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Do mental skills make champions? Examining the discriminant function of the psychological characteristics of developing excellence questionnaire

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Abstract

The ability to successfully develop to the highest levels in sport is dependent on a range of variables, not least an individual's ability to cope with the various challenges of development. Psychological Characteristics of Developing Excellence (PCDEs) include both the trait characteristics and the state-deployed skills that have been shown to play a crucial role in the realisation of potential. Psychological characteristics of developing excellence equip aspiring elites with the mental skills, attitudes, and emotions to cope with the challenges of the development pathway, as well as underpinning their capacity to make the most of their innate abilities. The Psychological Characteristics of Developing Excellence Questionnaire (PCDEQ) was designed to assess the possession and deployment of these characteristics. The purpose of this paper was to examine the ability of the Psychological Characteristics of Developing Excellence Questionnaire to effectively discriminate between good and poor developers based on their current possession and deployment of psychological characteristics of Developing Excellence Questionnaire to effectively discriminate between good and poor developers based on their current possession and deployment of psychological characteristics of Developing Excellence Questionnaire correctly classifies between 67% and 75% of athletes based on their responses. The Psychological Characteristics of Developing Excellence Questionnaire correctly classifies between 67% and 75% of athletes based on their responses. The Psychological Characteristics of Developing Excellence Questionnaire correctly classifies between 67% and 75% of athletes based on their responses. The Psychological Characteristics of Developing Excellence Questionnaire correctly classifies between 67% and 75% of athletes based on their responses. The Psychological Characteristics of Developing Excellence Questionnaire correctly classifies between 67% and 75% of athletes based on their responses. The Psychological Characteristics of Deve

Keywords: mental skills, talent development, discriminant function analysis, coaching

The focus of talent development systems should be on providing young athletes with the most appropriate learning environment to realise their potential. Unfortunately, and especially at junior levels of performance, success is often achieved because of an individual's relative maturity and physical dominance (Helsen, Hodges, Van Winckel, & Starkes, 2000) or because of advantages in terms of coaching and access to resources (Deakin & Cobley, 2003). However there is, at best, a tenuous correlation between age-group success and elite success. In fact, successful and highly supported young athletes are less likely to succeed at senior level compared with peers who, although less successful at early ages, persevere and enter support programmes later (Gullich & Emrich, 2006). This line of enquiry has important implications for applied practices in Talent Identification and Development. Instead of the traditional focus on environmental (e.g. early

specialisation, enrichment programs; e.g. Deakin & Cobley, 2003; Ericsson, 2006), physical (e.g. Helsen et al., 2000), and anthropometric (e.g. Reilly, Bangsbo, & Franks, 2000) factors that underpin short-term success, Talent Identification and Development models could more beneficially consider, monitor, and develop all the components that interact to determine an individual's capacity to develop in the longer term. In short, the focus should be on developing the skills needed for long-term success rather than concentrating on the factors that underpin current, but shorter term, performance (Abbott & Collins, 2002).

Psychological characteristics of developing excellence

It is well established that those athletes that achieve the greatest success consistently employ

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psychological skills that optimise learning and focus and enable them to successfully negotiate the inevitable challenges of development (Gould, Dieffenbach, & Moffett, 2002). In contrast, underachievers often have unrealistic expectations, low aspiration, and little persistence (Clark, 2001). In short, performers high in these constructs seem more likely to get to the top and do better when they get there. Frustratingly, however, despite this evidence base, psychological characteristics and their appropriate deployment are consistently overlooked in Talent Identification and Development practices (e.g. Vaeyens, Lenoir, Williams, & Philippaerts, 2008). In fact, few talent development models systematically encourage the development of those psychological factors highlighted as characteristic of success in sport (e.g. Gould et al., 2002).

Fortunately, a growing body of literature has begun to focus on identifying and promoting the factors that enable young athletes learn and develop in sport. Retrospective (MacNamara, Button, & Collins, 2010a) and longitudinal (MacNamara & Collins, 2010) studies of elite and developing sport performers have identified a range of psychological factors that aided the realisation of potential. This work found that learning strategies and particularly the employment of psychological processes (e.g. goal setting, planning, and performance evaluation) helped athletes benefit maximally from practice and development opportunities. Termed Psychological Characteristics of Developing Excellence (PCDEs; MacNamara et al., 2010a), these include 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. This body of research suggests that psychological characteristics of developing excellence equip aspiring elites with the necessary mental skills, attitudes, and emotions to cope with the inevitable challenges of the development pathway (e.g. increased deliberate practice), as well as underpinning their capacity to make the most of their innate abilities. Accordingly, 'good developers' in sport possess and systematically develop the psychological characteristics of developing excellence that allow them to interact effectively with the developmental opportunities they are afforded (Côté, 1999; Simonton, 1999).

A key finding of MacNamara et al.'s (2010a, 2010b) studies concerned the differential deployment of psychological characteristics of developing excellence relative to the individual's situation. For example, MacNamara et al.'s work with young athletes (MacNamara et al., 2010b) and musicians (MacNamara & Collins, 2009) found that, even though the same set of characteristics appeared to be important throughout development, they were

deployed differently depending on the individual's age, focus, stage of development, or level of maturation. Simply, psychological characteristics of developing excellence appear to be deployed on a developmental continuum, from a predominant promotion by significant others in the early years towards self-application at later stages of development. At the early end of the continuum, significant others use various means of reinforcement to regulate the actions of young performers. For example, coaches, teachers, and parents are largely responsible for young athletes' early motivation to practice and compete in their activity. As performers progress towards elite status, however, there is (or at least, should be) less emphasis on reinforcement from others with athletes assuming increasing responsibility and self-regulation over their actions. This shift in responsibility is important given that, at an elite level, responsibility for generating and maintaining motivation rests with the performers and not with the coach or parent (Young & Medic, 2008). Interestingly, previous research suggests that the sporting context may also influence the manner by which psychological characteristics of developing excellence are deployed (MacNamara & Collins, 2010). Team sport participation is typified by a 'late specialisation and early diversification' pathway with athletes usually beginning to specialise (at least in a UK context) at around 16 years of age (Ford, Ward, Hodges, & Williams, 2009). In contrast, young swimmers or gymnasts typically specialise from an early age and are engaged in considerable amounts of deliberate practice from a very early age. As a result, young athletes engaged in these sports are more likely to 'self-deploy' these skills from a much younger age than their team sport colleagues in response to these developmental challenges (MacNamara et al., 2010b). In sum, it is important to recognise that the 'stage by stage' application of psychological characteristics of developing excellence may vary considerably along different developmental trajectories.

The Psychological Characteristics of Developing Excellence Questionnaire (PCDEQ)

Although psychological skills training is often included in support programmes aimed at elite performers, it can be argued that a more effective approach would be to systematically develop these skills within talent development systems, with a specific contextual orientation to imminent events both within, but more crucially (for the developmental process itself) outside the usual focus on competition (MacNamara & Collins, 2010). Against the stated aim of talent development and retention, anticipating developmental transitions and challenges, and providing opportunities to develop and refine the appropriate skills to overcome them in advance (and providing remedial steps as necessary), would seem to hold considerably more promise than trying to address these issues 'as they happen'. As a step towards bridging the theory-practice divide, which is all too common in sports sciences, MacNamara and Collins (2011) developed a questionnaire - the Psychological Characteristics of Developing Excellence Questionnaire (PCDEQ) designed to assess the possession and deployment of these important characteristics. Building on a number of qualitative studies (MacNamara & Collins, 2010; MacNamara et al., 2010a, 2010b), a rigorous, multi-stage approach to the development of the questionnaire was employed and exploratory factor analysis revealed a six-factor structure, with 59 items in total. The 59-item Psychological Characteristics of Developing Excellence Questionnaire measures six meaningful categories of psycho-behavioural characteristics that influence effective development in sport (see Table I). Reflecting our previous points, an important characteristic of the questionnaire is that the differential deployment of characteristics is assessed. Factors 1 and 6 assess how performers deploy psychological characteristics of developing excellence as a result of encouragement from others (e.g. My coach/teacher encourages me to seek advice from appropriate others), while the remaining factors assess how individuals deploy these skills independently (e.g. I set myself challenging goals that I have to work hard to achieve). As such, the questionnaire assesses not only whether the athlete possesses these important skills but also their ability to deploy these

appropriately depending on the particular challenge that they face within their performance context. However, before the Psychological Characteristics of Developing Excellence Questionnaire can be used with confidence in this manner it is important to examine its ecological validity. Examining the criterion validity of the questionnaire is an essential part of the assessment of the questionnaire's psychometric properties (Baumgartner & Jackson, 1999; Safrit & Wood, 1995). Therefore, the purpose of this study was to examine the discriminant function of the Psychological Characteristics of Developing Excellence Questionnaire by testing whether the questionnaire could discriminate between 'very good' and 'very poor' developers in sport based on their current possession and deployment of psychological characteristics of developing excellence. A very good developer was described as an athlete who is progressing very well in their activity and who both possesses the necessary characteristics to develop to the highest level in their sport. By contrast, a very poor developer was described as an athlete who may be competing at a high level in their age group but does not possess or deploy the necessary characteristics required to progress to the highest level.

Method

Participants

Two hundred and eighty-five young athletes were recruited for this study. One hundred and ninety-two athletes ($M_{age} = 15.94$ years; 102 female, 90 male) were team sport participants (rugby, hockey, and soccer players), whilst 93 athletes were drawn from

Table I.	Factors	and	sample	items	of	the	PCDEQ
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Factor	Sample items
Factor 1 Support for long-term success (17 items)	My coach/teacher encourages me to seek advice from appropriate others My coach/teacher and I plan on the basis of my future success, not just for today
Factor 2 Imagery use during practice and competition (12 items)	I use imagery to correct my physical performance I imagine myself handling the arousal and excitement associated with competition
Factor 3 Coping with performance and developmental pressures (11 items)	When I make a mistake I find it difficult to get my focus back on task My coach/teacher doesn't push me to overcome difficulties I find it difficult to overcome my feelings of anxiety when I perform
Factor 4 Ability to organise and engage in quality practice (7 items)	In practice, I really think about and focus on what I have to do in that session I set myself challenging goals that I have to work hard to achieve
Factor 5 Evaluating performances and working on weaknesses. (5 items)	I analyse my performances to find out what I did well and what I did badly I consider my weaknesses and work hard on these in practice
Factor 6 Support from others to compete to my potential (7 items)	People around me help me to accommodate the demands of my activity I listen and learn from the people around me

individual sports (swimming and athletics; $M_{age} = 16.72$ years; 48 female, 45 male). All participated at a representative level in their sport (for example, at provincial or international levels of competition). Separate analyses were conducted on the team and individual sport participant data. Examining the discriminant function of the questionnaire in two different sport groups enabled an examination of generality (whether the same factors would discriminate across sports) while at the same time allowing an exploration of differences that might occur within sports (MacNamara et al., 2010b).

All participants were contacted and recruited via coaches, national/representative teams, and National Governing Bodies. A suitable assessor, typically a coach or talent development manager, was asked to rate each participant on a 5-point Likert scale based on their perception of the athlete's potential to develop to elite levels in their sport. The Likert scale ran from 1 indicating a 'very good' developer to 5 indicating a 'very poor' developer. The labels for the remaining responses were 'good', 'adequate', and 'poor'. Assessors were given descriptors of each 'category' and discussed these with the first author to ensure understanding. Assessors were asked to base their assessment of the athletes on these criteria. All the assessors were purposefully sampled based on their experience of coaching and developing young athletes up to elite levels of participation (i.e. all the assessors had more than seven years coaching experience and had been involved in supporting young athletes as they progress from junior to senior, elite levels of performance). In addition to this significant experience in talent development, each assessor had been involved in the coaching and development of these particular athletes at the time of data collection. Although the coaches were encouraged to rate the athletes based on their behaviour in, and attitude towards, their sport (rather than on their current performance levels), the subjective nature of these ratings must be acknowledged.

Following this step, 134 team sport participants were identified as very good or good developers and classified together. Forty-nine participants were identified as very poor or poor developers and classified together. Participants identified as adequate (n=9) were omitted from the subsequent analysis. Based on the coach assessment, 52 individual sport participants were identified as very good or good developers and classified together. Again participants identified as adequate (n=7) were omitted from the subsequent analysis. It was important to use the extreme ends of the Likert scale so as to discriminate as best as possible between athletes. This step was especially

important given the subjective assessment of each performer by a coach or teacher and the biases that might occur as a result. Table II outlines the makeup of each group of participants from each sport. The sample size in both cases was considered adequate as Tabachnick and Fidell (2001) suggest that the minimum number of cases per group needs to exceed 20. The unequal sample sizes were unproblematic given the assumptions underpinning discriminant function analysis (Tabachnik & Fidell, 2001).

Materials and procedure

Instrument. The Psychological Characteristics of Developing Excellence Questionnaire contained 59 items using a six-point Likert scale with a similarity response format from 1 (very unlike me) to 6 (very like me). This format ensured that participants were not allowed to remain neutral and therefore encouraged participants to think more carefully about whether he or she disagreed or agreed with the statement leading to greater precision (Chang, 1994). A mixture of positively and negatively worded items was included to minimise the danger of acquiescent bias. Previous examination of the Psychological Characteristics of Developing Excellence Questionnaire suggests it has a good psychometric basis, with good internal consistency, showing a clearly interpretable six-factor solution corresponding to theoretically relevant categories that explains 42% of the total explained variance (MacNamara & Collins, 2011). The internal consistency of the whole questionnaire was excellent with a Cronbach Alpha of 0.910. The internal consistency for all the factors was good, with factor 1 to factor 6 scoring 0.870, 0.866, 0.847, 0.741, 0.749, and 0.701 respectively (MacNamara & Collins, 2011).

Data collection. Ethical approval was granted from the authors' research ethics committee and informed consent was obtained from all participants and parents/guardians where the participant was under 18 years of age. A time was then arranged for data collection. All athletes who had returned parental consent forms and athlete consent forms were asked to complete the questionnaire under the supervision of the first author. Participants were reassured that their answers would remain confidential and were

Table II. Classification of participants.

	Team sport participants	Individual sport participants
Good developers	134 (71%)	52 (60%)
Poor developers	49 (29%)	34 (40%)

reminded of the need to be honest when answering the questions. The questionnaire took between 20 and 30 minutes to complete.

Data analysis

The discriminant validity of the Psychological Characteristics of Developing Excellence Questionnaire was examined through a Multivariate Analysis of Variance (MANOVA), univariate statistics and a discriminant function analysis. MANOVA was used to test for overall differences between the groups while discriminant function analysis was subsequently used to determine whether a combination of variables could reliably predict group membership. The statistical analyses were performed using SPSS with significance set at P < 0.05.

Results

Team sport participants

Assumption testing was conducted to check for normality, linearity, outliers, homogeneity of variance and covariance matrices, and multi-collinearity, with no serious violations noted. Box's M-test was not significant $(F_{(21, 31634)} = 1.15, P > 0.05)$ which indicated homogeneous variance-covariance matrices for each group (Norusis, 1993). Preliminary analysis confirmed that there was a significant overall difference in Psychological Characteristics of Developing Excellence Questionnaire scores between the two groups of team sport participants, $F_{(6, 176)} =$ 2.42, P = 0.028, Wilks Lambda = 0.924, partial eta squared = 0.076. The means, standard deviations, and significant levels from the subsequent univariate tests are presented in Table III. An examination of group means found that individuals who were classified as good developers reported higher scores on all six factors; this indicated that good developers were more likely to possess and deploy psychological characteristics of developing excellence than those individuals classified as poor developers.

Three of the six factors showed statistically significant differences between the two groups.

These were factor 1 (Support for long-term success), factor 3 (Coping with performance and developmental pressures) and factor 5 (Evaluating performances and working on weaknesses). A moderate effect size was found for factor 5, while all the other factors displayed small effect sizes.

The discriminant function analysis determined the ability of the questionnaire to predict group membership (i.e. good or poor developers). Since the group sizes were unequal, a priori probabilities for each group were computed from the original group sizes. The result indicated a significant discriminant function of the Psychological Characteristics of Developing Excellence Questionnaire (Wilks' Lambda = 0.924, $\chi^2 = 14.13$, P < 0.05) and a canonical correlation of 0.276. The questionnaire was able to correctly predict 75% of the team sport participants into the correct group (Table IV). The standardised discriminant function canonical coefficients (Table V) were also examined since these indicate the substantive nature of the variables by showing the extent to which each factor contributes to group separation (Field, 2005). Factors 3 and 5 were significant.

Individual sport participants

The same assumption testing reported in the previous section was conducted for the individual sport participants, with no serious violations reported. Box's M-test was not significant $(F_{(21, 18342)} = 1.04)$, P > 0.05), which indicated homogeneous variancecovariance matrices for each group (Norusis, 1993). Preliminary analysis confirmed that there was a significant overall difference between the two groups of individual sport participants $F_{(6, 79)} =$ 3.06, P < 0.01, Wilks Lambda = 0.812, partial eta squared = 0.19. The means, standard deviations, and significant levels from the subsequent univariate tests are presented in Table VI. An examination of group means found that participants classified as good developers had higher mean scores on all six factors. Three of the six factors showed statistically significant differences between the two groups. These factors were factor 1 (Support for long-term

Table III. Means, standard deviations, effect sizes, and significant levels for coach rating and PCDEQ factors (team sport participants).

	Good developers mean (SD)	Poor developers mean (SD)	Effect size	Significance	Significance following Bonferroni adjustment
Factor 1	4.25 (0.65)	3.99 (0.78)	0.025	P < 0.05	P < 0.05
Factor 2	3.89 (0.99)	3.81 (0.91)	0.001	P > 0.05	P > 0.05
Factor 3	4.27(0.77)	3.87 (0.86)	0.048	P < 0.005	P < 0.005
Factor 4	4.90 (0.61)	4.77 (0.58)	0.009	P > 0.05	P > 0.05
Factor 5	4.99 (0.72)	4.56 (0.85)	0.062	P < 0.005	P < 0.005
Factor 6	4.62 (0.63)	4.45 (0.64)	0.014	P > 0.05	P > 0.05

The discriminant function analysis determined the ability of the Psychological Characteristics of Developing Excellence Questionnaire to predict the group the athletes belonged to (i.e. good or poor developers). As before, a priori probabilities for each group were computed from the original group sizes. The result indicated a significant discriminant function of the questionnaire (Wilks' Lambda = 0.812, $\chi^2 = 16.91$, P < 0.05) and a canonical correlation of 0.434. The Psychological Characteristics of Developing Excellence Questionnaire was able to predict 67% of individual sport participants into the correct category. Utilising only factors with moderate and/or high effect sizes (factors 1, 2, and 4), 70% of

Table IV. Predicted group membership (team sport participants). (A) 75% of team sport participants were correctly classified (factors 1–6). (B) 68% of team sport participants were correctly classified (factors 3 and 5).

	Good developer group prediction	Poor developer group prediction
(A) Predicted group men	nbership (Factors 1-6)
Good developers (134)	130 (97%)	4 (3%)
Poor developers (49)	41 (84%)	8 (16%)
(B) Predicted group men	nbership (Factors 3 ar	nd 5)
Good developers (134)	90 (67%)	44 (33%)
Poor developers (49)	23 (47%)	26 (53%)

Table V. Canonical discriminant function coefficients (team sport participants).

Factor 1	0.142
Factor 2	0.055
Factor 3	0.455
Factor 4	-0.324
Factor 5	0.756
Factor 6	-0.007

the individual sport participants were classified into the correct rating category. For this group of participants, factor 1 (Support for long term success), factors 2 (Imagery use during practice and competition), and factor 4 (Ability to organise and engage in quality practice) predicted group membership for almost seven out of ten individual sport participants (Table VII). The canonical discriminant function coefficients were also examined (Table VIII). Factors 1, 4, and 6 were significant.

Discussion

The purpose of this study was to examine the discriminant validity of the Psychological Characteristics of Developing Excellence Questionnaire by testing whether it could discriminate between good and poor developers in sport. As a whole, the questionnaire was sufficiently sensitive to discriminate between good and poor developers from both team and individual sports. The discriminant function analysis provided evidence for the efficacy of the questionnaire structure by correctly classifying between 67% and 75% of the athletes based on their responses. However, significant differences were only found between the good and poor developers in team sports on factors 1, 3 and 5. In contrast, only factors 1, 2 and 4 discriminated significantly between good and poor developers in the individual sport group. Supporting this differential deployment of psychological characteristics of developing excellence, qualitative research has suggested (e.g. MacNamara et al., 2010b) that individual sport participants, swimmers for example, are required to deploy these skills from a much earlier age in response to the domain-inherent challenges, notably large amounts of deliberate practice, they faced during their early involvement in sport. By contrast, team sport participants do not typically specialise until much later in their careers and, as a result, are not required to invest similar amounts of deliberate practice, or make the associated sacrifices until later on in their careers. Reflecting the importance of a range of factors underpinning successful development, discrimination was optimised when multivariate profiles were

Table VI. Means, standard deviations, effect sizes, and significant levels for coach rating and PCDEQ factors (individual sport participants).

	Good developers mean (SD	Poor developers mean (SD)	Effect size	Significance	Significance following Bonferroni adjustment
Factor 1	4.3552 (0.60)	3.8962 (.73)	0.107	P < 0.005	P < 0.05
Factor 2	4.1763 (0.69)	3.7966 (.70)	0.069	P < 0.05	P > 0.05
Factor 3	3.6138 (0.88)	3.4534 (.82)	0.008	P > 0.05	P > 0.05
Factor 4	4.7644 (0.66)	4.2941 (.68)	0.108	P < 0.005	P < 0.05
Factor 5	4.9038 (0.74)	4.7118 (.75)	0.016	P > 0.05	P > 0.05
Factor 6	4.3489 (0.64)	4.1303 (.61)	0.029	P > 0.05	P > 0.05

Table VII. Predicted group membership (individual sport participants). (A) 67% of individual sport participants were correctly classified (factors 1–6). (B) 70% of individual sport participants were correctly classified (factors 1, 2, 4).

Good developer group prediction	Poor developer group prediction
embership (Factors	1–6)
44 (85%)	8 (15%)
20 (59%)	14 (41%)
embership (Factors	1, 3, 4)
47 (90%)	5 (10%)
21 (62%)	13 (38%)
	Good developer group prediction embership (Factors 44 (85%) 20 (59%) embership (Factors 47 (90%) 21 (62%)

Table VIII. Canonical discriminant function coefficients (individual sport participants).

Factor 1	0.763
Factor 2	0.296
Factor 3	-0.135
Factor 4	0.640
Factor 5	-0.115
Factor 6	-0.335

considered as a whole, even though good developers showed trends to higher values across all factors in both groups.

It is worth considering the differences between the team and the individual sport results. Interestingly, the factors that discriminated between good and poor developers were different for team and individual sport participants. Previous research can shed some light on these findings. For example, MacNamara et al. (2010a, 2010b) demonstrated that the importance of psychological characteristics of developing excellence may vary according to the needs and requirements of athletes at different stages of development and within different sports. Taking this into account, it is perhaps unsurprising that Factor 6 (support from others to compete to my potential) did not significantly differentiate between good and poor performers in the team sports. This factor related to how significant others helped the athletes cope with developmental demands, balance their commitments, and cope with the pressures of their sport. The mean age of the team sport participants in this study was 15.9 years, an age where they were just beginning to compete at representative levels of competition and previous findings suggest that team sport athletes are not required to independently deploy psychological characteristics of developing excellence until later in their development (MacNamara et al., 2010b). Of course this is not to say that talent identification and development models in sport should not encourage the development of

psychological characteristics of developing excellence earlier in the athletic career. It may well be that less successful, but perhaps more physically gifted, athletes do not realise their potential because they lacked the necessary psychological skills to cope with the challenges they faced. As such, it is important to recognise how the talent development environment, coaching, and sport system encourages and facilitates the development and deployment of these skills.

It is also worth noting however that the Psychological Characteristics of Developing Excellence Questionnaire's items were generated from evidence that characterised the psycho-behavioural skills that developing athletes should ideally possess and deploy. Contrastingly, when completing the questionnaire, the participants in this study were responding based on their own experiences in the sport. Given that psychological characteristics of developing excellence are not always an established feature of talent development environments, participants may not have reported these factors as part of their repertoire. Given that all the participants were sampled from the same environment, this point may also have accounted for the non-significant findings in both the team and individual sports. However, were education on, and application of, this approach more common this situation would likely change.

Practical applications of the Psychological Characteristics of Developing Excellence Questionnaire

The discriminant function analysis found that the six-factor, 59-item Psychological Characteristics of Developing Excellence Questionnaire was able to distinguish between good and poor developers with 67% and 75% accuracy in team sports and individual sports respectively. This finding has important applied implications for talent identification and development practices and offers a tool to evaluate the broad range of process characteristics that can underpin effective development in sport. This finding suggests that attention must be paid to a broad range of factors in order to reach a parsimonious understanding of effective development in sport. This is especially valid against our empirically supported suggestion (MacNamara & Collins, 2010) that developing a range of psychological characteristics of developing excellence may be an important facilitator of movement up the performance pathway.

The talent development process does appear to be driven by a chain of psycho-behavioural factors that require thoughtful and systematic guidance from teachers and coaches (Calderon, Subotnik, Knotek, Rayhack, & Gorgia, 2007). The importance of exposing young athletes to specialised coaching and training to accelerate their progress is well documented. As such, a systematic approach to developing psychological characteristics of developing excellence would seem to have significant merit. The lack of a coherent emphasis on psychobehavioural skills is a major limitation of current approaches to talent development. The integration of psychological characteristics of developing excellence into the talent development process will, of course, require changes to how coaches view talent development and will necessitate changes to how they interact with their charges. Subotnik and Jarvin (2005) support the role that instruction and guidance can play in enhancing the transformation of abilities into competencies and competencies into expertise. Several other investigations have also examined how coaches and teachers develop mental skills and characteristics in young performers (e.g. Gilbert, Côté, & Mallett, 2006; McCallister, Blinde, & Weiss, 2000). Although the coaches in these studies valued mental skills, and attempted to teach these skills to their athletes, this was not done in a systematic or intentional manner. Furthermore, the skill level of the coach mediated the effectiveness with which these psychological skills were taught. Skilled coaches used a variety of well-thought out and articulated strategies (e.g. team meetings, modelling behaviour, feedback) to teach psychological skills (Gilbert et al., 2006). Conversely, less skilled coaches taught psychological skills in an ad-hoc manner. An obvious next step, therefore, is to provide coaches with practical resources to promote the application of psychological characteristics of developing excellence within particular contexts and at particular stages and transitions of development. This initiative could involve the development of workbooks, workshops, and resources aimed at providing coaches with practical ways to promote the skills and characteristics that underpin successful development and performance in sport (MacNamara & Collins, 2011). By providing these resources, coaches will have a coherent and systematic approach to incorporating psychological characteristics of developing excellence into their coaching practices - a heretofore neglected area of talent identification and development programmes. This also marks a unique departure away from teaching 'life skills' through sport (e.g., Danish, Fazio, Nellen & Owens, 2002) to incorporating psycho-behavioural skills into sport coaching. In fact, placing the coach as the key agent in this process has significant benefits. Coaches should be able to use the Psychological Characteristics of Developing Excellence Questionnaire and accompanying resources to build on their existing knowledge and experience and independently promote the effective development and appropriate application of psycho-behavioural skills by athletes in their sport.

The current findings, taken together with the psychometric properties of the Psychological Characteristics of Developing Excellence Questionnaire's reported by MacNamara and Collins (2011), provide support for the use of the questionnaire as part of a holistic approach to the development of talent. A word of caution must be expressed at this point, especially in light of the (mis)use of testing procedures in talent identification and development. In our opinion and experience, the Psychological Characteristics of Developing Excellence Questionnaire should be used as a formative assessment (rather than a summative selection) tool to educate coaches and athletes about the skills and characteristics that act as important determinants of development in sport, and subsequently to identify and address these profiles. Of course, we are not suggesting that an ideal athlete psycho-behavioural profile exists, in much the same way that an ideal athlete physical profile does not. Instead we recognise that athletes can compensate for weaknesses in one area with strength in another (Ceci, Barnett, & Kanaya, 2003). However, the Psychological Characteristics of Developing Excellence Questionnaire should sensibly be used to monitor and reinforce changes in behaviour and evaluate individual needs and weaknesses in anticipation of development challenges. Of course, the questionnaire is potentially limited by respondent biases such as item interpretation, recall, and social desirability. Recognising that this may impact on the responses of young athletes, additional data collection methods are also recommended. In practice, these might include participant observation and/or asking open-ended questions about the constructs in question. In sum, a rich picture is preferred to a snapshot that might not reveal enough detail or information about an athlete's current status. We also recognise that culturally specific requirements may influence the deployment of psychological characteristics of developing excellence, an area that is an ongoing focus of our research.

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