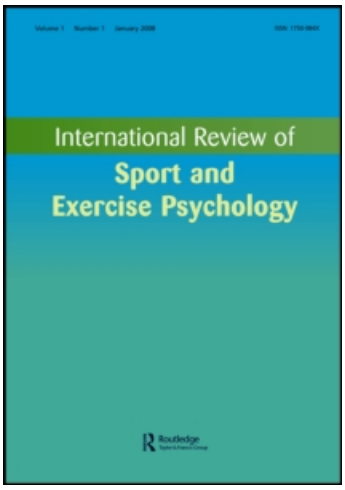

International Review of Sport and Exercise Psychology
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t762290975

Tracing the origins of athlete development models in sport: a citation path analysis

Mark W. Bruner [a]; Karl Erickson [a]; Kimberley McFadden [a]; Jean Côté [a]
[a] School of Kinesiology and Health Studies, Queen's University,

Online Publication Date: 01 March 2009

To cite this Article Bruner, Mark W., Erickson, Karl, McFadden, Kimberley and Côté, Jean(2009)'Tracing the origins of athlete development models in sport: a citation path analysis',International Review of Sport and Exercise Psychology,2:1,23 — 37
To link to this Article: DOI: 10.1080/17509840802687631
URL: http://dx.doi.org/10.1080/17509840802687631

International Review of Sport and Exercise Psychology
Vol. 2, No. 1, March 2009, 23–37

Routledge
Taylor & Francis Group

Tracing the origins of athlete development models in sport: a citation path analysis

Mark W. Bruner*, Karl Erickson, Kimberley McFadden, and Jean Côté

School of Kinesiology and Health Studies, Queen's University

(Received 24 October 2008; final version received 12 December 2008)

Reviews of the sport psychology literature have identified a number of models of athlete development in sport (Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 2001). However, minimal research has investigated the origins of knowledge from which each model was developed. The purpose of this study was to systematically examine the influential texts responsible for providing the basis of athlete development models in sport. A citation path analysis of the sport psychology literature was used to generate a knowledge development path of seven athlete development models in sport. The analysis identified influential texts and authors in the conceptualization of athlete development. The population of 229 texts (articles, books, book chapters) was selected in two phases. Phase 1 texts were articles citing seven articles depicting models of athlete development (n = 75). Phase 2 included texts cited three or more times by Phase 1 articles (n = 154). The analysis revealed how the scholarship of Benjamin Bloom (1985) has been integrated into the field of sport psychology, and how two articles appearing in 1993 and 2003 helped shape present conceptualizations of athlete development.

Keywords: athlete development; expertise; transition; citation; review

Introduction

Over the last three decades, a number of athlete development models in sport have been proposed. A review of the sport psychology literature by Durand-Bush and Salmela (2001) identified two models (Bloom, 1985; Côté, 1999) depicting an athlete's progression to elite sport. Another review conducted by Alfermann and Stambulova (2007) highlighted three additional models (Salmela, 1994; Stambulova, 1994; Wylleman & Lavallee, 2004) along with the two original models identified by Durand-Bush and Salmela (2001). More recently, Bruner, Côté, Erickson, and Wilson (2008) conducted a citation network analysis of seven athlete development models in sport (Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006; Stambulova, 1994; Wylleman, Alfermann & Lavallee, 2004). The citation analysis revealed two distinct bodies of research related to athlete development: 1) *talent development* including five models of athlete development (Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006) and 2) *career transitions* including two models of athlete development (Stambulova, 1994; Wylleman *et al.*, 2004). This finding is consistent with review articles and chapters on

*Corresponding author. Email: mark.bruner@queensu.ca

ISSN 1750-984X print/ISSN 1750-9858 online

DOI: 10.1080/17509840802687631
http://www.informaworld.com

athlete development in the sport psychology literature that tend to focus on either *talent development* or *career transitions* (i.e. Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 2001).

While often viewed as distinct, the two sub-groups of models on athlete development (*talent development* and *career transitions*) are often reviewed and discussed independent of the specific areas of research that form the basis of the two predominant approaches. The objective of this review is to enhance our understanding of the origins of research shaping present conceptual models of athlete development. An understanding of the lineage molding each approach is necessary to further advance and integrate the knowledge on athlete development.

Athlete development models based upon the *talent development* literature have been influenced by the field of cognitive psychology, skill acquisition, and expertise in domains such as music, art, and chess. The work of Bloom (1985), Chase and Simon (1973), and Ericsson (e.g., Ericsson, Chase, & Faloon, 1980; Ericsson, Krampe, & Tesch-Römer, 1993) have profoundly affected talent development research in sport over the last 30 years and subsequently the conceptualization of talent development models in sport. In their pioneering research, Bloom and colleagues (1985) inferred a general pattern of development that appeared necessary to reach elite performance in sport, science, mathematics, music and art. Ericsson and his colleagues (Ericsson, 1996; Ericsson *et al.*, 1993; Ericsson & Lehmann, 1996) used an expert performance approach (Chase & Simon, 1973), to demonstrate that expert performance in music, chess, sport, and other domains should be viewed as consequences of attaining a sequence of increasingly challenging goals through extended deliberate practice, rather than reflecting innate talents.

A sizable body of evidence from sport researchers supports Ericsson and colleagues contention about the role of deliberate practice and early specialization in the attainment of expertise in sport (e.g., Deakin & Cobley, 2003; Helsen, Starkes, & Hodges, 1998; Hodges & Starkes, 1996; Starkes, Deakin, Allard, Hodges & Hayes, 1996). Consequently, athlete development models based on talent development research tend to include deliberate practice as one of the most important elements of becoming an elite level athlete. However, specific studies (e.g. Baker, Abernethy, & Côté, 2003; Carlson, 1988; Orlick & Partington, 1988; Soberlak & Côté, 2003) examining athletes' pathways towards performance or continued participation in sport identified additional key elements of talent development (e.g. deliberate play, early diversification, role of parents, peers, etc; Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006) that have been integrated into conceptual models of athlete development.

The second approach to athlete development in sport is based on the *career transition* literature. Researchers in sport have been interested in the transitions of athletes for quite some time (e.g., Hallden, 1965; Mihovilovic, 1968). The number of investigations into athlete career transitions has risen substantially since the late 1960s. A review of the literature by McPherson in 1980 revealed 20 articles on athlete career transitions while two more recent reviews by Lavallee and colleagues (1998a; 1998b) found 226 articles on the topic. The increased attention has brought about several key developments including major shifts in research foci and theoretical frameworks, the consideration of contextual factors, and the construction of a position statement (1997) and monograph (1999) on career transitions in sport by the

European Federation of Sport Psychology (FEPSAC) (Alfermann & Stambulova, 2007; Wylleman *et al.*, 2004; Wylleman, Lavallee, & Alfermann, 1999).

Much of the early transition research in sport psychology has focused on understanding how the transitions out of elite sport influence the athlete (e.g., Baillie & Danish, 1992; Ogilvie & Howe, 1986; Pearson & Petitpas, 1990; Taylor & Ogilvie, 1994; Werthner & Orlick, 1986). An important development attributed to this body of research is the 'holistic' perspective on the athlete's career rather than one solitary event in time (e.g., career termination; Wylleman, Lavallee, & Alfermann, 1999) and increased attention to the psycho-social variables that affect development over a number of critical transitions in a sport career. Accordingly, researchers now hold a developmental perspective on athlete transitions. Athletes are viewed as undertaking a number of important career transitions which are influenced by transitions in other spheres (psychological, psycho-social, academic) of the athlete's life (Wylleman & Lavallee, 2004).

The present developmental perspective on career transitions has been heavily influenced by the work of Schlossberg (1981) in the area of counseling psychology. Schlossberg (1981) proposed a conceptual framework that identified three factors contributing to the adaptation of an individual to a transition. These include the characteristics of the individual (e.g., age, past experience with a similar transition), characteristics of pre-transition and post-transition environments (e.g., social support of friends and family, institutional support), and perception of the particular transition (e.g., gradual or sudden event, degree of stress, positive or negative affect). While much of the early work in athlete transitions adapted Schlossberg's (1981) framework to better understand and improve athlete disengagement from sport (e.g., Pearson & Petitpas, 1990), recent studies have focused on how social (e.g., coaches, parents, peers) and societal (e.g., sport system, culture) influences contribute to athlete development and transitions (Bruner, Munroe-Chandler, & Spink, 2008; Stambulova, Stephan, & Järphag, 2007; Wylleman, De Knop, Ewing, & Cumming, 2000).

Qualitative reviews (Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 1991) and citation analysis of athlete development models (Bruner, Côté *et al.*, 2008) have clearly identified two cohesive sub-groups of models that permeate the literature. However, qualitative reviews and citation analysis did not reflect, in a systematic manner, the incremental development of knowledge over time and the sequence of texts that constitute the foundation of our present knowledge. Main path analysis is a citation analysis technique that was developed to focus on the flow of knowledge over time by identifying the publications that are the crucial links in the literature on a particular topic (de Nooy, Mrvar, & Batagelj, 2005). Citation path analysis structurally analyzes the *connectivity* of the citation practices in a field with a goal of identifying the main stream of literature shaping the present understanding of a topic (Hummon & Doreian, 1989). The connectivity of the citations are encompassed in a complex social network comprised of nodes (articles) and links between the nodes (Barabási, 2003; Barabási & Bonabeau, 2003).

Researchers examining networks in a variety of fields (mathematics, physics, cell biology, engineering, technology) categorize article citations as being a scale-free rather than random network (Barabási & Bonabeau, 2003). The authors base this assumption on graph theory and suggest that citations are not random networks with most nodes (articles) having approximately the same number of links to other

articles (Barabási & Bonabeau, 2003). In contrast, article citation networks resemble a distribution in which most nodes (articles) have just a few connections and some central nodes (articles) known as 'connectors' or 'hubs' have a high number of links to other articles (Barabási, 2003; Barabási & Bonabeau, 2003). A common analogy used by researchers to differentiate the two types of networks is a uniform road grid for Random Networks, in which the cities are linked by major highways compared to an airline flight system for Scale-Free Networks, in which a large number of smaller airports are connected to each other through a few major hubs (Barabási & Bonabeau, 2003).

Considering the diverse origins of the athlete development literature, it is important to identify through main path analysis the most important citations or central 'hubs' that constitute the foundation of our present understanding of athlete development models. Undertaking this analysis will move beyond descriptions of athlete development models and provide a novel perspective on the interconnectedness of the athlete development literature.

Methods

The main path analysis of the sport psychology literature was conducted in two phases. In Phase I, based on Bruner, Côté *et al.*, (2008) citation analysis, conceptual models of athlete development in sport were identified based upon seven criteria:

(1) presenting a conceptualization of development;
(2) specific to the sport domain;
(3) sport-general, not sport-specific (e.g., not a basketball- or swimming-only development model;
(4) covering more than one age, phase, or transition;
(5) culture-general (e.g., not a North American-only development model);
(6) gender-general (e.g., not a female- or male-only development model) and;
(7) having been published in a peer-reviewed, English language, academic journal.

In total, seven articles representing seven distinct models of athlete development in sport were selected as the base of the article population (i.e., Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006; Stambulova, 1994; Wylleman *et al.*, 2004). The full Phase 1 article search was undertaken in November–December 2007 and was restricted to articles citing at least one of the seven model articles from two databases: 1) Web of Science and, 2) Scopus. Web of Science is comprised of five independent indices providing access to over 16,750 journals including all major sport and exercise periodicals (ISI Web of Knowledge, 2008). The Scopus online database contains over 15,000 peer-reviewed journals from a variety of disciplines (Scopus, 2008). After eliminating non-English language articles and articles not meeting the proposed criteria, a total of 75 peer-reviewed articles (including the original seven model articles) comprised the Phase 1 text population.

To create a main path of the Phase 1 literature, the text population in Phase 2 was expanded to include articles, books, and book chapters (not in the original text population) that were cited three or more times in the original 75 articles. The

expanded search identified an additional 154 texts. The texts included articles, books, and book chapters but were not required to be in the field of sport psychology or appear in the Web of Science or the Scopus databases. Collectively, the main path analysis is based on 229 texts – 75 from Phase 1 and 154 from Phase 2.

Procedure

After specification of the text population, print copies of each article were obtained. The reference list of each of the 229 texts was then examined to determine if they cited any of the other texts in the population. The citation information was entered into UCINET network analysis software (Borgatti, Everett, & Freeman, 2002) and centrality scores were calculated for each text. Centrality scores measure the prominence of texts within a network and can be further differentiated into in-degree (i.e., how many other articles in the text population cite a specific article) and out-degree (i.e., how many other articles in the text population are cited by a specific article) centrality measures (Moore, Shiell, Hawe, & Haines, 2005). Of particular interest was the identification of texts with high in-degree centrality measures indicating more central or influential roles in the network population (Moore *et al.*, 2005).

Following the calculation of in-degree centrality scores, faction analysis was conducted on the entire network, using the UCINET software. Faction analysis permits the identification of possible network sub-groups or groupings of articles that are more closely connected to one another in their citation ties than to articles in other factions (Borgatti *et al.*, 2002; Hanneman & Riddle, 2005).

To trace the main stream of intellectual flow in the literature, a main path analysis (Hummon & Doreian, 1989) was conducted to map the key links or 'hubs' in the evolution of knowledge in athlete development models over time using the software program Pajek (Pajek 1.23, Batagelj & Mrvar, 1996). In the derivation of the main path, the analysis mathematically explores all possible citation paths beginning with an origin text to an ending or terminal text (with no ties leaving it) (Hummon & Doreian, 1990). The main path of research was determined through an examination of the highest 'traversal counts' between texts in the citation network (Hummon & Doreian, 1989; Hummon & Doreian, 1990; Hummon, Doreian, & Freeman, 1990). Traversal counts indicate the number of times a text is involved in possible citation pathways from origin to terminal texts (Hummon & Doreian, 1990). As such, traversal counts reveal the importance of specific texts as linking other texts in the network. The end product of the analysis is a longitudinal representation of how the area of athlete development has been shaped by the citations of texts in the field.

Results

The citation network for the 229 texts is presented in Figure 1.

Within Figure 1, each text is represented by a square or triangle. The size of the square or triangle is indicative of the prominence of the text attributed to its in-degree centrality score as relative to the other texts in the population. Larger-sized squares or triangles represent the 'hubs' or the more prominent texts. The mean

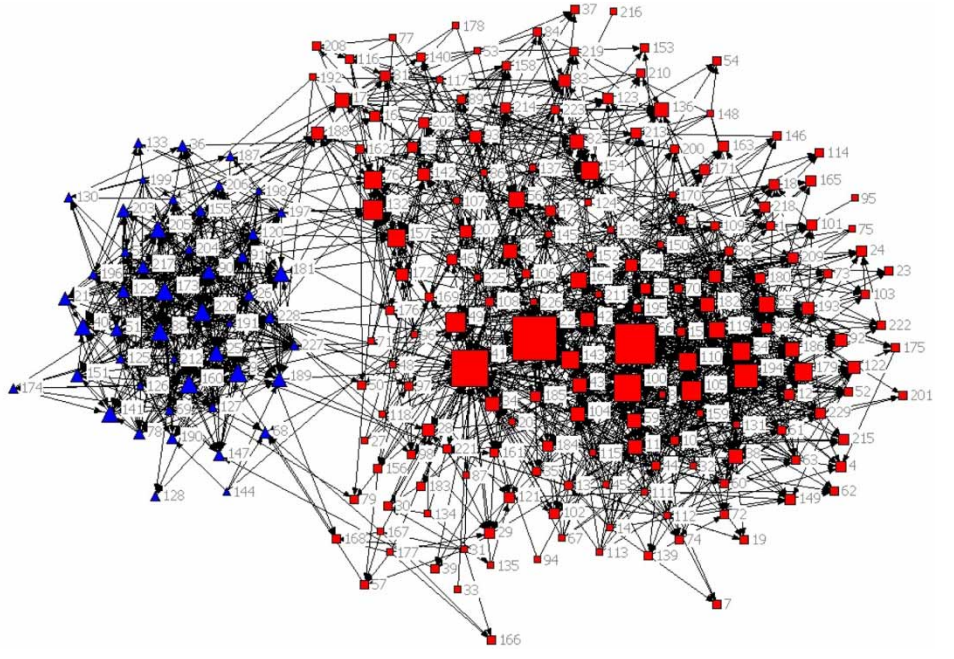

Figure 1. Athlete development citation network diagram.

in-degree citation score for the citation network is 9.06 (SD = 9.31), meaning that on average texts within the population were cited by approximately nine other texts.

Table 1 presents the most prominent texts in the citation network.

The most central or prominent text in the network is Bloom's (1985) *Developing Talent in Young People* with an in-degree centrality score of 68. Further support for the prominence of Bloom's text is provided by the addition of the 56 citations from four often cited chapters within Bloom's text by Gustin, Kalinowski, Monsaas, and Sosniak. The additional citations would increase the in-degree centrality score to 124 in-degree citations. The second most prominent text in the network is the article by Ericsson, Krampe, and Tesch-Römer (1993) entitled 'The role of deliberate practice in the acquisition of expert performance' with an in-degree centrality score of 62. Finally, the article by Côté (1999) entitled 'The influence of the family in the development of talent in sport' was the third most prominent article with an in-degree centrality score of 55. Faction analysis of the total network revealed the presence of two separate sub-groups or factions within the population. Texts in the first faction, represented by triangles in Figure 1, are centered on transition literature and include the two transition-based model articles (Stambulova, 1994; Wylleman *et al.*, 2004). The second faction, represented by circles in Figure 1, focuses on the staged-based talent development literature and includes the remaining five talent development-based model articles (Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006).

Twenty-three texts were found to be on the main path (see Figure 2).

Table 1. Ten most prominent (cited) texts in the citation network

Rank	Title	In-degree score
1	Developing talent in young people (Bloom, 1985)	68
2	The role of deliberate practice in the acquisition of expert performance (Ericsson, Krampe & Tesch-Römer, 1993)	62
3	The influence of the family in the development of talent in sport (Coté, 1999)	55
4	Team sports and the theory of deliberate practice (Helsen, Starkes & Hodges, 1998)	36
5	Deliberate practice in sports: what is it anyway? (Starkes, Deakin, Allard, Hodges & Hayes, 1996)	32
6	Wrestling with the nature of expertise: a sport specific test of Ericsson, Krampe and Tesch-Römer's (1993) theory of 'Deliberate Practice' (Hodges & Starkes, 1996)	24
7	Naturalistic inquiry (Lincoln & Guba 1985)	24
8	Talented teenagers (Csikszentmihalyi, Rathunde & Whalen, 1993)	23
9	Understanding the career transition of athletes (Baillie & Danish, 1992)	22
10	Expert performance: its structure and acquisition (Ericsson & Charness, 1994)	22
	Innate talents: reality or myth? (Howe, Davidson & Sloboda, 1998)	22
	Mental links to excellence (Orlick & Partington, 1988)	22
	Retirement experiences of successful Olympic athletes (Werthner & Orlick, 1986)	22

The top of the path represents the most recent articles in the area of athlete development while the bottom of the path indicates the origin texts in the field. An examination of the texts in the main path revealed that fewer than half (5 of 12) of the most prominent texts from the citation network analysis were in the main path. In addition, all texts from the path's origins to the terminal texts were based upon the expertise and talent development literature. None of the texts along the main path were from the career transition literature. A surveillance of the origin texts also displays a diverse background from areas such as chess, mathematics, music and sport. The text by Helsen, Starkes, and Hodges (1998) in the 14th position indicates the first expertise text devoted solely to athlete development.

One peculiar observation of the main path was the two texts that appear out of chronological order (Young & Salmela, 2002; Starkes, Helsen & Jack, 2001). A secondary analysis of the reference lists of the two identified texts revealed that the articles were out of order in the main path due to a publication lag. Starkes, Helsen and Jack (2001) had cited Young and Salmela (2002) in their work leading to the observed order in the main path.

Discussion

The way in which athlete development has been conceptualized in the literature has had a profound influence on the direction of research on athlete development. Based on qualitative analysis (Alfermann & Stambulova, 2007) and citation network analysis (Bruner, Côté *et al.*, 2008), athlete developmental models can be classified

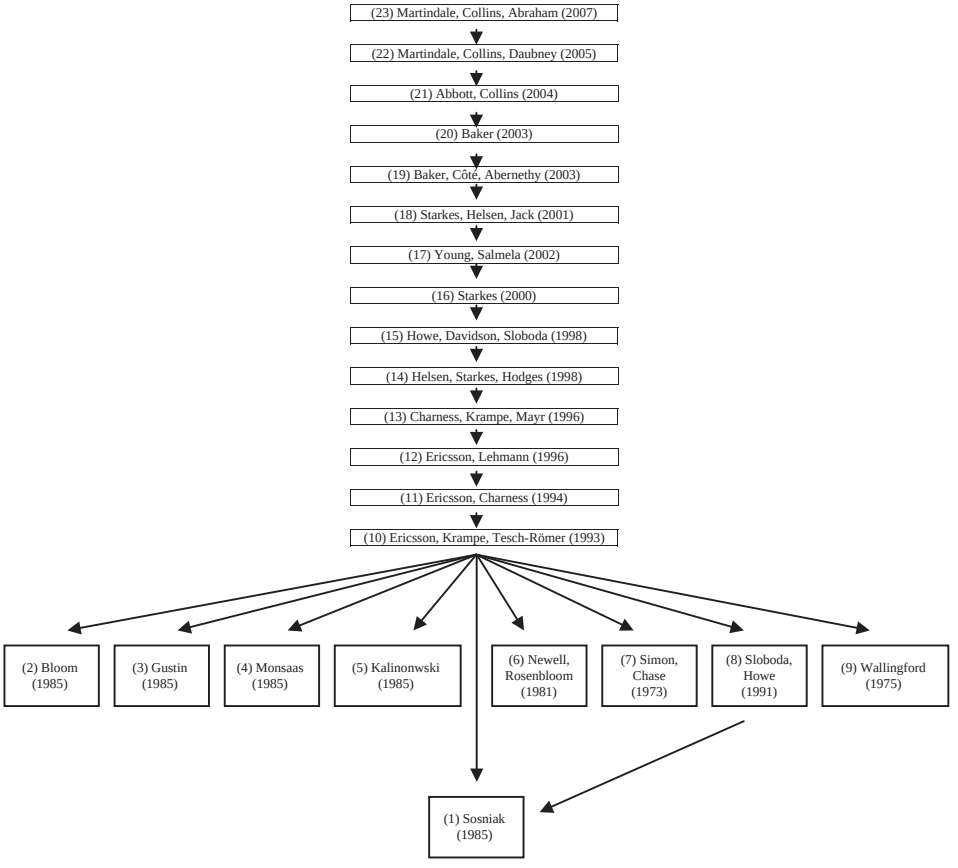

Figure 2. Athlete development main path diagram.

into two different conceptual approaches: talent development and career transitions. Five of the identified models of athlete development were based on the talent development literature, while two models of athlete development originated from the career transition literature. While previous reviews of athlete development models (Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 2001) have been fruitful, the research synthesis approach taken in the previous reviews – content analysis – does not delineate the incremental development of knowledge over time. The main path analysis conducted in the present study addressed this methodological limitation through the identification of the central or 'hub' texts that were vital to the development of current conceptualizations of athlete development. In doing so, the results served to compliment and inform findings from previous research synthesis approaches (e.g., content analysis and citation network analysis) in the field of sport and exercise psychology.

Twenty-three texts appear on the main path. At the top of the path are the most recent texts on athlete development, while texts at the bottom of the path are the core texts from which athlete development models were constructed. All the texts contained in the main path are representative of the talent development approach, with no specific texts representing the career transition approach. The fact that the

literature contains five athlete development models based on the talent development literature, compared to two models based on the career transition literature, may help explain the absence of career transition texts in the main path analysis. Furthermore, few texts connect the two approaches (Bruner, Côté *et al.*, 2008), making it difficult for the career transition literature to emerge in the main path. This finding is consistent with the minimal integration of texts between the talent development and career transition approaches noted in the citation network. The main path analysis could be generally divided into four stages of research that led to our present understanding of athlete development in sport.

The first stage of the main path analysis contains the foundation texts published between 1973 and 1991. Five texts (Bloom, 1985; Gustin, 1985; Kalinowski, 1985; Monsaas, 1985; Sosniak, 1985) at the foundation of the main path were contained in Bloom's report of interviews with talented individuals in disciplines such as mathematics, art, science, and sport. The other four texts at the foundation of the main path present a more experimental approach to expertise development that includes the seminal work of Simon and Chase (1973) on expertise in chess. An interesting feature of the nine texts that form the basis of athlete development models is the emergence of two very different methodological approaches to talent development. Bloom's approach was qualitative and retrospectively described the entire life of talented individuals, taking into consideration the influence of family, peers, teachers, and coaches. On the other hand, the other four texts (Newell & Rosenbloom, 1981; Simon & Chase, 1973; Sloboda & Howe, 1991; Wallingford, 1975) focus on the information processing resources of human performance by highlighting cognitive mechanisms and the role of practice on perception and performance.

The cognitive and practice approach to expertise development is developed further in the texts that constitute the second stage of the main path. At the core of the second stage we find the work of Ericsson, Charness, Howe, and colleagues (texts 10, 11, 12, 13, and 15) in music and chess. These five texts adopted methods and principles of cognitive psychology to develop and apply the 'expertise approach,' and proposed different conditions of practice (i.e. deliberate practice) as the essential elements of expertise development. These authors refer to the work of Bloom, however, they limited their focus to the perceptual and cognitive aspects of skill acquisition. Aspects of motivation, social influences, and psychological variables are acknowledged by the authors of this second stage but not seriously discussed and integrated in their approach to talent development.

The year 1998 marked the beginning of the third stage, featuring the first sport study of the main path analysis (Helsen, Starkes, & Hodges, 1998; text 14). This stage includes four texts (Helsen *et al.*, 1998; Starkes, 2000; Young & Salmela, 2002; Starkes *et al.*, 2001) that were heavily influenced by the work of Ericsson and Charness on deliberate practice in the previous stage. These studies focused mostly on practice activities throughout development by eliciting information from athletes through retrospective questionnaires. The main suggestion from these studies is that a monotonic relationship exists between the number of hours spent in relevant practice activities and the level of performance attained by athletes. When answering a retrospective questionnaire, athletes rated practice activities (i.e. deliberate practice) that are high in effort as also being high in enjoyment. This stage of sport expertise research began to revive the work of Bloom by highlighting important aspects of talent development such as enjoyment, motivation, and psycho-social

influences that were signaled as being critical. However, these aspects were not yet fully integrated in athlete development research.

The fourth stage includes texts that focus on aspects of athlete development in sport that move beyond the sole examination of practice activities. Baker, Côté & Abernethy (2003); text 19) first provided a retrospective study of athlete development that focused on practice but also integrated psycho-social aspects of talent development such as the role of play and other sporting activities during childhood. The design of this study was based on the original study of deliberate practice (Ericsson *et al.*, 1993) and the Developmental Model of Sport Participation (Côté, 1999), which was heavily influenced by the work of Bloom (1985). The remaining texts in this last stage continue to advocate the importance of practice in athlete development but also highlight the cost of deliberate practice at a young age (Baker, 2003), while proposing a view of athlete development that includes both psycho-social and training aspects of expertise (Abbott & Collins, 2004; Martindale, Collins, & Daubney, 2005; Martindale, Collins, & Abraham, 2007).

One of the noted discrepancies between the citation analysis and main path analysis findings was the absence of several prominent texts in the main path. Only five of the top 12 most cited texts in the citation network analysis appeared in the main path. Of the notable exclusions, the third most cited text ($n = 55$) in the citation network by Côté (1999) did not appear in the main path. One possible explanation to account for this finding involves the skill acquisition focus of the talent development literature around the timing of the Côté (1999) text. In the main path, the texts prior to and after Côté's (1999) article (Howe, Davidson, & Sloboda, 1998; Starkes, 2000) are ingrained in the expertise literature building upon Ericsson's and colleagues work on deliberate practice. Côté's (1999) suggestion of the importance of considering psycho-social factors (e.g., family) on talent development was not cited and integrated into the main path until much later (e.g., Baker, Côté, & Abernethy, 2003; Abbott & Collins, 2004). As highlighted earlier in the discussion, the work of Baker and colleagues (2003) constitutes a critical 'bridging text' to integrate the stream of deliberate practice literature and the psychosocial influences proposed by Côté (1999) in the field of talent development. The Baker *et al.* (2003) text was an empirical test of the propositions suggested by Ericsson *et al.* (1993) and Côté (1999) on talent development.

Despite the emergence of two transition pieces in the most cited texts (Baillie & Danish, 1992; Werthner & Orlick, 1986), transition-based texts did not appear in the main path. The notable absence of this approach is likely attributed to the far fewer articles grounded in the career transition literature. The creation of athlete development models such as the one by Wylleman and colleagues (2004) integrating the influential transition work of Schlossberg (1981) and the talent development literature may become future bridging texts along the main path much like the work of Baker and colleagues (2003) in the integration of deliberate practice and psychosocial influences in athlete development.

In concert, the findings from the citation network and main path analysis offer a number of future directions. An examination of literature in the area of athlete development revealed two sub-groups (talent development, career transitions) with minimal integration. Further research is necessary exploring the appropriateness of the integration or 'bridging' of the two conceptual approaches to athlete development. While recent conceptualizations of athlete development (Wylleman *et al.*,

2004; Abbott & Collins, 2004) have attempted to integrate elements of the two sub-groups, minimal research has empirically tested the proposed complex models. The athlete development field in general is in need of more model testing. Research systematically testing theory such as the work of Ericsson on deliberate practice (e.g., Hodges & Starkes, 1996; Helsen, *et al.*, 1998) has tailed off. Much recent work in the field (identified as being terminal texts in the main path) has consisted of conceptualizations and commentaries (Abbott & Collins, 2004; Martindale *et al.*, 2005; Martindale *et al.*, 2007). While these works represent important bridging efforts between the two conceptual approaches, this is a concern as model testing and model development serve as the fundamental basis to advance knowledge in any scientific area (Thomas, 1992).

Based upon the study findings, additional research is required to explore the psychosocial factors affecting young athlete development at different stages of career transitions. The influential role of family, coaches, and peers on young athlete development has been conceptualized and reported in the sport psychology literature (e.g., Bruner, Munroe-Chandler, *et al.*, 2008). However, further research is necessary describing the role of social agents during a young athlete's career. The utilization of prospective designs, multi-methods, and retrospective interviews have been advocated to gain a better understanding of the role of social support networks (e.g., coach, parent, siblings, peers) on the athlete's career transitions and development (Wyllemann, Alfermann, & Lavallee, 1999). In addition, alternative methodological approaches used in other areas of developmental psychology (e.g., dynamic systems-based observation techniques; Hollenstein, 2007) to study athlete development may be informative. Future research should also consider the context of the athletic environment and its relationship with young athlete development. Literature in developmental psychology has pointed to the importance of evaluating the developmental features of an activity setting (e.g., appropriate structure, supportive relationships, opportunities to belong, positive social norms, etc.; NRCIM, 2002). An understanding of these features is viewed as paramount to the obtainment of a number of desired developmental outcomes from the setting (e.g., competence, confidence, character, connection, caring; Lerner, Fisher, & Weinberg, 2000; Fraser-Thomas, Côté, & Deakin, 2005). Aligning with this research is a greater understanding of the key developmental constructs viewed as ideal outcomes of athlete development. Through such investigations, researchers will be better positioned to offer empirically supported recommendations to sport organizations and government bodies.

The novel methodology of citation network and main path analysis introduced and used in this study holds great promise in the field of sport and exercise psychology. The statistical analysis of the citations in the present study provided a visual representation of the main stream of literature shaping our present conceptualization of athlete development. While other review strategies in the area of sport and exercise psychology have provided content analysis (e.g., coaching review; Gilbert & Trudel, 2004) and a statistical summary of the results in a field (e.g., meta-analysis by Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006), researchers have not yet analytically explored the interconnectedness of literature shaping each field. The present study served to demonstrate how the creation and advancement of knowledge can be partially attributed to the acceptance and integration of ideas through the citation practices of researchers in a field. Developing a genealogy

or main path of specific areas in sport and exercise psychology would provide a current, structural overview of these areas and highlight specific approaches and conceptualizations that are predominant or neglected in an area of study. In this manner, the potential for integration of theory from other areas or disciplines can be promoted. Further exploration of topics using a citation path approach in the field of sport and exercise psychology is encouraged.

Acknowledgements

This research was supported by a standard research grant from the Social Sciences and Humanities Research Council of Canada (SSHRC Grant #410-08-1266). The authors would also like to thank Spencer Moore for his valuable advice on the citation path analysis.

References

Abbott, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: considering the role of psychology. *Journal Sport Sciences*, *22*, 395–408.

Alfermann, D., & Stambulova, N. (2007). Career transitions and career termination. In G. Tenenbaum & R.C. Eklund (Eds.) *Handbook of sport psychology* (pp. 712–733). New York: Wiley.

Bailey, R., & Morley, D. (2006). Towards a model of talent development in physical education. *Sport, Education and Society*, *11*, 211–230.

Baillie, P.H.F., & Danish, S.J. (1992). Understanding the career transition of athletes. *The Sport Psychologist*, *6*, 77–98.

Baker, J. (2003). Early specialization in youth sport: a requirement for adult expertise? *High Ability Studies*, *14*, 85–94.

Baker, J., Côté, J., & Abernethy, B. (2003). Sport-specific practice and the development of expert decision-making in team ball sports. *Journal of Applied Sport Psychology*, *15*, 12–25.

Barabási, A.L. (2003). *Linked: How everything is connected to everything else and what it means for business, science, and everyday life*. New York, NY: First Plume Printing.

Barabási, A.L., & Bonabeau, E. (2003). Scale-free networks. *Scientific American*, *288*, 50–59.

Batagelj, V., & Mrvar, A. (1996). Pajek-program for large network analysis. Retrieved August 11, 2008, from http://vlado.fmf.uni-lj.si/pub/networks/pajek/.

Bloom, B.S. (1985). *Developing talent in young people*. New York: Ballantine.

Borgatti, S.P., Everett, M.G., & Freeman, L.C. (2002). *UCINET 6 for Windows*. Harvard, MA: Analytic Technologies.

Bruner, M.W., Côté, J., Erickson, K., & Wilson, B. (2008). An appraisal of lifespan developmental models in sport through citation network analysis. *Journal of Sport & Exercise Psychology*, *30*(Suppl), S19.

Bruner, M.W., Munroe-Chandler, K.J., & Spink, K.S. (2008). Entry into elite sport: a preliminary investigation into the transition experiences of rookie athletes. *Journal of Applied Sport Psychology*, *20*, 236–252.

Burke, S., Carron, A., Eys, M., Ntoumanis, N., & Estabrooks, P. (2006). Group versus individual approach? A meta-analysis of the effectiveness of interventions to promote physical activity. *Sport & Exercise Psychology Review*, *2*, 19–35.

Carlson, R.C. (1988). The socialization of elite tennis players in Sweden: an analysis of the players' backgrounds and development. *Sociology of Sport Journal*, *5*, 241–256.

Chase, W.G., & Simon, H.A. (1973). Perception in chess. *Cognitive Psychology*, *4*, 55–81.

Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist*, *13*, 395–417.

Deakin, J.M., & Cobley, S. (2003). A search for deliberate practice: an examination of the practice environments in figure skating and volleyball. In J. Starkes & K.A. Ericsson (Eds.) *Expert performance in sport: recent advances in research on sport expertise* (pp. 115–135). Champaign, IL: Human Kinetics.

De Nooy, W., Mrvar, A., & Batagelj, V. (2005). *Exploratory social network analysis with Pajek*. New York: Cambridge University Press.
Durand-Bush, N., & Salmela, J.H. (2001). The development of talent in sport. In R.N. Singer, H.A. Hausenblas & C Janelle (Eds.) *Handbook of sport psychology* (pp. 269–289). New York: Wiley.
Durand-Bush, N., & Salmela, J.H. (2002). The development and maintenance of expert athletic performance: perceptions of world and Olympic champions. *Journal of Applied Sport Psychology*, *14*, 154–171.
Ericsson, K.A. (1996). *The road to excellence: the acquisition of expert performance in the arts and sciences, sports and games*. New Jersey: Lawrence Erlbaum Associates.
Ericsson, K.A., Chase, W.G., & Faloon, S. (1980). Acquisition of a memory skill. *Science*, *208*, 1181–1182.
Ericsson, K.A., Krampe, R.T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, *100*, 363–406.
Ericsson, K.A., & Lehmann, A.C. (1996). Expert and exceptional performance: evidence of maximal adaptation to task constraints. *Annual Review Psychology*, *47*, 273–305.
Fraser-Thomas, J.L., Côté, J., & Deakin, J. (2005). Youth sport programs: an avenue to foster positive youth development. *Physical Education and Sport Pedagogy*, *10*, 19–40.
Gilbert, W.D., & Trudel, P. (2004). Analysis of coaching research published from 1920–2001. *Research Quarterly for Exercise and Sport*, *75*, 388–399.
Gustin, W.C. (1985). The development of exceptional research mathematicians. In B.S. Bloom (Ed.) *Developing talent in young people* (pp. 270–331). New York: Ballantine.
Hallden, D. (1965). The adjustment of athletes after retiring from sports. In F. Antonelli (Ed.) *Proceedings of the 1st international congress of sport psychology* (pp. 730–733). Rome.
Hanneman, R., & Riddle, M. (2005). *Introduction to social network methods*. Riverside: University of California.
Helsen, W.F., Starkes, J.L., & Hodges, N.J. (1998). Team sports and the theory of deliberate practice. *Journal of Sport and Exercise Psychology*, *20*, 12–34.
Hodges, N.J., & Starkes, J.L. (1996). Wrestling with the nature of expertise: a sport-specific test of Ericsson, Krampe and Tesch-Römer's (1993) theory of 'deliberate practice'. *International Journal of Sport Psychology*, *27*, 400–424.
Hollenstein, T. (2007). State space grids: analyzing dynamics across development. *International Journal of Behavioral Development*, *31*, 384–396.
Howe, M.J.A., Davidson, J.W., & Sloboda, J.A. (1998). Innate talents: reality or myth? *Behavioral and Brain Sciences*, *21*, 399–442.
Hummon, N.P., & Doreian, P. (1989). Connectivity in a citation network: the development of DNA theory. *Social Networks*, *11*, 39–63.
Hummon, N.P., & Doreian, P. (1990). Computational methods for social network analysis. *Social Networks*, *12*, 273–288.
Hummon, N.P., Doreian, P., & Freeman, L.C. (1990). Analyzing the structure of the centrality-productivity literature created between 1948 and 1979. *Science Communication*, *11*, 459–480.
ISI Web of Knowledge. (2008). *Web of science database help*. Retrieved April 1, 2008, from http://images.isiknowledge.com/help/WOS/h_database.html
Kalinowski, A.G. (1985). The development of Olympic swimmers. In B.S. Bloom (Ed.) *Developing talent in young people* (pp. 139–192). New York: Ballantine.
Lavallee, D., Sinclair, D.A., & Wylleman, P. (1998a). An annotated bibliography on career transitions in sport: I. Counselling-based references. *Australian Journal of Career Development*, *7*, 34–42.
Lavallee, D., Wylleman, P., & Sinclair, D.A. (1998b). An annotated bibliography on career transitions in sport: II. Empirical references. *Australian Journal of Career Development*, *7*, 32–44.
Lerner, R.M., Fisher, C.B., & Weinberg, R.A. (2000). Toward a science for and of the people: promoting civil society through the application of developmental science. *Child Development*, *71*, 11–20.
McPherson, B.D. (1980). Retirement from professional sport: The process and problems of occupational and psychological adjustment. *Sociological Symposium*, *30*, 126–143.

Martindale, R.J.J., Collins, D., & Abraham, A. (2007). Effective talent development: the elite coach perspective in UK sport. *Journal of Applied Sport Psychology*, *19*, 187–206.
Martindale, R.J.J., Collins, D., & Daubney, J. (2005). Talent development: a guide for practice and research within sport. *Quest*, *57*, 353–375.
Mihovilovic, M.A. (1968). The status of former sportsmen. *International Review for the Sociology of Sport*, *3*, 73–93.
Monsaas, J.A. (1985). Learning to be a world-class tennis player. In B.S. Bloom (Ed.) *Developing talent in young people* (pp. 211–269). New York: Ballantine.
Moore, S., Haines, V., Hawe, P., & Shiell, A. (2006). Lost in translation: a genealogy of the social capital' concept in public health. *Journal of Epidemiology and Community Health*, *60*, 729–734.
Moore, S., Shiell, A., Hawe, P., & Haines, V.A. (2005). The privileging of communitarian ideas: citation practices and the translation of social capital into public health research. *American Journal of Public Health*, *95*, 1330–1337.
Morgan, T.K., & Giacobbi, P.R. (2006). Toward two grounded theories of the talent development and social support process of highly successful collegiate athletes. *The Sport Psychologist*, *20*, 295–313.
National Research Council and Institute of Medicine (2002). *Community programs to promote youth development* (Washington, National Academy Press).
Newell, A., & Rosenbloom, P.S. (1981). Mechanisms of skill acquisition and the law of practice. In J.R. Anderson (Ed.) *Cognitive skills and their acquisition* (pp. 1–55). Hillsdale, NJ: Erlbaum.
Ogilvie, B.C., & Howe, M. (1986). The trauma of termination from athletics. In J.M. Williams (Ed.) *Applied sport psychology* (pp. 365–382). Palo Alto, CA: Mayfield.
Orlick, T., & Partington, J. (1988). Mental links to excellence. *The Sport Psychologist*, *2*, 105–130.
Pearson, R.E., & Petitpas, A.J. (1990). Transitions of athletes: developmental and preventive perspectives. *Journal of Counseling and Development*, *69*, 7–10.
Salmela, J.H. (1994). Phases and transitions across sport careers. In D. Hackfort (Ed.) *Psychosocial issues and interventions in elite sport* (pp. 11–28). Frankfurt: Lang.
Schlossberg, N.K. (1981). A model for analyzing human adaptation to transition. *The Counseling Psychologist*, *9*, 2–18.
Scopus Info. (2008). Scopus overview: What is it? Retrieved April 1, 2008, from http://info.scopus.com/overview/what/.
Simon, H.A., & Chase, W.G. (1973). Skill in chess. *American Scientist*, *6*, 394–403.
Sloboda, J.A., & Howe, M.J.A. (1991). Biographical precursors of musical excellence: an interview study. *Psychology of Music*, *19*, 3–21.
Soberlak, P., & Côté, J. (2003). The developmental activities of elite ice hockey players. *Journal of Applied Sport Psychology*, *15*, 41–49.
Sosniak, L.A. (1985). Learning to be a concert pianist. In B.S. Bloom (Ed.) *Developing talent in young people* (pp. 19–67). New York: Ballantine.
Stambulova, N.B. (1994). Developmental sports career investigations in Russia: a post-Perestroika analysis. *The Sport Psychologist*, *8*, 221–237.
Stambulova, N.B., Stephan, Y., & Järphag, U. (2007). Athletic retirement: a cross-national comparison of elite French and Swedish athletes. *Psychology of Sport and Exercise*, *8*, 101–118.
Starkes, J.L. (2000). The road to expertise: is practice the only determinant? *International Journal of Sport Psychology*, *31*, 431–451.
Starkes, J.L., Deakin, J.M, Allard, F., Hodges, N.J., & Hayes, A. (1996). Deliberate practice in sports: what is it anyway? In K.A. Ericsson (Ed.) *The road to excellence: the acquisition of expert performance in the arts and sciences, sports and games* (pp. 81–106). New Jersey: Lawrence Erlbaum Associates.
Starkes, J.L., Helsen, W.F., & Jack, R. (2001). Expert performance in sport and dance. In R.N. Singer, H.A. Hausenblas & C.M. Janelle (Eds.) *Handbook of sport psychology* (pp. 174–201). New York: Wiley.
Taylor, J., & Ogilvie, B.C. (1994). A conceptual model of adaptation to retirement among athletes. *Journal of Applied Sport Psychology*, *6*, 1–20.

Thomas, R.M. (1992). *Comparing theories of child development*, 3rd ed. Belmont, CA: Wadsworth.
Wallingford (1975). Long distance running. In A.W. Tayler & F. Landry (Eds.) *The scientific aspects of sport training* (pp. 118–130). Springfield, IL: Charles C. Thomas.
Werthner, P., & Orlick, T. (1986). Retirement experiences of successful Olympic athletes. *International Journal of Sport Psychology*, *17*, 337–363.
Wylleman, P., Alfermann, A., & Lavallee, D. (1999). Career transitions in Competitive Sport. *Monographs of the European Federation of Sport Psychology* (ISSN 1562–1278).
Wylleman, P., Alfermann, D., & Lavallee, D. (2004). Career transition in sport: European perspectives. *Psychology of Sport & Exercise*, *5*, 7–20.
Wylleman, P., De Knop, P., Ewing, M.E., & Cumming, S.P. (2000). Transitions in youth sport: a developmental perspective on parental involvement. In D. Lavallee & P Wylleman (Eds.) *Career transition in sport: international perspectives* (pp. 143–160). Morgantown: FIT.
Wylleman, P., & Lavallee, D. (2004). A developmental perspective on the transitions faced by athletes. In M.R. Weiss (Ed.) *Developmental sport psychology: a lifespan perspective* (pp. 507–527). Morgantown: FIT.
Young, B.W., & Salmela, J.H. (2002). Perceptions of training and deliberate practice of middle distance runners. *International Journal of Sport Psychology*, *33*, 167–181.