (2001) notion of 'leisure capital'. Finally, all these considerations (eg what children want versus parental expectation versus club offerings) need to be tempered against what research suggests is necessary in the biological and psychological domains. It may well be the longer-term benefits for children, whether they aspire to performance or participation, are best served by a more genuinely educational/developmental agenda, rather than simply the 'fun-time' orientation, which can result in short-term adherence. For example, there are clearly specific developmental outcomes (such as structural strength or realistic performance evaluation) that should be promoted further within youth sport. However, how exactly these outcomes fit with the interrelated expectations/aspirations of each individual concerned is an area that requires further investigation. In short, the need to include elements of development and education (in the same way that 'Teaching Games for Understanding' has been used within physical education), in addition to the fun experience, may better help and inform the expectations and aspirations of all involved. An altruistic and holistic approach to each individual will be far more beneficial to the individual than the expectations of team sports and mixed ability/age group structures that currently exist.

Although there is a vast amount of empirical data on the influence of parents on participation there is very little that really defines how parents affect club sports participation. Moreover, it is acknowledged that club sport is the core of sport in the UK (Kirk and MacPhail, 2003), but there is very little research to explain how the interaction, choice or even participation link between family and club operates in practice. For example, much of the empirical data on sport identifies the family as important and there is little to suggest how this works. Only by examining the works of De Knop and colleagues in their 'Values and Norms Project' in mainland Europe, do we begin to see anything of the reality of the family-club link, and only through MacPhail et al (2003a) do we gain any sense of it in the UK. MacPhail et al (2003a) propose sports clubs are becoming integral to the sports experiences of young people as physical education time in schools becomes more limited and UK government and Sport England policies become more focused upon community-based club sport. Indeed, the five hours of sport per week, pledged by the Labour government in 2007 (identified at the time as 90% of young people achieving at least two hours of high-quality physical education per week, Department for Culture, Media and Sport, 2007) has resulted in around 50% of pupils achieving at least three hours of high-quality physical education and out-of-school sport each year (Department for Children Schools and Families [DCSF], 2009). This is still short of the 'aspirational' notion of five hours per week, but does appear to highlight an increase. In addition, the latest report (DCSF, 2009) also highlights a slight increase in school-club links from the previous year, indicating some further engagement within the physical education, school sport and club links (PESSCL) structures. The importance of club sport is further stressed by MacPhail et al (2003a) who report results of a 2000 MORI survey identifying that 80% of adults think sport is a vital part of children's development. This development is further highlighted through Siedentop's (2002) notions of functional goals for participation: educative, public health and elite development (cf MacPhail et al, 2003a). The developments of these goals are ones that can be ascribed to a social unit. While little is known about these units of club sport, there are clear analogies of a link to family life, nuclear construction and a supportive environment. In short, there are similarities between the traditional 'family' and the 'sports club'.

There is also some evidence linking clubs to the notion of family and there are a number of studies that establish there is a family environment within some clubs. Anderson's (2001) study of a Danish capoeira club noted 'adults invoked a family metaphor: "We're really like one big family; when we're out on trips, we take care of them"' (Anderson, 2001; 241). In this sense, the adult students acted as parents or older siblings of their younger teammates.

There are also allusions to this within the positioning roles noted by Kirk and MacPhail (2003). The parents fill the roles they create for themselves as non-attenders, spectators, helpers and committed members so it is clear they are involved in the club experience. Although Kirk and MacPhail (2003) do not differentiate between parents of samplers and specialisers, their grouping of parents does begin to illustrate this point. It also highlights further research needs to be done in this area. At the same time, their interpretation of coach positions also brings the family analogy to the fore since the coaches acknowledge they conduct these roles voluntarily and for the moral, social and physical good of the children; they are unconsciously ascribing to their practice that of the core values of parenthood. This analysis is similar to that of Zevenbergen et al (2002), whose study of junior golf club cultures emphasised familial habits that were congruous and reflected those of the club, resulting in acceptance and, ultimately, membership. This caring environment also needs to be considered against the wider aims of the club (eg the strength and evaluation agenda presented earlier)

The family is also important within the coaching process and can affect participant development. Jowett and Timson-Katchis (2005) identified how the notion of athlete triads (coach-athlete-parent) is important and the role of parents within this is vital to the relationship. They note that over-involved or over-supportive parents caused personal distance problems within the triad's relationships. They highlight these relationships are complex and multifaceted. Similarly, Wolfendon and Holt (2005) looked at talent development in tennis through a small sample study involving nine participants (three players, four parents and two coaches). Importantly, they noted parents were the most significant parties through their offering of emotional and tangible support, while the coach provides technical advice. They identified it as a 'team approach' where each party fulfils specific roles in the relationship. Martin et al (2001) conducted a psychological study on 239 adolescents and their parents' coaching preferences. The results highlighted differences between the requirements and expectations of the young people and their parents as to the type of coach they wanted. The study showed the sample had the same wishes for a coach to: (a) implement effective instructional practices; (b) perform the skills required of the sport; (c) provide opportunities for the athletes to compete and achieve their goals; and there were a number of discrepancies. Firstly, mothers (and fathers to a lesser extent) wanted their children to have opportunities to compete, but the children preferred a coach who could develop team spirit and friendship and who could also perform the task themselves. Clearly, this suggests a discrepancy and confusion of expectations and also highlights the complexity of the parent-child requirements in relation to a sports experience. Putting this into a dynamic sports club environment shows just how complex coaching expectation and reality really are within a family, and also between a family, coach and club. Martindale et al (2007, p. 194) further note, in their guide to talent development, that the 'key to educate all those involved - parents, coaches, peer groups, role models, teacher, schools and society as a whole', is a key aspect to any participant development model. Indeed, it is this need to further 'educate' and 'manage expectation' of all involved in sport that is crucial to participation.

From a slightly different perspective, Lally and Kerr (2008) studied the parents of retired elite gymnasts in the United States who noted their children's retirement from the sport had had an impact upon their own personal and social relationships, and left feelings of doubt over their lack of intervention behaviour with coaches. This investigation was obviously focused on the pursuit of ERE and there is clearly a further need to examine the extent to which parents feel coaches or teachers have met other aspects of the participant development agenda. What this research does highlight is the plethora of work upon the influence of the family on young people's participation in sport and physical activity, but, additionally, the dearth of work on the effect of the family on participation of those of any other age group.

To recap, the empirical data and research that has been conducted upon the influence of the family on sports participation, suggests strongly that young people who come from a two-parent family and from a higher socioeconomic background have a much greater advantage than those who do not (Kay, 2003). This appears to be linked to parental experiences and expectations, parenting styles and the involvement of siblings and peers in sport. There is little doubt that parental support (financial, emotional and practical) is a key aspect of any participant development model.

Socioeconomic Factors

The socioeconomic factors that can influence participation are vital in the consideration of any development strategy. While this is inextricably linked to the family, socioeconomic status has a significant influence upon participation from a young age, with the cost associated with membership, training, transport and equipment/kit having a significant impact upon participation outside school.

There are a number of studies identifying middle class children participating and receiving more family support than children from low-income families (Lin-Yang et al, 1996; Van Deventer, 2000, Zeijl et al, 2000; Kay, 2003). Those from low-income families are also more likely to drop out (Rowley and Graham, 1999). This is also reflected in national statistics where participation in sport by those of different income groups is highlighted (Hylton and Totten, 2001). Since there are also direct links to income and social class here, there are clear connotations and policy issues to be addressed. The acceptance of a family, 'cost' of kit, time, support and travel is key to participation and, as Kirk et al (1997a; 1997b) highlight, in sport generally, the cost to the family in terms of time, social and economic 'outgoings' can be heavy. It is not just participants who are affected by social and economic influences; for example, Coleman (2002) highlights coaches reflect the socioeconomic background of the participants in cricket.

It is already argued, when identifying talent (in soccer), an individual's sociological and psychological background needs to be taken into account (Williams et al, 1999). This is also evident within the game in Ireland, where players are still targeted from the working classes in soccer (Bourke, 2003). Bourke's figurational analysis highlights the complexity, pressure and power relationships of all involved, from the family to the professional club. More than this, it suggests that within sports themselves there is a traditional/stereotypical divide between socioeconomic status and participation. While it is simplistic to say the cost of sports participation can be low financially, it is key to note there are both time and social cost considerations that have to be taken into account when participating (Kirk, 1997a; 1997b).

This 'problem' of parents, time commitments and the like, is further substantiated in studies of youth sports clubs and volunteerism (Nichols et al, 1998), studies of positioning in club sport (MacPhail et al, 2003a), and the effect of sports participation on family life (Kay 2000a). The time demands on families of junior sports participants also emphasises the social consequences on their family and sibling relationships (Kirk et al, 1997a).

These social costs and benefits were linked more directly to the emphasis on changes to routine and structure of family life. Kirk et al (1997a) also argue that this cost and benefit analysis (as well as time) was a significant barrier to children's participation, which was further compounded by the lack of single-parent families available for this sample. Rowley and Graham (1999) support this and explain from their sample of 282 children in the UK that the cost of participation in intensive training (time and financial) led to drop out, particularly of working-class children and those from single-parent families. However, interestingly, Green and Chalip (1997) also note the soccer organisation used in their study was also a useful place for parental socialisation into their child's sport.

Further afield, the major economic and contextual factors on participation in Belgium and Flanders (in the Netherlands) have also been examined (De Knop et al, 1999). The latter highlights particular concerns around the privatisation of sport (increasing costs, legislation and administration) on sports clubs. They further note that this has a knock-on effect on the demographics and economics of participants from certain groups. Scheerder et al's (2005) longitudinal social stratification study found parents' participation and support determined their children's involvement and concluded that social background is, therefore, a key variable in participation. They also noted club-and-school organised activities, as well as gender being key variables. Similar concerns about sport in the UK have also been raised (Nichols et al, 1998). Geographically and economically, Côté et al (2006) studied the notion of an athlete's birthplace being a factor. They noted there was a significant over-representation of elite athletes within North America's National Hockey League, National Basketball Association, Major League Baseball and the United States Professional Golfers' Association, who were born in small cities (ie with a population less than 500,000). This suggests the opportunity, economic capacity and facilities for sports participation, development and performance are based upon a number of socioeconomic and geographical factors. The implications of such a study are important in any participant development model as place of birth has significant influence upon the opportunities available for participation (De Knop et al, 1999 and Bale, 2003). More recently, many sports in the UK (eg cricket) have been focusing upon inner-city areas and areas with traditionally poor participation rates to try to identify talent. On a wider scale, the interest professional soccer clubs now have in Asia and Africa, again highlights this 'potential', although these may also be for fundamentally economic reasons.

It is very difficult to separate family and socioeconomic status within the research evidence. In short, the evidence presented here suggests that those from higher socioeconomic status backgrounds will have greater opportunity and support to play and continue participation in sport throughout their lives. This complex issue (which links to the other domains within this review) additionally requires further detailed examination, but highlights the need for 'interactive' interventions when developing appropriate participant development models. For example, the Chance to Shine project (run by the Cricket Foundation) focuses directly on cricket in inner-city areas and state schools. Such a focus on developing interest within marginalised groups is important in any holistic model development. This is a serious consideration for those involved in developing participant development models and requires careful and appropriate analysis on general and sport specific levels.

Schooling/Education

Within a UK-educational framework there is a wealth of research that identifies the importance of the educational sector upon sports participation (cf Bailey and Dismore, 2004). In addition, the type of school attended (socioeconomic status), the geographical location (access to facilities and size of community) and educational attainment levels all impact on participation (Côté et al, 2006). There are a number of areas within schooling/education that deserve noting: it is the main societal institution for promoting sport and physical activity (Sallis et al, 1997); it can act as way of identifying and promoting participation and talent development (Bailey and Morley, 2006); and it provides

a social arena for young people to interact with peers in an environment where sports participation is often seen as central to individual development (Bailey and Dismore, 2004).

Within the dimension of peer influence in sport, school experience is central. Weiss et al (1996) conducted an inductive study on sports participation among groups of friends that identified 16 friendship dimensions (12 positive and four negative). They noted these reflect other work on friendship done in school situations and highlight the importance of peer domains on sport. They also noted there were few gender differences identified and that each gender had similar expectations of each other. This highlights the dynamic and unique relationships held within sports organisations and the way these are experienced by young people. Gold (1999) explains this further with the notion of a 'circle of friends' in which young people (particularly, in Gold's work on disabled youngsters) are provided with leisure and social support from their peers.

Relative age can also affect peer group members and their sporting success. Côté et al, 2007 note the greater one's relative age in a peer group, the more likely a player is to achieve success. The mechanism seems to be that children who are physically and biologically mature in relation to their peers will generally perform relatively well and, consequently, will be offered more chance to improve their skills. The 'relative age effect' is closely linked to the educational system of each particular country and the start date for their school years: children born in the first term of the academic year (September to December in the UK) will end up being between nine and 12 months older than schoolmates born in the last term (June to August). Research into relative age effect in sport identifies the over-representation of those born earlier in the selection period (Musch and Grondin, 2001).

Geographical location has also been identified as a key indicator of cultural practice and, therefore, sporting practice/access (Bale, 2003; Wright et al, 2003). Those who live in an area with appropriate educational and sporting opportunities are relatively advantaged compared to those who do not (Côté et al 2006). Therefore, within the UK, differential opportunity and competition needs to be taken into account. In short, living and/or being educated in an area that offers great opportunities for participation and competition in sport provides a distinct advantage.

Whereas educational policy is a key driver to participation development (Houlihan and White, 2002), the issues surrounding opportunity and types of schooling are varied. As a general discussion of these issues, there are clearly concerns surrounding educational policy and opportunity within physical education in the state education system, against that of the independent/private school system (Roberts, 1996). At that time, those children in the state secondary system experienced approximately two hours of physical education per week on average, whereas those in the independent/private school systems experienced around four to six hours (often increased with the provision of after-school activities). In addition, the amount of actual sports 'coaching' that goes on in independent schools is significantly higher (as is the level of organised interschool competition). This, in turn, is a reflection of research into socioeconomic status and income (which often provides greater opportunity for the independent sector compared with state schools). Indeed, the traditional (and hegemonic) usage of competitive sport in independent schools for keeping children occupied, consequently, offers a (normally) positive and supportive esteem provider within a closed society. This is relevant as this esteem value of competitive involvement in state schools may be lower and solely dependent on familial pressures or a favourite teacher. This link between social class, educational attainment and sports participation has already been well established within the empirical literature (Hasbrook, 1986; Kay, 2003). Within an educational setting there are data that suggest those who play sport for a school can enhance their identification with it (Marsh, 1993) and these young people tend to be from the higher educational bandings/streams. It must be noted, however, that even within the elite development system of sport there is an anti-education culture. An example of this is the case of soccer, where not only is there a perception it is

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for the academic low achievers (Bourke, 2003), but even within the academy level of the sport, there has been a significant polarised culture towards soccer and education and work (Parker, 2000).

Another issue is around educational ages and participation. While it is known there is a 'drop off' in participation when students leave compulsory education (Green et al, 2005), there is currently little evidence on the wider transitions. However, Toms et al (2009) have begun to explore the patterns and levels of participation of athletes in the UK (N=1047) during their schooling and have identified 'key moments' when both participation and training increases (the period of transition from primary to secondary school), as well as decreases (post-GCSE level and upon entering university) across club level sport. The transition periods between primary/middle schooling and school/college to university are central periods to the process of participation development and it has been suggested by Toms et al (2009) that these educationally related ages (more than the physiological 'windows of opportunity') are the most appropriate. Indeed, on linking this to the work of Bailey and Morley (2006) who call for a review of existing policy and practice away from club sport and back towards physical education as a vehicle for participation development, it seems a wider appreciation of the transition periods needs to be progressed.

The other key sources of socialisation revolve around the school, children's peers and sports clubs (Hendry et al, 1996). It is this key link to sports clubs and their importance in this process in both the socialisation and sports socialisation process to which the data now points. Socioeconomics of the family affect participation until later adolescence, when it is the young person's own socioeconomic background that has an effect. UK government documents (eg *Sport Raising the Game*) and strategies (eg PESSCL) highlight the importance of linking school sport to club sport in a developmental manner. Kirk (2005) notes physical education and PESSCL need a clearer structure and approach in order to improve participation. He points out that class, gender and disability are all barriers to participation and involvement in club level sport. Indeed, it could further be argued parental influence has an effect upon this as well.

So, it is clear that education and schooling have a significant impact upon the availability and opportunity for participation in sport. The research highlights there is a significant bias towards those who are educated in the independent/private sector, which, in turn, is linked to socioeconomic status and family background. A significant issue for any participant development model is a greater understanding of the transition ages and the opportunities available at those significant times in a young person's development. In addition, a greater and more coherent link between educational policy (eg PESSCL) and physical education participant development is required.

Participation and Performance

This section is split into two key topics: participation (or more generically, grass-roots sport) and performance. However, it is not easy to define the two within research evidence from a socio-cultural perspective. There is also an apparent dearth in research on adult participation and performance from a social perspective.

There is evidence to suggest young people's experience of participation in sport is not necessarily positive and can be emotionally painful (Brettschneider, 1999). Others (eg Morton and Docherty, 1980) have noted how, for some children, the promises of youth sport may never be fulfilled. Bizzini (1999) points out how modern society takes away the possibility of an autonomous experience of sport because a child's first experience (away from school) comes from a framework of organised club activity. This is further highlighted in the UK through Sport England, who claim that almost half (46%) of the population aged 9–16 years have been a member of a sports club (Sport England, 2000). In the UK, this is seen in a very positive manner, but Bizzini (1999) warns this may come at some cost and claims that 10% of organised sporting activities 'are unacceptable, exploit children and

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threaten their health' (Bizzini, 1999; p.28). This notion of 'club' is also important since in the UK clubs tend to be single sport with typically less than 50 members, compared to much larger multi-sport clubs from Europe (Nichols et al, 1998). Since this is relational to the notion of volunteers and participation, it is also linked to the idea of quality and experience. As Nichols et al (1998, p. 45) argue, clubs are now 'faced by the increasing demands of members for a service comparable with the private sector'.

Elling et al (2001a) follow on the work of De Knop et al (1998) with regard to club sport and highlight the theoretical notion that in Western society the functionalist nature of sports clubs is on a micro level to offer sport at a number of levels and on a macro level to integrate society. The idea and notion of a club and how it functions lacks any interpretive clarity; although Middleton (1986) provides an interesting ethnographic account (from a feminist perspective) of a sports club from a village perspective and Sugden (1987) offers an in-depth analysis of a boxing club subculture. Middleton's perspective sheds light on the inner workings and male dominance of a cricket and hockey club; the hierarchy, history and, ultimately, dominance over village life. This suggests that club sport in the UK also holds a key role within local and regional areas, and it is clear, in some places, there is a strong 'social' bond between the club and the area in which it is based (Kirk and MacPhail, 2003; Toms, 2005). This indicates the importance of the social and geographical make-up of the club within a particular town or village; they are socially dependent upon each other and the players/members involved (Toms, 2005).

On a more pragmatic note, the amateur and traditional way that club sport is arranged and coordinated (De Knop et al, 1998) has recently come under close scrutiny with political documents like *Sport Raising the Game* (Department for National Heritage, 1995) and *A Sporting Future for All* (Department for Culture Media and Sport, 2000) pointing to the importance of club sport in the development of young performers. What is important to note is that with such diverse organisations there is no set or correct way for them to offer youth sport, hence they are producing different (and, arguably, often haphazard) experiences. What is apparent is sports clubs do not always provide a positive reinforcing experience for young people in sport (De Knop et al, 1995; MacPhail and Kirk, 2006) and they may produce negative consequences such as injury, stress and social problems among others (FIMS/WHO, 1998).

More importantly, there is little empirical evidence of the role the sports-club experience has on these young people and how this can affect their participation and commitment in both the long and short term. However, studies into physical education and sports commitment have been conducted at high-school level by Carpenter and Scanlan (1998), who found commitment was directly related to involvement opportunity. At the same time, sport psychological research into involvement and commitment has also taken place (Iwasaki and Havitz, 1998), but there is little data on commitment from a sociological perspective. Carpenter and Coleman (1998) have approached elite youth cricket (9-17-year-olds) from this theoretical commitment perspective and identified that 'youth athletes join programmes for the opportunities they perceive to exist and leave when these opportunities do not present themselves or are available elsewhere' (p. 206). However, they importantly acknowledge care needs to be exercised when examining motivational outcomes and extrinsic motivation. Their claim is that commitment reflects persistence in an activity and accounts for the situations where individuals either want to, or have to, continue their involvement. However, the issue of commitment dynamics is not suitably addressed and what the study does not give is any qualitative empirical data to explain *why* these changes occurred and to what these changes may be attributed. Neither does it explain in any detail whether these changes were identified as either positive or negative, nor why these changes should occur at an 'elite' level. It can be surmised that at a grass-roots level even these (albeit unknown factors) may be further exacerbated.

Although in sociology there is limited research on expectations generally, the work that has been conducted tends to focus upon medium- and long-term lifestyles and material aspirations (Eskilson and Glenn-Wiley, 1999) rather than on medium- (and short-) term sporting social experiences. Grob et al (1995) have examined perceived control and expectations of adolescents in a longitudinal study of their personal, social and societal domains. They concluded that expectations and appraisal of activities were central to the adolescents' perceived control of their lives and particular social situations, and that these were inextricably linked. Lin-Yang et al (1996) also argue little is known about parental expectations and further work is needed to identify how these expectations affect sports participation.

Vanreusel et al (1997) highlight the issues around the continuation of sports participation from youth to adulthood and how this differs according to the type of youth sport career. They noted that the style of involvement (recreational or competitive) affects later involvement in sport, with competitive athletes maintaining participation longer than recreational athletes. Further, McGee et al (2006) note that participation in clubs and groups, influenced by parents (as well as friends and the school/work place), leads to a strengthening of relationships by taking part in sporting activity. These relationships further extend to religion, with Carpenter (2001) reporting sport as a valuable tool to promote social interaction (in his case the church). Moving away from sport, Nichols and King (1999) have noted that drop-out rates in the Girlguiding movement, between the ages of 9–15 years, are a problem. Concerns are raised over problems of how to recruit more volunteers, which echo the current issue with sports clubs.

The effect of youth sport programmes on participation and performance has also been explored and concerns raised about psychosocial development and the positive and negative effects of sports on young people. Petitpas et al (2005) discovered value acquisition and positive development occur when the context is appropriate for self-discovery, and internal assets exist when positive external assets and ongoing evaluation are around them.

Adult participation in sport at any level suffers from a dearth of empirical data. While there are numerous national surveys that indicate rough participation levels (such as the General Household Survey), much focused sports participation research is reliant upon the likes of Sport England. Data that does exist tends to be based more around health and medicine (Stamatakis and Chaudhury, 2008) than gaining an understanding of participation or development. The empirical data that exists suggests a change from active participation towards leisure involvement as people age (Brown and Frankel, 1993), and that older people become more passive consumers of sport. In addition, there appears to be a change of role, and it is the adults' involvement in their children's sports participation that begins to take centre stage (Kay, 2000a; Lally and Kerr, 2008).

Overall, the issues surrounding participation and performance are highly complex and interwoven and the performance (excellence) and participation stages are continuum distinct. There are important issues that need to be further understood, which are linked directly to the socioeconomic, family and educational background of the individuals involved. In addition, there are clear inferences that geographical location, availability of facilities and specific sports will be influential in allowing participation development.

Gender and Ethnicity

While gender has been briefly discussed earlier in this section, there is little doubt both gender and ethnicity are vitally important in the participation process (a fact not missed in the research noted in this area). However, underlying these are the key factors of: (a) family; and (b) socioeconomic status. It must also be noted here that much of this research is upon young people and there is little (apart from national surveys and the work of

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Brackenridge, 2007) that investigates the older age groups. Although this section is briefer than previous ones, it does highlight the complex interrelationship between gender and ethnicity (with the factors highlighted above) needs further examination in the participation-development context. However, in addition, it proposes further exploration of the works of Brackenridge (2007) on gender and Long et al (2009) on ethnicity, would be an important starting point for further research.

The reviews of girls and women in sport for **sportscotland** (cf Biddle et al, 2005 and Brackenridge, 2007) and Sport England (cf Cox, Coleman and Roker, 2006) are important in understanding the complex issues associated with participation. Indeed, each study highlights the key research around barriers and issues, and the approach by Brackenridge (2007) further explains the complexity of the area through the use of themes (eg women and age, family, participation etc). This, again, is important as there are important interpersonal areas to consider within the social domain and participant-development strategies need to reflect this complexity. The research base on gender and sport (Bailey et al, 2004) is fairly extensive and it is apparent that gender itself is a major predictor for sports participation (Garton and Pratt, 1991). Coakley and White (1992) have previously highlighted that gender is a key tenet of participation. In a more recent study on adolescent physical activity behaviour in New Zealand, gender differences were found (boys played sport more than girls) and it was noted that the existing gender stereotypes within gender appropriate sports were perpetuated (Dovey et al, 1998). There are also gender differences around the use of sport in young people's lives. For example, Frydenberg and Lewis (1993) identified that when coping with stress and change, young males tend to turn towards sport as a means of escape while their female counterparts turn to their friends and peers.

It is not just gender that is key here, but also expected social roles. Willming and Gibson's (2000) feminist empirical work on family life in the late 1990s highlights some of the key issues for women in leisure. Not only does it acknowledge many women suffer from 'role overload' through their diverse maternal, domestic and employment responsibilities, but also how the traditional patriarchal family unit affects women's leisure. A conflict of gender roles appears and leisure time often suffers. However, although Willming and Gibson (2000) do not define what they mean by leisure, it is clear that they do not mean organised sport. They highlight that women are more likely to become involved in leisure through the family than men. They also suggest this involvement occurs most when a child reaches middle-school age, and is more likely reflected through a mother's involvement in taking her children to a class or club, or playing with them directly.

The issue of gender roles (and also ethnicity/culture) are highlighted in more recent research (Long et al, 2009) and it is clear these are inextricably linked with family and class as well. Indeed, there is a plethora of research on these topic areas generally; although, little on participant development. More widely, it is clear the issues are complex and interrelated. Take, for example, the US study that identified Latina softball players who spent time negotiating existing academic attitudes and Latin American family structures in order to access and compete within the college system (Jamieson, 2005). While the likes of Carrington and MacDonald (2001) and Cashmore (2005) have detailed a number of the key issues surrounding participation of ethnic groups within sport, there are, clearly, other issues that impact upon this, such as socioeconomics, family background and educational opportunity. Both Sterkenberg and Koppers (2007) and Van DeVenter (2000) highlight the problems associated with participation that are linked to education and socioeconomic status. Within the work that has been conducted are issues surrounding stereotyping, role models and the media as areas in which many people encounter and reflect participation patterns (Sterkenberg and Knoppers, 2007).

The most comprehensive work on the area of ethnicity and participation is the recent review by Long et al (2009) for 'Sporting Equals'. This highlights the significant amount of research that has been conducted on issues of ethnicity and physical activity in the UK in recent years. Their literature review highlights the need for further research into the

diversity of participation within ethnic communities of differing cultural and religious backgrounds. In addition, they note the importance of understanding the particular social needs of participants within policy and practice in coaching and sports development. This is a key theme to be aware of within this aspect of the review, highlighting the particular complexity of issues even within a single domain.

There are clear issues linked to gender and ethnicity in participation at all levels and there appears to be an unequal opportunity for females and/or those from ethnic minority groups to access, participate and achieve in sport. In the evolution of any sports participation development model, it is clear additional consideration needs to be made for these areas.

Summary

This section of the review has attempted to provide an empirically based analysis of the social effect on participation. Although there is a bias (due to the general focus of existing research) on young people, there is clear evidence throughout of the importance of the family (and, in particular, parents) in the support and development of participation. However, at the same time there is also evidence that this support can have a significant negative effect if it is not well managed, which can lead to drop out.

The role of social factors in participation (as both reasons that underpin involvement as well as causing attrition) are complex, dynamic and multi-faceted. Clearly, there is more opportunity for involvement if an individual comes from a certain type of background (eg middle-class, well-educated, two-parent family, with a reasonable level of income). Indeed, within this is growing evidence that schooling is important and participation decisions in sport, taken at certain ages, reflect educational transitions (cf Toms et al, 2009) as well as the type of school attended (Bailey and Dismore, 2004). However, there are other factors impacting upon this (eg peer groups, cultural, religious and ethnic background), which are all important elements to both review and understand as part of participant development.

The findings reviewed in this section raise serious issues about the lack of appreciation of the social domain within most existing models of participant development. There are, clearly, elements that require closer scrutiny and analysis to ensure they are taken into account with any model/pathway of participation. Aligned with the other domains within this review many of these issues are inextricably linked (within and across domains), thus, the development of a clear model/pathway requires significant thought and development. Such a model/pathway may need to be sport specific, or could, indeed, be region, area or 'target group' specific. For example, a policy for the development of participation of children from single-parent families (which made up approximately 24% of families in 2002; Kay, 2003) is clearly an important aspect in general sports development policy. The use of focused and sport-specific strategies needs further encouragement and thought within generic sports policy as well as within the development plans for governing bodies for sport.

Section Seven: Summary of Findings and Ways Forward

Through the commissioning of this review and associated working party initiatives, sports coach UK has recognised the need for a participant-orientated approach to coaching. Indeed, the *UK Coaching Framework* aims to 'promote a holistic view of the child, athlete and player'. At its best a participant development model must be holistic, but must offer more than that. It should also address the complexity of interactions between different domains of functioning and offer clear practical guidelines and directions for further investigation and development, while providing an empirical and theoretical justification for these statements. Unfortunately, the current state of research in this crucial area does not provide a sufficiently comprehensive understanding of the key interactions between domains, nor provide a sufficiently firm base for future progress and application. Against this backdrop, we suggest our review of the scientific literature can act as a starting point for further exploration.

There is little doubt the emergence of participant models, like LTAD and DMSP, have brought significant advances in the understanding of sports participation. Much the same could be said for the progression of the *UK Coaching Framework*. Each has sought to move beyond the informal, ad hoc approaches that have characterised sports development in the past and offered an excellent basis for debate and evolution. This *Academic Review* moves the debate further by gathering, analysing and summarising relevant scientific literature, together with some summary recommendations to stimulate this ongoing debate.

This review is designed to be academically rigorous, with arguments supported sufficiently to provide clarity in the evaluation of existing initiatives and ideas. However, given the applied significance of the topic and the aims of sports coach UK itself, it must also provide some practical implications and directions for consideration and, where appropriate, implementation. Accordingly, and by way of summary, we conclude the review process by briefly addressing three questions that seem to be central to the continued evolution of sports coach UK's approach to participant development:

- **What do we know?**
 - Which claims are warranted by the available evidence?
 - Which findings ought to inform further planning?
- **What do we think we know (but don't necessarily)?**
 - Which claims ought to be treated with care?
 - Which proposals seem to go beyond the data?
 - Which presumptions require a cautious evaluation, or even, re-evaluation?
- **What do we need to know?**
 - Which areas require further research?
 - Which specific topics ought to inform sports coach UK's and related groups' future research agenda?

These summary statements are provided as a general overview. Each of the three domains examined should follow clearly from the evaluations made and evidence presented within the body of each section.

Table 7.1: Summary of Generic Findings

Generic	
What do we know?	<ul style="list-style-type: none"> Physical talent or anthropometric qualities alone are unlikely to lead to successful participation in sport or physical activity for either excellence in the form of high-level sporting performance or excellence in the form of participation and personal performance. Instead, prolonged engagement in sport and physical activity is underpinned by an array of factors (social, physical, technical and psychological). Fundamental movement skills are a prerequisite since they underpin the actual and perceived competence, which acts as a foundation for lifelong physical activity participation and the achievement of excellence.
What do we think we know (but don't necessarily)?	<ul style="list-style-type: none"> Potential for future performance can be identified based on physical, performance or anthropometric measurements. Early specialisation is a necessary condition to achieve excellence at high levels of sport performance. If 'windows of opportunity' during development are missed, an individual will never regain those potential gains and realise his or her optimal or genetic potential.
What do we need to know?	<ul style="list-style-type: none"> Whether the participant development pathways available in sport cater for the needs of all participants, particularly those not on a pathway towards high-level sporting achievement. How participation models in sport can equip participants with the necessary skills to make non-linear transitions (eg from a high-performance pathway to a recreational pathway; 'returners') at different points during development.

Table 7.2: Summary of the Biological Domain

Biological Domain	
What do we know?	<ul style="list-style-type: none"> Throughout infancy to adulthood there is a non-linear development of the human organism; with anatomical, neurological, muscular and hormonal structural changes. The variance in the rate of physical structural change of the human organism will affect the rates of fitness component development for an individual. Consequently, this will affect an individual's rate of improvement and/or timing of peak performance in sport, exercise and physical activity. Athletic performance development is also affected by the size of training stimulus and there is an optimal load to bring maximal change. The integration of these variables will affect an individual's position on the 'Three Worlds' Continuum.

<p>What do we think we know (but don't necessarily)?</p>	<ul style="list-style-type: none"> • Hormonal development is the underlying factor that will control athletic performance progression. • Applying a training stimulus during the accelerated maturational-related growth periods produces a greater athletic performance gain that cannot be obtained through equal training load at other times in the developmental pathway. • Practitioners that utilise concepts of long-term athletic planning models are aiding an individual's athletic progression and are helping to reduce injury risk. • Subsequently, such applied practice will contribute to an individual moving towards ERE from PRE on the 'Three Worlds' Continuum.
<p>What do we need to know?</p>	<ul style="list-style-type: none"> • More conclusive evidence to identify the actual accelerated and decelerated periods of athletic fitness components, using controlled longitudinal investigations, in addition to showing the factors that can affect changes. • Greater transparency, with supportive objective data, of the effect size and wider impact of specific physical training programmes to facilitate fitness component developments during infancy to adulthood. • If a maturational-related training response operates as a 'window', or if it is purely an accelerated change period. • Related to this, greater evidence to identify if exercise training outside of an accelerated growth period carries less worth than training within it. • The importance of using a generalised exercise/physical activity-related training programmes in comparison to sport-specific tasks in line with the proposed accelerated development periods. • The effect of genetic inheritance upon the maturational changes observed in athletic performance, using sports participation, exercise training and physical activity as an enzymatic tool. • Whether appropriate training prescription enhances athletic end-performance or merely allows an individual to achieve optimal performance capacity faster. • Applied stakeholder information for the long-term impacts of various training regiments upon subsequent achievement, performance and behaviour ('Three Worlds' Continuum).

Table 7.3: Summary of the Psychological Domain

<p>Psychological Domain</p>	
<p>What do we know?</p>	<ul style="list-style-type: none"> • The development of a range of psychobehavioural skills and characteristics enables an individual to realise their potential and make unrestricted participation choices across the lifespan, as well as facilitating movement across the 'Three Worlds' Continuum. • Motor competence (both actual and perceived) is an essential precursor to effective exploitation/application of the 'Three Worlds' Continuum. • Psychobehavioural characteristics (AKA metacognitive skills) play a particular role in countering pressures to drop out of sport and physical activity, most notably at the crucial adolescent stage.

What do we think we know (but don't necessarily)?	<ul style="list-style-type: none"> • Participants move logically and linearly through development pathways. • There are distinct developmental pathways for performance and participation (the dual pathway approach) that mean distinct and separate initiatives, agencies and research approaches are required to promote them. • Fun is primarily associated with immediate success in young participants; delayed gratification is not a common trait.
What do we need to know?	<ul style="list-style-type: none"> • How sport and physical activity participation models can systematically develop those factors (psychomotor and psychobehavioural) that underpin prolonged engagement in sport and physical activity. • What 'blend' of psychobehavioural characteristics is needed to avoid drop out at particular transitions during development and for specific populations. • In the specific case of adult participation, the ways in which early experiences and/or psychobehavioural characteristics may influence uptake, return to, or maintenance of, exercise habits. • How the context and characteristics of the individual influence the deployment of psychobehavioural characteristics.

Table 7.4: Summary of the Social Domain

Social Domain	
What do we know?	<ul style="list-style-type: none"> • Socioeconomic background and family influence participation (and support networks) within youth sport. Middle- and upper-class individuals from a two-parent family have more opportunity and resources to support their participation at all levels. • The opportunity to access and become involved in sports participation as a child is a major influence on continued participation during adulthood. • The interrelated issues around gender, ethnicity, schooling and also geographical location can directly influence participation. • Accepting that social issues are not necessarily in the control of the individual automatically highlights that their impact upon will be non-linear.
What do we think we know (but don't necessarily)?	<ul style="list-style-type: none"> • The educational background of a young person directly relates to their sporting success. • There are socially critical moments and episodes that can affect lifelong participation. • Social factors are correlational rather than causal factors in participation.
What do we need to know?	<ul style="list-style-type: none"> • Whether physical education policy and practice (both currently and as it could be evolved) is effective in maintaining participation development. • The transition stages within education and their effect upon participant development. • The 'real world' process through which people sample, specialise and invest in sport within the context of UK culture. • The reasons behind participation/drop out decisions and the critical moments and episodes that can be influenced. • How sports clubs and/or coaching 'work' as a means of maintaining and increasing participation in sport.

Models for Further Progress: Design Parameters and Considerations

Traditional models have tended to portray participant development as a relatively simple affair, in which participants' entry and engagement in sport/physical activity are almost exclusively determined by their interests, while their success is the result of their ability and effort. Clearly, such factors are of vital importance, but so too are a host of mediating elements, such as developmental maturation, the provision of skills within an effective development environment, socialisation and, ultimately, luck. Reflecting the traditional standpoint, and for the purpose of clarity, we have presented our analysis in terms of domain-specific research as a way of drawing out the main findings from the academic literature. Crucially, though, we do not believe that participant development can adequately be understood in such narrow, disciplinary terms. On the contrary, we suggest that any complex system, such as the interactionist nature of human behaviour, benefits from the enhanced vision provided by multiple lenses. On the basis of these contentions, we suggest future considerations in this (and, indeed, many other) aspects of human behaviour be truly interdisciplinary in nature.

Consider, by way of example, the phenomena of smoking uptake and cessation. This is a subject that has garnered a considerable amount of empirical research (cf Zhu et al, 1999) and evidence suggests uptake and cessation are influenced by a wide range of factors, as summarised in Figure 7.1 (below). Indeed, research suggests such health-related behaviours are best understood with reference to social, psychological and biological factors (Sarafino, 2001).



Figure 7.1: Factors influencing smoking uptake and cessation

Our contention is that participant development in sport is inherently more complex and multidimensional than smoking, which is somewhat binary in nature. Accordingly, there is a need for an acknowledgement of the diversity of influences on engagement in any models that purport to accurately represent or inform the process. One way of conceptualising its multifaceted, multi-factorial nature is represented in Figure 7.2 (overleaf).

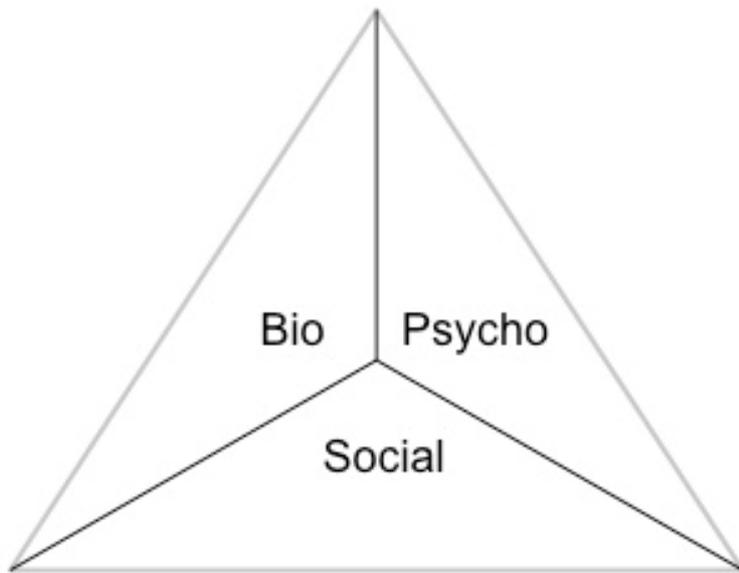


Figure 7.2: The biopsychosocial nature of participant development in sport

Our artistic ability notwithstanding, the main message is that while the different factors impacting on engagement can be profitably analysed as discrete elements that offer value, they should not be used solely and in isolation as the basis of policy and recommendations. This warning is especially noteworthy in light of the fact the two most influential models of development (LTAD and DMSP) are explicitly based on relatively narrow disciplinary perspectives (physiology and developmental psychology, respectively¹²). A biopsychosocial perspective undermines simple equations of participant development with biological maturation, psychological development or social factors. In fact, almost any feature of human development understood holistically is far too idiosyncratic to be reduced in this mono-disciplinary fashion.

We wonder whether some of the well-known stage models of youth sport, in which young players are claimed to progress through discrete developmental phases that related directly to their maturational readiness, are mediated by rather more mundane factors like transitions within schooling systems and the differential access to specialist teaching and facilities. In similar fashion, the widely acknowledged and often considered drop out from physical activity by young women is hardly explained by a unidisciplinary approach. It is neither due to hormonal change, nor peer pressure, nor social expectation, but rather a subtle and probably individual-specific interplay between these and other factors drawn from all three domains. Extending this argument to its logical application, it is unlikely that a fitness-indexed activity programme, a self-concept-boosting initiative, or a 'group vote for content' physical education programme is likely to generate a significant impact in isolation. Notably, all three have been tried in recent years. Rather, effective models and effective interventions are almost of necessity, required to address all three components and their interaction. In short, the biopsychosocial approach offers an effective basis for modelling *and* manipulating this crucial, but complex, facet of human behaviour.

¹². We are not suggesting, of course, that either of these models set out to provide a comprehensive account of participant development. However, we do argue that this is the way they have been interpreted by some initiative funders and national sports groups.

The applied aim for any model in this context is to explain, predict and enable the modification of human behaviour. Unfortunately, the ability of models like LTAD and DMSP to account for the patterns of participation in different national contexts is equivocal. For example, Côté's description of young people's socialisation into sport (Côté and Hay, 2002b) has received support from MacPhail and Kirk's (2006) study of an athletics club in England. Notably, both these examinations came from a unidisciplinary approach. However, both Côté's model and Balyi's much more detailed and prescriptive-phased account (2001a; 2002), have been thrown into doubt by Toms' (2005) study of young cricketers' socialisation into their sport. In keeping with our interdisciplinary proposals and the evidence presented in this review, Toms found involvement in their sports club was contingent on positive, socially mediated episodes, psychological support and motivation, as well as physical ability and that the actual, 'real-world' experiences of young people did not follow a linear trajectory (see Figure 7.3, below). Similar findings of non-linearity and a complex interaction of influences are increasingly common in investigations of related topics (Ollis, Collins and MacPherson, 2006).

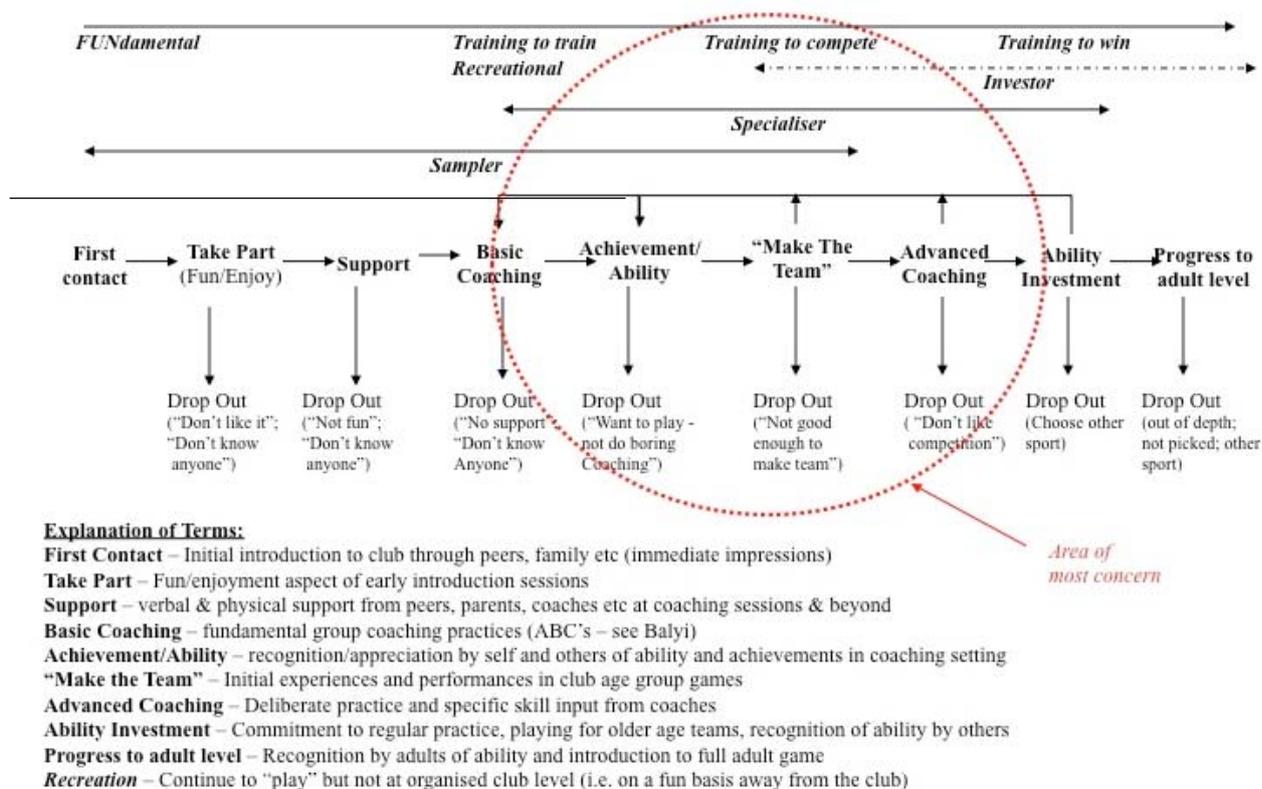


Figure 7.3: A thematic conceptual model of the development of experiences of young cricketers aged under 13 years (Toms, 2005, p. 113)

None of this is intended to argue against the need for models of participant development. On the contrary, we reiterate our conviction that models like LTAD and DMSP have proved to be extremely valuable in promoting a developmental, evidence-based perspective in sport. Their weakness is not in terms of their content, but rather in their scope and application. Models are intended to represent meaningful conjectures about the varied factors that impact upon a particular phenomenon or situation, their possible interrelationships or causal sequence. Their value lies in the extent to which they can be critically evaluated to investigate their coherence, their evidential basis, their internal consistency, or whatever happens to be of interest. As we discussed in Section Three of this review, time and testing may see some models develop or contribute to an emerging theory. Others will wither and die; that is the nature of science (Popper, 1934).

The point is it is the testing of models, not their creation, that is of greatest value. This suggests that policy makers and practitioners ought to view all models with caution: they are provisional and permanently so (Bailey, 2000).

From Two- to Three-Dimensional Modelling of Participant Development

Perhaps we can represent the holistic nature of development more effectively by a three-dimensional, rather than two-dimensional image. Consider, then, Figure 7.4 (below), in which the three segments of a sphere represent the elements of the biopsychosocial complex.

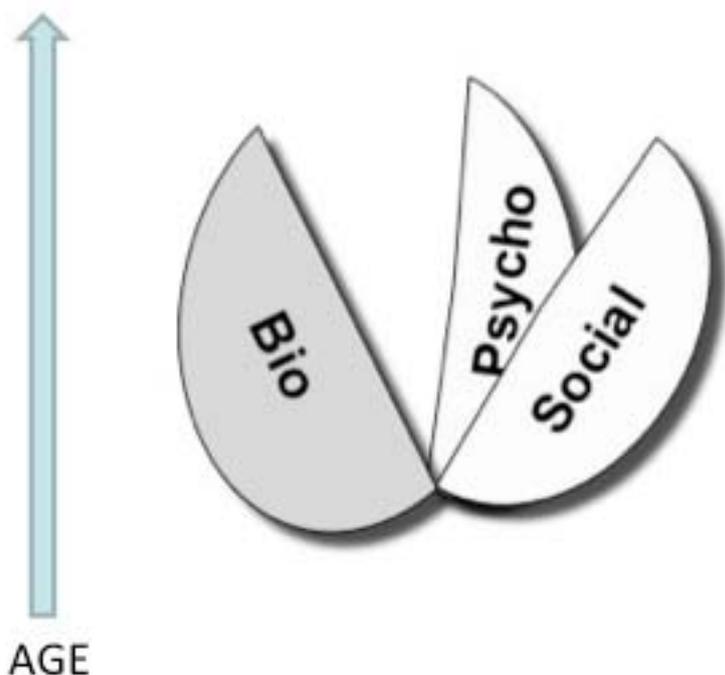


Figure 7.4: The biopsychosocial sphere

The virtue of an image like this is that it allows us to include a third dimension that is integral to participant development: its different pathways of development. As we have argued throughout this review, all human development is the result of, and is constrained by, an interactive dynamic of biological, psychological and sociological factors. Furthermore, as suggested by the 'Three Worlds' Continuum (see Figure 2.1), the dynamic for any individual must vary with age in order that physical activity participation be genuinely lifelong. There are significant shared aspects of the different participant pathways and it is vital this is not forgotten.

Consider the addition of the axis for age, as presented in Figure 7.4. At an early age, the number of options available to an individual is small, even though all three elements (bio, psycho and social) must be catered for. Accordingly, guidelines are going to be more prescriptive and investigations comparatively simple. As the participant ages and develops (thus, moving towards and through the 'equator'), the number of permutations becomes greater, as reflected by the larger area within which a particular dynamic (the combination of bio, psycho and social factors) can be envisaged. In short, there are a large number of options, relating to the characteristics of the participant and his or her environment, together with the objective of the process (eg ERE, PRE or PPW). As the participant reaches old age, the number of permutations decreases towards an almost exclusively PPW orientation, with a comparatively small number of different options at the pole.

We attempt to present this diagrammatically in Figures 7.5. For each 'age group', exemplar plots show alternative domain maps of investigation/intervention possibilities.

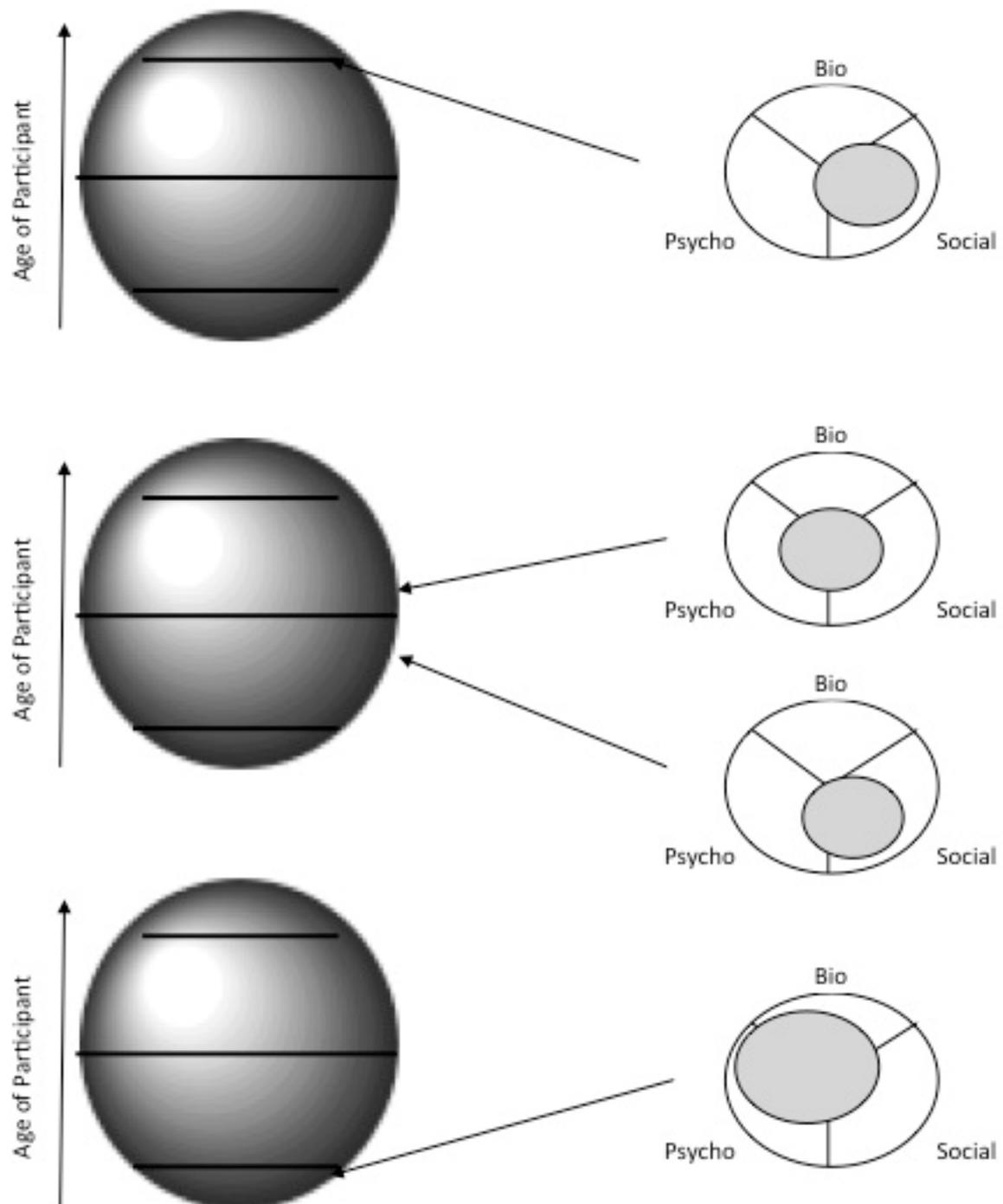


Figure 7.5: 'Three Worlds' Exemplars: how the biopsychosocial model can be deployed

In the bottom sphere, a young participant's needs are perhaps best met through a predominantly bio-psycho focus. The diagram in Figure 7.5, superimposed on the slice through the sphere, shows this diagrammatically.

In the middle sphere, at later age, concerns are more varied; two exemplars are presented from the many possible permutations. The upper option shows a predominantly

psycho-social focus, ideal perhaps for promoting activity uptake and adherence through the late teens and early 20s. The lower option depicts a largely psychological focus; best perhaps for an aspiring elite about to make the key transition to university.

The top slice represents the thrust for interventions with geriatric populations. In keeping with research findings to date, investigation/intervention packages at this stage would focus on predominantly social issues, with biological and psychological well-being seen as associated, but fringe, benefits.

The main objective of all this complex artwork is to depict diagrammatically the following checklist:

- Investigations **and** interventions focused on this important, but complex, aspect of human behaviour **must** be interdisciplinary.
- In each case, however, the focus will be driven by an empirically/theoretically justified 'balance' between the bio-psycho-social domains.
- The balance between domains will change, based on the objective (ie ERE, PRE and PPW, together with environmental and personal characteristics) and the individual (ditto) and within the individual as age/development progresses (ie The 'Three Worlds' Continuum).
- Mapping the domain balance for an individual as he or she progresses through age and stage will enable an evaluation of preparedness for new challenges (eg Have the psychosocial influences on this middle-aged man been catered for/countered by earlier developmental stages and experiences?).
- In similar fashion, drop out or non-participation may be better understood by means of a series of intra-individual development maps, enabling a search for causative trends.
- Consequently, investigations/interventions and the funding models and policies that underpin them must be driven by a clear awareness and explicit consideration of interdisciplinary issues.

The Venn diagrams may offer a convenient way to qualitatively summarise the thrust of many different programmes; it is possible to envisage a quantitative and empirical equivalent, which could be employed in the meta-analysis of approaches and their relative impact.

Our call for interdisciplinarity is certainly not new. Over a decade ago, Burwitz, Moore and Wilkinson (1994) pushed for the promotion of interdisciplinary research into sports performance. At the same time, they recognised the difficulty of this approach in existing academic environments: 'The academic reward structure encourages sport scientists to publish as many articles as possible in refereed journals. This may lead some of those who conduct multi- and/or interdisciplinary research to publish several separate mono-disciplinary articles as opposed to one article which considers the complex interaction between the various elements'. It is not obvious that the situation has significantly improved, at least if publication in scholarly journals is an accurate measure. As a result, individuals and even institutions are unlikely to be able to initiate systemic change. What is needed is, as Burwitz et al highlight, is 'collaboration between sport scientists, higher education institutions, professional organisations, government agencies responsible for research and for sport, practitioners, journal editors and conference conveners'. This is no short-term strategy, but we believe it to be necessary if sport science is going to adequately address the real problems of sports participation and performance.

In Conclusion

This section offers the rationale underpinning our emphasis on an interdisciplinary approach to this important facet of human behaviour. In the next and final section, we briefly explore some recommendations that emerge from the review.

Section Eight: Recommendations

Our aim in this final section is simple: to make some recommendations for future policy, research and practice. These recommendations emerge from a synthesis of the results of our enquiry and discussion, and are meant to be considered alongside the other components of this report. We hope they will provide sports coach UK (and associated groups) with a stimulus for moving forward.

Participant development ought to remain a central feature of the coaching framework for the UK

- sports coach UK is to be commended for its recognition of the importance of participant development for coaching. Previously, and still in some cases, participants were treated as, essentially, separate from, and rather marginal to, the coaching process. Sports coaching only makes sense with reference to the coach-participant nexus.
- The nature of science is such that research into participant development should be recognised as of vital importance to successful coaching. This report should be seen as merely a point within a journey and rather than a summation of evidence.

Interdisciplinary research should become the norm, rather than the exception, in sports coaching research

- Universities remain the main centres for sport-science research and institutional pressures continue to push scholars towards narrow, disciplinary-based research activity. This is in contradiction to the persuasive case for the necessity of interdisciplinary research.
- sports coach UK and other leading sports agencies should act as facilitators for interdisciplinary research; for example, through direct interaction with government, funding agencies and charities.
- sports coach UK should seek funding to establish national research institutes that draw expertise from across the UK, with different foci related to physical activity participation, sports performance and coaching.
- Ample experience shows the limitations of closely linking institutions and trusts with central government. Therefore, any institutional developments need to take account of the need for financial and political independence.

Models, research and proposals should be continually and independently evaluated

- A standing review group, made up of senior coaches, coach educators and academics should be established that is capable of offering an independent view of developments and initiatives in sports coaching.
- There are precedents for such groups (such as the National Institute for Health and Clinical Excellence) and any group focusing on coaching should follow the principles of basing recommendations on the best available evidence and involving all stakeholders in a transparent and collaborative manner.
- Such transparency is particularly important when private consultants may sit in judgement on their own initiatives. Independent peer review, ideally framed against clearly established principles of practice, is another example of ways in which nepotistic challenges may be overcome.

Participant development should be based upon the concept of development of excellence in different contexts

- Excellence can form a unifying theme for all pathways.
- Research into the nature of excellence in one context (such as ERE) should be explicitly examined for lessons for others (PRE and PPW).
- Many of the standard talent development practices are based on dubious assumptions about the predictability of performance over key transitions, the stability of biological indicators, the underestimation of psychological aspects and the almost total ignorance of sociological and economic mediating factors. Talent development needs to be conceived of as a long-term strategy, based on mass participation, numerous participation pathways and good fortune.
- From an ERE perspective, initiatives and driver agencies need to acknowledge and cater for the differences between talent identification, talent development and talent transfer.
- Across the 'Three Worlds' Continuum, sports coach UK should act as the primary conduit to 'educate the marketplace' on the characteristics of effective coaching. Such 'building the market' initiatives are an important aspect of the promotion and professionalisation of effective coaching.

The relationship between performance and participation is synergistic

- Almost all policy discussions about sport force an inaccurate and unhelpful distinction between high-performance sport (ERE) and recreational sport (PRE and PPW). Apart from specific instances, such as funding for particular events like the Olympic Games and Paralympic Games, this distinction is wrong-headed.
- Every elite performer began their sporting career in informal settings and early experiences seem to be determining factors of later success. Directing significant proportions of funding from the former to the latter is likely to be a dangerous strategy in terms of long-term and sustainable success.
- In similar fashion, acceptance that our ideal aim is for lifelong physical activity participation should be acknowledged and applied. Against this agenda, support for tightly focused initiatives that fail to demonstrate exit strategy, sustainability and long-term impact should be questioned, especially at a time of sparse resources.

There is a clear and present need for 'joined-up thinking'

- One of the clearest findings to emerge from this review is the need for consistently targeted pathways, with considerable interaction and, hence, overlap and benefit between stages.
- Accordingly, sports coach UK and its partners may beneficially push for even greater interaction and integration between education systems (pre-school, compulsory and post-compulsory education), governing bodies of sport and government agencies at local and national level.

Policy and practice need immediate revision and future changes should be informed by a purpose-driven research agenda

- This review offers clear indications of where present policy/practice is not underpinned, or even contradicted, by research. By contrast, this review offers a series of statements, which are both empirically supported **and** have the capacity to inform application.
- The research agenda provided by this report, in tandem with other inputs, should be used as the basis for an integrated development strategy, focused explicitly on the needs of the field rather than the more limited research agendas of individuals or small groups.

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