

TOWARDS A MODEL OF TALENT DEVELOPMENT IN PHYSICAL EDUCATION

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ABSTRACT

Traditional conceptions of talent generally emphasise the construction of threshold values and the development of relatively unitary abilities, and this approach still dominates talent development programmes for elite sport. Most researchers in the areas of talent development and high ability now favour domain-specific, multidimensional conceptions of ability that stress the development of behavioural potential and its interaction with personal and environmental characteristics. This paper presents a model of talent in physical education, drawing together findings from a wide range of literature on the realisation and inhibition of abilities, international studies of effective school-based identification and provision strategies, and a conception of the subject as an integration and realisation of different forms of ability. In presenting this model, the authors aim to redress the imbalance within the current debate from an almost total concern with out-of-school clubs and the preparation for adult elite sport, in favour of a more equitable and inclusive approach, premised upon the unique importance of mainstream, curricular physical education within any talent development scheme.

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INTRODUCTION

The development of high ability in both educational and sporting domains in the UK have received significant political interest and produced a great deal of policy documentation in recent years (DCMS, 2000; DCMS /Strategy Unit, 2002; Select Committee on Education and Employment, 1998; cf. Green, 2003). It is, perhaps, not surprising that physical education, the area of the school curriculum most obviously connected to the domains of sport and education has also been expected to join this discourse (Youth Sport Trust, 2005). However, whilst the development of high ability in sport and generic education have received increasing academic attention in recent years (e.g., Heller, et al, 2000; Starkes and Ericsson, 2003), interest in physical education as a discrete domain is conspicuous for its absence.

This paper presents a model of talent development in physical education (see Figure 1). To the best of our knowledge, no such model has been published before. However, in light of the United Kingdom's (UK) government's expectation that all curriculum subjects identify and provide for a cohort of very able, or 'Gifted and Talented', students (DfES, 2001), this is a timely task.

In presenting a model, the aim is to make explicit the theorising concerning the nature, content and character of the talent development process in physical education. The term 'model' is preferable to the more ambitious 'theory' as the process of talent development

in physical education is very much in its infancy. Indeed, academic discussions of talent within the context of curricular physical education are almost non-existent (exceptions include Kirk and Gorely, 2000; Penney, 2000). In designing the model, we have drawn on a variety of sources and exemplars, particularly from sport and education (such as Abbott, et al, 2002; Regnier, et al, 1993; Heller, et al, 2000), and have generally found multidimensional, developmental educational models (Gagné, 2000; Perleth and Heller, 1994; Schoon, 2000) most suitable, for reasons that should become clear in the text.

In the words of Keeves (1988, p.559), ‘the model, like the hypotheses, which are contained within it, can be built from accumulated evidence, intuition by analogy, or derived from theory’.

This model describes a framework for investigating the actualisation of abilities related to physical education, and, in doing so, it draws together a wide range of evidence, analogy and theory, framed within value judgements regarding the nature and purpose of physical education.

MULTIDIMENSIONAL MODELS OF TALENT

Traditionally, researchers and educational planners have tended to conceptualise ability or intelligence as unitary, genetically inherited and measurable (Eyre, 1997). So, it has often been assumed that a single measure (such as IQ), which individuals have to a greater or lesser extent, can be accurately measured and individuals ranked accordingly. Contemporary theorists, however, almost universally favour *multi-dimensional* models of high ability (Ziegler and Heller, 2000), cognisant of a wide range of personal and

environmental factors. So, for example, Freeman (1998, p. 15), reviewing current theorising on the development of talent, states:

The assumption that a high IQ is essential for outstanding achievement is giving way to recognition of the vital role of support and example, knowledge acquisition, and personal attributes such as motivation, self-discipline, curiosity, and a drive for autonomy – all this being present at the right developmental time.

These new models recognise that ability takes many forms. The previously central place of narrow cognitive ability has increasingly been brought into question, and other forms of ability have been proposed to stand alongside them. Domain-specific theories make distinctions between different, relatively independent forms of ability, which frequently relate to specific areas of achievement (see Table 1).

!INSERT TABLE 1 ABOUT HERE!

Recognition of the multiplicity of factors impacting upon an individual's performance is less common in sporting contexts (although, see Williams and Reilly, 2000). Talent identification procedures are frequently reduced to levels of current performance. However, as Abbott and her colleagues (2002, p. 26; emphasis in original) emphasise, 'there is a need to distinguish between determinants of *performance* and determinants of *potential / skill acquisition*'. Individual development is the result of an interaction between inherited abilities, social and cultural learning (Clark, 1997; 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 (Holt and Morley, 2004).

In devising this model of talent development in physical education, we were mindful of the following:

1. The model should be cognisant of the multi-dimensionality of abilities;
2. It should differentiate between potential and performance;
3. It should acknowledge the range of factors that can impact upon an individual's development of an ability; and, to return to a point made in the introduction,
4. It should focus on physical education, *per se*, rather than related, but distinct concepts, like sport.

!INSERT FIGURE 1 SOMEWHERE NEAR HERE!

A MODEL OF TALENT IN PHYSICAL EDUCATION

ABILITIES AND OUTCOMES

It is important to distinguish between the expression of abilities and the progressive emergence of these abilities into certain formalised outcomes (Gagné, 2000; Perleth and Heller, 1994). It is not being proposed that children identified as possessing high ability on some domain will necessarily evolve into high performing adults in a related area; empirical and psycho-biographical research falsifies that common assumption (Bloom, 1985; Howe, 2001). Rather, it is simply asserted that it is useful to make explicit the

abilities that are developed within certain domains, and which are (sometimes) refined, combined and elaborated into particular behaviours later in life.

In devising our suite of abilities, we asked ourselves the following question:

What abilities are developed in physical education?

We analysed presentations from various sources, including textbooks (e.g., Bailey, 2001; Mawer, 1995), reports of teachers' views (Green, 2000; Bailey, et al 2004) and central government guidance and policy (DCMS / Strategy Unit, 2002), and created various formulations. These were then presented to specialist physical education practitioners (to date, around 1,000), mainly within the context of a national professional development programme, and they were asked to comment on the extent to which the various formulations reflected their views of the abilities they sought to develop in their students.

The resultant list is as follows:

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

The Outcomes, at the other end of the process, are necessarily incomplete. The possible list of all outcomes, both intended and unintended, positive and negative, would be extensive. The outcomes listed here are proposed to be relatively acceptable to the physical education profession (evaluated through the same process as outlined above), but there is also a challenge to an assumption that underpins a great deal of writing on the role of talent development in physical education: it is not accepted that the selection of a cohort of elite representative sportsplayers is the only or even the main goal of a talent development scheme for physical education. However, the most frequently used metaphors for the relationship between physical education and sport all seem to take this goal for granted (Kirk and Gorely, 2000). Our view is that the purpose of any *educationally* orientated talent development programme must have as its primary goal the meeting of students' educational needs.

Physical education can contribute to a wide range of recreational and career outcomes, and among the most important of these is lifelong physical activity (Doll-Tepper and Scoretz, 2001). Others may be the development of socially based qualities, such as leadership and interpersonal skills (Shields and Bredemeier, 1995). How does this relate to talent development? Because, in striving to meet individual needs, an effective talent development programme should also strive to maintain students' engagement with the subject so that, on leaving formal schooling, individuals take with them a lifelong commitment to the activity areas that make it up. It is a peculiarity of the standard discourse that physical education, alone among subject areas, seems incapable of

separating itself from specified adult careers. Conceptualisations of the development of talented students in other subjects do not seem to justify themselves in terms of the identification and recruitment of professional historians, mathematicians or poets. Such schemes may result in the emergence of outstanding new practitioners, but that is a fortuitous consequence of a process fundamentally concerned with meeting students' needs by offering appropriate support and curriculum for able learners.

None of the above discussion should be taken as a rejection of the physical education contribution to the development of talented young sportsplayers. On the contrary, we suggest that the implementation of an education-orientated scheme is a necessary (if not sufficient) step in the identification of sports talent. This is because, being located within mainstream curricular physical education, this model is concerned with an incomparably larger group of potentially talented players than selective sports-based approaches. This is a point often overlooked by advocates of after-school and out-of-school models of talent identification, including those who promote this 'sports approach' (that is, extra-curricular provision) to other curriculum areas (Freeman, 1998). After-school activities are valuable supplements to mainstream provision, but their very nature means that some sections of the school population (and, so, the sub-set of potentially talented students) will be excluded from its benefits. The proportion of Primary and Secondary school students who participate in extra-curricula sporting activities rarely rises above 50% (Sport England, 2002). Moreover, as research shows conclusively, it is extraordinarily difficult to predict later achievement from early promise (Abbott, et al, 2002). So, the logical solution to this problem is a scheme that offers access to the largest possible

population, is sufficiently flexible to allow later developers, and offers multiple desirable outcomes.

TALENT DEVELOPMENT

Abilities act as building blocks of talent or defining features, and the process of talent development occurs when the child experiences a period of structured learning. This process can be informal (that is, self-taught), but it is far more likely that it takes place within formal settings (such as schools). Gagné (1993) has emphasised that learning, training and practice illustrate best the longitudinal dimension of talent development. Without general and specialised forms of learning, individuals will be excluded from a large number of opportunities, irrespective of their abilities (Schoon, 2000).

Educational theorists often distinguish between the identification of and provision for talent (Eyre, 1997; Freeman, 1998), which suggests a two-stage process in which talented students are recognised by teachers, after which a programme of teaching or support is initiated. Williams and Reilly (2000) offer an alternative, sports-based model (see Figure 2).

!INSERT FIGURE 2!

The rationale for the addition of Talent Detection and Selection stages is related to the difficulty of sports coaches of identifying potentially able athletes, since the only individuals they are likely to see have already undertaken training (Abbott, et al, 2000).

Therefore, it is necessary to precede the formal identification of talent with a purposeful pursuit of potentially able people who are not already involved in the activity. Talent detection may be less of a problem in physical education than sports coaching, since the whole population ought to be engaged in the activity at some level. So, in the name of parsimony, we have not adopted Williams and Reilly's classification, turning to the standard educational stages of identification and provision. However, we have added a third component, practice. Conceptually, practice could be subsumed under the provision label, as it relates to informal or formal learning, but its vital importance for the development of talent is such that we suggest it warrants discrete consideration (Bloom, 1985; Baker, et al, 2003; Ericsson, et al, 1993).

There is a wide range of talent identification and provision strategies in the areas of education (Heller, et al, 2000) and sport (Brown, 2001). Predictably, there is much less specifically concerned with talent identification in physical education. As stated, it is common in educational literature to distinguish between talent identification and talent provision (Eyre, 1997). This distinction reflects the standard educational dichotomy of assessment and teaching, and the identification and provision of talented students might usefully be understood as context-specific versions of these concepts.

Currently, in the UK, schools are adopting a systematic model of 'defining, identifying and providing' that seeks to clearly identify Gifted (excelling in academic subjects) and Talented (excelling in physical education, sport and the creative arts) students for further support and specialised provision (Bailey, et al, 2005). Implicit in this approach is an

assumption that students identified within a specific category have broadly similar abilities, and require provision aimed at the needs of the group, rather than that of the individual. Tilsey (1995) has offered an alternative and potentially more inclusive model whereby *provision* is offered, *evaluated* and subsequently modified to address students' needs. This model of 'providing-evaluating-providing' reflects more closely a multidimensional approach to talent development, as it afford opportunities for a range of abilities to emerge.

Identification

If we are to accept the notion that talented children in physical education may possess high levels of ability in one or more area of ability , then it is important that the identification strategies used are commensurate with this aspiration. The scope of this paper does not allow for a detailed explanation of the strategies that may be used to develop talent in physical education, but some of the concepts applied to the identification process are worth a mention here in order to acquire an understanding of the guiding principles involved.

We can conceptualise broad types of identification strategies: relatively generic strategies (which assess overall performance or a cluster of core abilities at the same time); activity-specific measures (which include assessments of performance in different activities); and ability-specific strategies (which focus on the assessment of the abilities underlying participation and performance in physical education contexts). The use of a range of strategies ensures a diverse talent cohort, which is in keeping with guidelines for central

government agencies (DfES, 2001), and reflects the nature of the subject area more accurately than the purely performance-based identification procedure conventionally found in sport. This approach, which utilises multiple identification criteria, is typical of systems that are advocated both by researchers and theorists writing on gifted and talented education (Bore, 2003; Freeman, 1998), and by national initiatives (DfES, 2001). Fundamentally, the process of identification relies heavily on a stimulating, challenging and revealing environment whereby the various abilities of all children can be readily manifest. Moreover, many of the simplest yet more suitable identification strategies lie at the heart of good generic teaching practice, such as formative assessment (Morley and Bailey, 2004). However, it may be the case that such generic strategies provide a broad-brush portrait of a student's ability and achievement so, at some stage of the process, there may be a need to focus on specific abilities as part of a more detailed assessment of that student's talent.

There are no absolute methods to identification as many factors, such as staff expertise, facilities, equipment, and existing whole school and subject area curriculum planning, will have a bearing upon the most appropriate identification process (Bailey, et al, 2005). Indeed, the employment of uni-dimensional forms of assessment, such as fitness testing, are unlikely to prove successful in identifying talent, and seem destined to focus subsequent provision entirely on current performance. Research with teachers suggests that the intricacies and complexities of physical education make identification of talented students in the subject area an extremely difficult process and this difficulty is possibly

responsible for the majority of teachers using current sports performance as the main identification criteria for talent in physical education (Bailey, et al, 2005).

Provision

Whilst talent identification would seem problematic for some practitioner, provision for talented students is often seen as less problematic (Bailey, et al, 2004). It is not clear why this distinction has been drawn, but it may be associated with a view that existing strategies for addressing the needs of interested students (especially after-school clubs) can easily be transferred to provision for the talented (Freeman, 1998). This assumption seems to be shared by almost practitioners (Bailey, et al, 2005). It is not, however, a plausible position, as interested students represent a self-selected group, whilst talented students do not (Morley and Bailey, 2004).

It has been suggested that the pacing of programmes and experiences offered to talented students ought to meet their needs (Van Tassel-Baska, 2003). One of the most frequently cited approaches to provision is acceleration, which is often implemented through the use of grade skipping, whereby students ‘move faster through academic content, which typically includes offering standard curriculum to students at a younger-than-usual age’ (Davis and Rimm, 2004, p.120). Although popular in some countries (such as the US), the practicality of establishing grade-skipping schemes in other systems (like the UK’s) seems dubious, and there have been negative reports on the use of acceleration in UK schools (Hymer, 2003).

‘Subject skipping’, in which a student’s curriculum is accelerated within a specific subject area seems more applicable, although even in this case, the instances of such methods are limited (White et al., 2003). However, the use of subject skipping in relation to early examination entrance may be a viable option and the possibilities for allowing children to participate in extra curricular activities alongside older children would also seem a possible method of accelerating their development. Indeed, the use of this developmental rather than chronological approach to provision would seem to reflect research findings on the impact of maturation and peak velocity height (PVH) on accurately measuring and subsequently providing for sports players (Lefevre, et al, 1990).

Enrichment is the other common approach to provision for talented students, and can include a number of features ranging from a themed approach to teaching an activity to out-of-school opportunities. Enrichment is used to deepen students’ knowledge of a subject area in different environments and situations, allowing them to re-contextualise previously learned skills in a number of different domains. In the context of physical education, at least in the UK, the enrichment process has generally involved the use of supplementary activities for talented students, such as the use of sports coaches within after-school clubs and visits to Universities (Bailey, et al, 2005). Various writers have questioned the effectiveness of activities that do not relate to mainstream curriculum provision, voicing scepticism over the long-term impact of such schemes that normally deal with a small number of children (Montgomery, 2001; OfSTED, 2004). Therefore, more appropriate enrichment activities would seem to reside within mainstream curriculum provision, supported by with specific adaptations for talented students.

Practice

Many people seem to hold an implicit theory that talented individuals are qualitatively different than the rest of the population, so that they appear to make extraordinary achievement without the hard work and effort required by the rest of us (Howe, 2001). Shermer (2001) calls this the 'Amadeus Myth', which he defines as 'the belief that genius and original creations are produced by mysterious mental miracles limited to a special few' (p. 263). In fact, nowadays, we are more likely to attribute such powers to genetics than to miracles, and the appearance of extremely high-level performers, like Mozart, are often explained away in terms of some convergence of innate mechanisms (Winner, 1996).

Empirical research does not support the Amadeus Myth. This is not to deny the contribution that genetics makes to human development. Indeed, to do so would be to deny decades of robust evidence (Plomin and DeFries, 1998). But it is reasonable to deny that innate dispositions alone are sufficient to secure high-level achievement. Genetics provides a range of possibilities, a 'genetic reaction range', which represents the parameters within which environmental conditions may take effect (Shermer, 2001, p. 95), and the scope for development within this range is potentially vast. Of course, the relative contribution of genetics and environment on performance depends a great deal on the specific activity in question. Endurance events rely on the body's ability to take up oxygen (VO_2^{\max}), and this has been estimated to be accountable to genetics by 81-86% (Åstrand, et al, 2003). However, performance in most sporting activities seems far less

genetically constrained. So, whilst descriptions of the ‘natural footballer’ or ‘born dancer’ are probably convenient phrases for sports commentators, they are less useful as a basis for talent development.

Empirical studies have highlighted the role of practice in high-level performance (Baker, et al, 2003; Ericsson, et al, 1993; Howe, 2001; Starkes and Ericsson, 2003) . Perkins (1981) claims that the appearance of certain individuals acquiring skills at a faster rate than others is more readily explained by sustained but unobserved practice. He is supported in this claim by a number of psycho-biographical studies of elite performers in a range of activities, including sport (Kalinowski, 1985; Monsaas; 1985); music (Sloboda and Howe, 1991); science and literature (Shermer, 2001). Interestingly, there is evidence of a distinct pattern in the time necessary to progress from beginner to expert. Hayes (cited in Abbott, et al, 2002) demonstrated that *all* major composers, without exception, have required at least ten years of concentrated training in order to reach their high level of mastery. And Raskin (ibid.) reviewed the careers of important scientists, poets and authors, and concluded that an average of ten years elapsed between first work and best work. 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 (Ericsson, et al, 1993). Thus, Ericsson talks of ‘deliberative practice’ to refer to activities that are structured, goal-orientated, require effort and are not always inherently enjoyable.

It ought to be acknowledged, before we get too carried away, that studies of this sort demonstrate correlation, not causal relations. That experts have tended to evidence more

deliberative practice that non-experts, may itself reflect an ability difference (Sternberg, 2000): successful high ability performers may be motivated to practice more, whereas unsuccessful individuals of low ability may be prompted to give up. Or perhaps both ability and practice are indicative of a third variable (for example, cultural expectations). So, there could be a host of contributing factors underlying these correlational associations, but the research data suggest that, at the least, practice represents a necessary (if not sufficient) condition of the realisation of talent.

ENVIRONMENTAL CHARACTERISTICS

Many children exhibiting signs of high ability during early childhood do not achieve high levels of performance in later life (Tannenbaum, 1992). Whilst there is a host of developmental and maturational factors that are likely to influence the development of ability during the childhood years (Malina, et al, 2004; Schoon, 2000), it also seems likely that a significant number of children never fulfil their early promise due to an inadequate or inappropriate social environment (Perleth, et al, 2000). Of course, there is no way of calculating the number of potentially talented children who were born and brought up in non-supportive backgrounds and whose gifts were never realised, but we might presume that figure to be high.

One aspect of the talented child's environment that has witnessed a considerable amount of research from a wide variety of domains is the family (Feldman and Goldsmith, 1986; Sloboda and Howe, 1991), and this includes some useful studies focusing on the influence of the family on the emergence of sporting talent (Côté, 1999; Holt and Morley,

2004; Kay, 2000). In his study of 120 musicians, artists, athletes, mathematicians and scientists, Bloom (1985, p. 3) found ‘strong evidence that no matter what the initial characteristics (or gifts) of the individuals, unless there is a long and intensive process of encouragement, nurturance, education and training, the individuals will not attain extreme levels of capability in these particular fields’.

Simonton (1998), through his psycho-biographical studies of world-class achievers, has argued that there is no ideal family for producing giftedness, and the backgrounds of such individuals is, indeed, varied. However, certain patterns do emerge from the literature that suggest there are some family characteristics that are facilitative of the development of high ability in a specific area, including parental income, traditional family structure and relatively small family size (Kay, 2000; Rowley, 1992; Yang, et al, 1996). As Kay (2000, p. 151) summarises, within the context of elite sport, ‘children are simply much more likely to achieve success if they come from a certain type of family’.

A considerable amount of academic research has been carried out that examines the relationship between peer influence and participation in specific activities (Brustad, 1993). Friendship seems to play a particularly significant role in decisions to invest time and effort in sports, compared with other domains. For example, Abernethy, et al (2002), reported that, in the early stages of their careers, the Australian elite athletes in their sample all mentioned having a group of friends who were also involved in sport. Research in other areas presents the relationship between high ability and peer influence as problematic (Colangelo and Dettermann, 1983; Winner, 1996). There is some

evidence that the possession of a gift or talent can endanger social acceptance, and this seems to be especially the case for girls (Luftig and Nichols, 1991; Winner, 1996).

It seems tautologous to claim that schools influence the development of talent in physical education: by its nature, physical education is a school-based activity. Nevertheless, it would be remiss to overlook the contribution that schools make, since the outcomes of the talent development process are diverse and not restricted to educational aims. Formal schooling certainly seems to be an important factor in children's cognitive and academic development (Ceci, 1991). Moreover, the initial acquisition of culturally valued skills is most likely to occur during formal schooling (Geary, 1995). It is interesting to note, then, that elite adult performers in some domains, especially art and music, are often suspicious of formal education (Goertzel and Goertzel, 2004; Sloboda, 2005), believing such teaching to be unnecessary for the development of an individual's talent, and potentially destructive of their talent (Gardner, 1980). For example, none of the elite sculptors interviewed by Sloane and Sosniak (1985) had anything good to say about either their primary or secondary art education. These individuals attributed far greater influence to private teachers and professional artists.

The limited autobiographical evidence available suggests that elite sportsplayers are much more positive about their school experiences, with numerous high level athlete and sportsplayers crediting school physical education teachers with identifying and then nurturing their talents (Gunnell and Priest, 1995; Johnson, 2003; Redgrave, 2000). However, whilst responsive and supportive physical education teachers constituted a

necessary factor in the development of elite sports participation, they are rarely sufficient. Côté and his colleagues (2003) cite specialist coaches as one of the main sources of influence on children as they progress through their development in sport. In the early stages, the coach's role is generally supplementary to that of school teachers, offering structured practice activities and emphasising basic skill development (Abernethy, et al, 2002). Only later (at approximately 13 years of age, in Abernethy's study) does the coach-athlete relationship become closer and more professional (Rowley, 1992).

PERSONAL CHARACTERISTICS

Teacher-orientated literature abounds with descriptions of personal characteristics of children with gifts and talents (Eyre, 1997). The empirical basis for such lists is unclear, and their main function seems to be restricted to representing a 'template' of a gifted or talented child against which teachers can rank their students. For the present purposes, such descriptions are of limited value, since they rarely include reference to the types of abilities developed within physical education lessons. A more fruitful source of information is the type of longitudinal and psycho-biographical research discussed above. These studies suggest a range of inter-individual differences in achievement that seem to form necessary but not sufficient preconditions for high-level performance in various domains (Schoon, 2000).

Historically, sport science research has emphasized the role of kinanthropometric and physical measures for the identification of individuals who have the potential to excel in a particular sport (De Garay, et al, 1974; Hoare, 1995). According to this approach, sports

talent can be successfully identified by searching for young people whose physiques and proportions match profiles of elite performers. Despite its intuitive appeal, this approach is flawed when working with young sportsplayers for a number of reasons, including the facts that kinanthropometric and physical measures are unstable during adolescence and determinants of performance vary with growth, maturation and development (Abbott, et al, 2002; Bailey, in press).

This is not to deny the contribution of biological factors towards performance in any domain. The literature testifying to the hereditary nature of many cognitive and physiological characteristics is impressive (cf. Rankinen, et al, 2002). Research suggests that a range of factors that are likely to impact on performance in physical education contexts are genetically constrained, including sub-maximal aerobic capacity (Pérusse, et al, 2001), resting heart rate (An, et al, 1999), information processing (Chorney, et al, 1998), and an individual's response to training (Bouchard, et al, 1998). As compelling as this research is, however, there are a number of reasons for remaining tentative in the use and acceptance of genetic research data in the current area of study. Little genetic research has specifically examined elite performers, focusing instead on the general population (Baker and Horton, 2004), so it is inadvisable to extrapolate findings to this group. Moreover, the limited research that has explored the genetics of elite performers has been concerned with a narrow range of (relatively easily measurable) cognitive skills and physiological measures, rather the multi-domain actions and procedures characteristic of physical education settings.

A more established area of research with regard to elite performance is that which relates to their psychological characteristics. Studies from a range of fields have established such characteristics as vital to high-level performance (Bloom, 1985; Lens and Rand, 2000). Indeed, the relationship may even be a causative one (Abbott, et al, 2002). As Kane (1986, p. 191) put it: ‘the ultimate factors accounting for achievement are likely to be the unique personal and behavioural dispositions which the individual brings to the actual performance’. Considering the role already attributed to practice in skill development, it is not surprising that aptitudes facilitative of many hours of training have been associated with exceptional achievement. So, determination and persistence in pursuing one’s ambition has been identified as a factor (Bloom, 1985), as have self-efficacy (Tenenbaum, 2003), ambition and autonomy (Gagné, 1993; Schoon, 2000). Motivation is a concept that underpins much of the literature on personal characteristics and numerous authors have attested to its central role in the development of talent in all domains (Lens and Rand, 2000; Sternberg, 2000). Early intrinsically motivating behaviours seem to have a positive effect on later willingness to engage in extended practice (Vallerand, 2001).

Within the contexts of physical education and sporting activities, the role of fundamental movement skills may also be important (Abbott, et al, 2002). The specialised movements of different activities are built on a foundation of basic skills, such as running, jumping, balancing and turning (Bailey, in press). Children who lack these basic skills ‘are often relegated to a life of exclusion from organised and free play experiences of their peers, and subsequently, to a lifetime of inactivity because of their frustration in early

movement behaviour' (Seefeldt, et al, cited in Abbott, et al, 2002, p. 19). Whilst it is difficult to envisage a causative relationship, and there is little empirical work in this area, to date, it seems unarguable that high-level performance in any formalised physical activity will be impossible without an adequate foundation of fundamental movement skills.

CHANCE

Since no studies have measured individual differences in the role of chance over people's lives (Gagné, 2000), it is impossible to ascertain the extent to which it contributes to certain individuals' successes. Nevertheless, it seems reasonable to hypothesise that chance will play a role in the talent development process. The environmental characteristics discussed above are all amenable to fortune: experiencing a responsive teacher, in a supportive school, with a suitable gifted and talented programme, in a society that values one's particular gift, all coming together at a particular point in time. But, as modern evolutionary theory makes clear, chance is also an ingredient in the transmission of genetic information. Atkinson (cited in Tannenbaum, 1983, p. 221) captured the situation nicely when he wrote that all human accomplishment can be ascribed to 'two crucial rolls of the dice over which no individual exerts any personal control. These are the accidents of birth and background'. In a similar vein, we recall the words of an old National athletics coach: 'The trouble with you, son, is that you had the wrong parents'!

ACCESS AND OPPORTUNITY

Access to certain types of learning environment can be very influential in terms of achievement. The opportunity to study in a school with high expectations of its students, and to be taught by teachers and coaches with specialist skills makes a significant contribution to later performance in specific domains. Conversely, children deprived of the necessary equipment and support to participate at even a rudimentary level will struggle to become aware of whatever talents they might possess. This may go some way to account for the reported difference in patterns of identification of gifted children among social economic groups (Eyre, 1997).

APPLICATIONS OF THE MODEL

'Cheshire Puss,' she began, rather timidly ... 'Would you tell me, please, which way I ought to go from here?' 'That depends a good deal on where you want to get to,' said the Cat. 'I don't much care where,' said Alice. 'Then it doesn't matter which way you go,' said the Cat. 'So long as I get somewhere,' Alice added as an explanation. 'Oh, you're sure to do that,' said the Cat, 'if you only walk long enough.' (Lewis Carroll, Alice's Adventures in Wonderland)

A FRAMEWORK FOR INVESTIGATION

Whilst scientists and philosophers have abandoned the tired old talk of nature or nurture (Clark, 1997; Geary, 1995) in favour of interactionist explanations for the development of human minds and behaviour, many educational and sports professionals still seem to cling to the dichotomy (Abbott, et al, 2002). The model does not ignore the role of

genetics in child development, but neither does it equate talent development with the maturation of innate potential. Rather, it attempts to make clear the variables, some relatively fixed and some relatively changeable, associated with the realization of talent in physical education.

By drawing out the various elements of the process of talent development, we are seeking to offer foci for future research. From the synthesis of findings presented in this paper, it is evident that among the most urgent areas of research are those that examine development in physical education-specific contexts (rather than sport, education or the arts). Similarly, there is a need for research that explores the relationships between physical education and intended outcomes. We have questioned the equation of talent in physical education with talent in sport. But what are less clear are the alternative outcomes. And what of the suggested abilities? Can they really constitute the abilities that are developed in physical education? If so, how do we fairly and accurately assess them? Are we not destined to simply measure performance, and then mount privilege on privilege?

It might be possible to reanalyse existing data sets, using the categories outlined in the model to assess their relative causal effects. In doing so, we could offer structure and a purpose to otherwise disparate groups of findings (Gagné, 2000). We could also use the categories within the model as a framework for supplementary studies, such as:

- Teachers' evaluation of the relative significance of the different abilities in physical education;

- Students', parents', teachers' and coaches' views of the relative influence of personal, environmental and genetic characteristics on the actualization of talent;
- Case studies of talent development of individuals or groups;
- Correlational studies of measures on (posited) ability tests and later outcomes;
- Systematic reviews of the literature related to specific categories within the model.

AN OPPORTUNITY TO THINK AGAIN ABOUT THE NATURE OF PHYSICAL EDUCATION

Last, and certainly not least, discussions of talent development in physical education lead one to think again about the justification, purpose and nature of physical education, *per se*. The essentialist pursuit of definitions has proved as fruitless as some predicted (Gellner, 1959). Decades of asking ourselves 'What is physical education?' does not seem to have had any effect upon either practice or shared understanding, and recent international research suggests that physical educators are still a long way from reaching a consensus definition of the term (Bailey and Dismore, 2004). We posit another question: 'What do we do in physical education?' Or more accurately, 'What abilities are developed in physical education?' This is a question that need not be restricted to talk of talent, and its application in special cases leads practitioners to reflect critically on the fundamental aims of their subject, and assess the extent to which those aims correspond to practice. This reflection may lead to changes in practice or philosophy, or it may not. But at least, as the Cheshire Cat teaches us, it is generally useful to give a thought to where we are headed.

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