



An appraisal of athlete development models through citation network analysis

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ABSTRACT

Background and purpose: A number of models have been proposed to help explain how athletes develop in sport. However, minimal research has attempted to examine the prominence and interconnectivity of the athlete development models in the literature. The purpose of the present study was to synthesize and evaluate the interconnectivity of the English-language literature that serve as the foundation for athlete developmental models in sport using a novel research synthesis approach to sport psychology – citation network analysis. Unlike other research synthesis techniques, citation network analysis reveals the cognitive structure and interconnectedness of a field of study [Moore, S., Shiell, P., Hawe, P., & Haines, V.A. (2005). The privileging of communicarian ideas: citation practices and the translation of social capital into public health research. *American Journal of Public Health*, 95, 1330–1337].

Methods: Based upon seven criteria, seven articles representing models of athlete development in sport were selected as the base of the article population. All peer-reviewed, English journal articles that cite at least one of these seven model articles were compiled, resulting in a total population of 75 articles. From this article population a network of inter-citations was created.

Results and conclusions: Analysis of the total network revealed the presence of two separate factions working in relative isolation from one another. Articles in the first faction were centered around the Stambulova [(1994). Developmental sports career investigations in Russia: a post-perestroika analysis. *The Sport Psychologist*, 8, 221–237.] and Wylleman, Alfermann, and Lavallee [(2004). Career transitions in sport: European perspectives. *Psychology of Sport and Exercise*, 5, 7–20.] model articles while the second faction contained five other model articles [Abbott, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: considering the role of psychology. *Journal of Sport Sciences*, 22, 395–408; Bailey, R., & Morley, D. (2006). Towards a model of talent development in physical education. *Sport, Education and Society*, 11, 211–230; Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist*, 13, 395–417; 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; Morgan, T. & Giacobbi, P. R., Jr. (2006). Toward two grounded theories of the talent development and social support process of highly successful collegiate athletes. *The Sport Psychologist*, 20, 295–313.]. The results offer a comprehensive representation of how researchers use existing models and articles to unravel the complexity of athlete development in sport.

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For over a century, scientists have highlighted the necessity to review and synthesize research (cf. Rayleigh, 1885). Research synthesis involves the “analysis, evaluation, and integration of the published literature” (Thomas, Nelson, & Silverman, 2005, p.247). A good research synthesis presents more than a summary of related research; it is a systematic review that offers tangible, valid conclusions, and provides future directions (Thomas et al., 2005). During the last quarter of the 20th century, several analytical

research techniques have been identified for their systematic approaches to research synthesis.

Meta-analysis (Glass, 1976) is regarded as one of the most rigorous analytical techniques to review the literature. A meta-analysis includes a detailed methodology to guide the decisions in a literature analysis, and quantifies the results of various studies to a standard metric (i.e., effect size) to permit analytical comparison (Thomas et al., 2005). Meta-analysis has featured prominently in the sport psychology literature examining such topics as the effect of mental practice on motor skills learning and performance (Feltz & Landers, 1983), anxiety and sport performance (Kleine, 1990), affect and achievement goals (Ntmoumanis & Biddle, 1999),

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cohesion and performance in sport (Carron, Colman, Wheeler, & Stevens, 2002).

A second analytic technique is content analysis. Content analysis is regarded as one of the most important research techniques in the social sciences (Krippendorff, 2004). The technique is viewed as systematic, objective, and often quantitative in nature (Holsti, 1969). The goal of content analysis is to make replicable and valid inferences from texts (Krippendorff, 2004). Over the past three decades, a number of content analyses have been conducted in the sport psychology literature, notably in the areas of youth sport (Gould, 1982; Weiss & Bredemeier, 1983; Weiss & Raedeke, 2004). Of particular relevance to the present study, content analysis has recently been used to examine models of athlete development (Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 2002).

In their review of the literature on athlete development, Durand-Bush and Salmela (2002) examined the content of two models depicting athletes' development over time (Bloom, 1985; Côté, 1999). More recently, Alfermann and Stambulova (2007) critiqued the content of five athlete development models including the two identified by Durand-Bush and Salmela (2002): (i) Bloom (1985), (ii) Côté (1999), as well as three others - (iii) Salmela (1994), (iv) Stambulova (1994), and (v) Wylleman & Lavallee (2004). Within their review, Alfermann and Stambulova (2007) highlighted the necessity for clarity in athlete development terminology. One important distinction made by Alfermann and Stambulova (2007) within the review of athlete development models was between *career stages* and *career transitions*.

Career stages often refer to successive time periods of an athlete's career and development (Alfermann & Stambulova, 2007), characterized by distinct performance, training or psychosocial qualities. Past conceptualizations of athlete development have commonly used a career stages or stage-based approach (e.g., Bloom, 1985; Côté, 1999; Salmela, 1994). In contrast, *career transitions* have been operationalized as the critical turning points and phases in an athlete's career (Alfermann & Stambulova, 2007). The term *transition* has its roots in the counseling psychology literature and is commonly defined as, "an event or non-event that results in a change in assumptions about oneself and the world and thus requires a corresponding change in one's behaviour and relationships" (Schlossberg, 1981, p.5). Schlossberg's definition and conceptual framework of adaptation to transition have provided a basis for researchers in sport (e.g., Bruner, Munroe-Chandler, & Spink, 2008; Pearson & Petitpas, 1990). One notable advancement from Schlossberg's definition of transition is a view of transition in sport as a *process* rather than a single event or non-event (Wylleman, Alfermann, & Lavallee, 1999). This new conceptualization is representative of Stambulova's (1994) and Wylleman and Lavallee's (2004) models depicting an athlete's salient career transitions.

While the two previous reviews of the athlete development literature using content analysis (Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 2002) have been beneficial to compare and contrast the models, research has not yet evaluated the prominence and interconnectedness of these models in the literature. To address this paucity, it is imperative to appropriately match the selection of the research synthesis approach with the identified research question. While meta-analysis standardizes quantitative results of multiple studies and content analysis summarizes and integrates research conclusions, neither can address questions regarding the structure and organization of literature in a particular area. One appropriate, under-utilized research synthesis approach to address the prominence and interconnectedness of athlete developmental models in the literature is citation network analysis. Citation network analysis is an analytical research synthesis technique which reveals the structure and interconnectedness of the citation practices of a field of study or an area of specialization

(Barabási & Bonabeau, 2003; Moore, Shiell, Hawe, & Haines, 2005). The resulting structure evaluates the prominence and visibility of certain scholars, articles, and theoretical and methodological approaches (Moore et al., 2005; de Nooy, Mrvar & Batagelj, 2005). The analysis also provides an identification and evaluation of existing subgroups within the citation network. As researchers within a domain tend to cite each other (de Nooy et al., 2005), the clustering of subgroups may inform our understanding of the interconnectedness of athlete developmental models in the sport psychology literature.

Citation network analysis holds considerable promise as an effective research synthesis technique to improve our understanding of the complexity of athlete development. Considering that the athlete development research has already benefited from content analysis of specific issues (i.e., motivation, anxiety, moral development; Weiss & Raedeke, 2004) and comprehensive reviews of developmental models (Alfermann & Stambulova, 2007; Durand-Bush & Salmela, 2002), citation network analysis will be beneficial to improve our understanding of the complexity of athlete development research. The analytical approach has been successfully applied in other scientific areas (e.g., health promotion, biology; Hummon & Doreian, 1989; Moore et al., 2005) to provide a helpful typology of the field. The purpose of the present study was to synthesize and evaluate the prominence and interconnectedness of the English-language literature that serve as the foundation for athlete developmental models in sport using a novel research synthesis approach to sport psychology – citation network analysis. The investigation was based on two primary research questions: 1) what are the most prominent English-language conceptualizations (or models), and texts within the field of athlete development? and 2) how are these models and their associated literature connected within the field of sport psychology?

Methods

Specification of article population

In selecting the article population for analysis, we sought an overview of current conceptualizations of athlete development in sport and their use in academic literature. As a base for the target article population, models of athlete development were reviewed. Models were selected based on meeting seven criteria: 1) presenting a conceptualization of development; 2) specific to the sport domain; 3) not explicitly intended as specific to a single sport (e.g., not a basketball- or swimming-only development model); 4) covering more than one age, phase, or transition; 5) not explicitly intended as specific to a single country or culture (e.g., not intended as an Australian-only development model); 6) gender not specified (e.g., not a female- or male-only development model) and; 7) having been published in a peer-reviewed, English-language, academic journal. For each model that met all seven selection criteria, a peer-reviewed article was selected as representing the initial conceptualization of the model. Primary authors of each model were contacted and verified the selection of the initial conceptualization article. 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, Alfermann, & Lavallee, 2004; see Table 1 for a brief description of each model).

The Web of Science online database was then used to search for all articles citing at least one of the seven model articles. We chose to restrict our initial analysis to the Web of Science multidisciplinary database because of its comprehensive coverage of the English-language social sciences. Collectively, the database is

Table 1
Descriptions of athlete development models in chronological order.

Initial model conceptualization	Type of athlete development model	Emphasis	Span
Stambulova (1994) [62]	Career/Transition-based,	Experiences, context, and resolution strategies and consequences of each transition.	Initial entry into sport through to career termination
Côté (1999) [15]	Talent/Expertise-based	Differential occurrence of deliberate play and deliberate practice, and influence of family during each stage.	Initial entry into sport through to entry into high performance sport participation.
Durand-Bush and Salmela (2002) [20]	Talent/Expertise-based	Contextual, personal, training, and competition factors at elite stages.	Initial entry into sport through to elite sport participation.
Wylleman, Alfermann, and Lavalée (2004) [75]	Career/Transition-based	Integration of transitions at athletic, psychological, psychosocial, and academic/vocational levels.	Initial entry into sport through to career termination.
Abbott and Collins (2004) [2]	Talent/Expertise-based	Influence of psycho-behaviours in facilitating transitions between stages of talent development.	Initial entry into sport through to elite sport participation.
Bailey and Morley (2006) [4]	Talent/Expertise-based	Influence of talent identification, practice and provision strategies in physical education (PE) on PE and sport outcomes.	Initial physical education experiences through to life-span outcomes.
Morgan and Giacobbi (2006) [52]	Talent/Expertise-based	Factors at different points in time leading to continued talent development.	Birth through to highly successful collegiate sport participation.

Note. Values enclosed in square brackets indicate the articles identification number in Fig. 1.

comprised of five independent indices providing access to over 16,750 journals and 1, 460, 670 articles including all major sport and exercise periodicals (ISI Web of Knowledge, 2008). Of the 1, 388, 976 articles accessible in Web of Science, 95% (1, 460, 670) of the articles are published in the English-language. From this search a list of 67 English-language articles that cited at least one of the model articles was compiled and cross validated using the Scopus online database, which contains over 15,000 peer-reviewed journals from a variety of disciplines (Scopus, 2008). The expansive coverage of this database resulted in the addition of one article not listed in the Web of Science database. A final total of 68 articles, plus the original seven model articles provided a total article population for analysis of 75 articles (a list of all 75 articles can be obtained from the corresponding author).

Procedure

After specification of the article population, print copies of each article were obtained. Each paper was classified by type as either empirical (quantitative or qualitative), review, theoretical, methodological, case study, or commentary according to American Psychological Association guidelines (APA, 2002). The reference list of each article was then checked and citation of any other article(s) in the total article population was noted. This citation information was entered into the UCINET network analysis software's spreadsheet (Borgatti, Everett, & Freeman, 2002). Subsequent to this omnibus step we examined the text of each article citing a model article in an effort to better understand how the model articles are being used in the literature. Using the work of Chubin and Moitra (1975) as a guide, a citation classification scheme was developed. A citation of a model article was considered 'substantive' if the reference was deemed central to the discussion of results in empirical articles or main arguments in review, theoretical, or commentary articles. If the reference was not integral to the results or main conclusions/arguments, the citation was classified as 'passive' in its use of the model. The citation classification scheme was conducted independently by the second and third authors. This process yielded an inter-rater reliability of 96% between researchers. Any discrepancies between the researchers were resolved during a meeting with the four co-authors.

UCINET and its associated network diagramming package, NETDRAW, were used to graphically display the directed ('cites' vs.

'is cited by') citation network of the article population. Additionally, both in-degree and out-degree centrality scores were calculated for each article. In-degree centrality refers to how many other articles in the total population cite a specific article, while out-degree centrality refers to how many other articles in the total population are cited by a specific article (Moore et al., 2005). The higher the centrality score (either in-degree or out-degree), the more central or connected that particular article is to the whole network (Moore et al., 2005). In network analysis, the more prominent features (e.g., scholars, articles) identified by higher centrality scores are often referred to as "connectors" or "hubs" (Barabási & Bonabeau, 2003).

Finally, faction analysis was conducted on the entire network, also using the UCINET software, in order to identify possible network subgroupings. Specific to this study, factions consist of 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). Exploratory faction analysis has often been used in conjunction with measures of centrality in an effort to identify cliques or substructures that are more connected to each other than to nodes in other factions (Hanneman & Riddle, 2005).

Results

Of the 75 articles in the final population, 30 were quantitative empirical works, 22 were qualitative empirical works, 10 were theoretical, 8 were reviews, 3 were methodological, and 2 were commentary. The citation network for all 75 articles is presented in Fig. 1. Each node (triangle or circle) in Fig. 1 represents an article. The number beside each node represents the identification number for the article in the citation network. The direction of the arrow illustrates how a specific article cites another article in the population (i.e., arrow pointing toward another node) or is cited by another article in the network (arrow pointing toward node). The size of each node represents its relative in-degree centrality score (i.e., bigger nodes represent articles that have more arrows pointing toward them and indicate articles that are being cited more often) as compared to the other articles in the population.

The mean in-degree citation score for articles in the network was 2.5 ($SD = 6.5$), meaning that the average article in the population was cited by approximately two or three other articles. The average out-degree centrality score was 2.5 ($SD = 1.7$), meaning

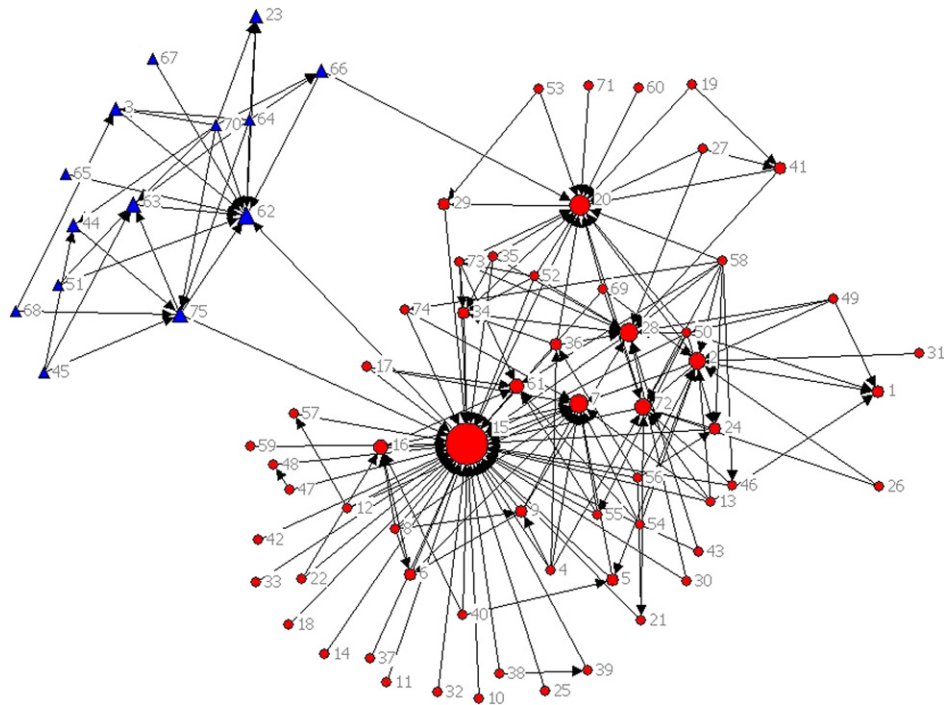


Fig. 1. Citation network for the 75 articles in the athlete development in sport article population.

roughly that the average article in the population cited two or three other articles also in the population.

Table 2 first presents in-degree and out-degree centrality scores for the articles where each model was first conceptualized. Côté (1999) is the most highly cited model article, with an in-degree score more than three times higher than the next most cited model article. Abbott and Collins (2004) have the highest out-degree score of the model articles, citing seven other articles in the population. The final two columns of Table 2 highlight the number of other articles in the study population that have referenced the models and indicate whether the citation was used substantively or passively, as per our aforementioned classification scheme. Côté's (1999) model has received the most substantive use from other articles in the population to date, followed by the models of Durand-Bush and Salmela (2002) and Stambulova (1994).

Table 3 lists the most cited or hub articles in the population and the type of publication, regardless of whether or not they were a model article. Of note, six of the 11 most central are not model articles (Baker, Côté, & Abernethy, 2003; Côté, Ericsson, & Law, 2005; Gould, Dieffenbach, & Moffett, 2002; Stambulova, 2000; Soberlak & Côté, 2003; Williams & Reilly, 2000).

Analysis of the total network revealed the presence of two separate factions within the network. Articles in the first faction, represented by triangles in Fig. 1, are centered around the Stambulova (1994) and Wylleman et al. (2004) model articles. The

second faction, represented by circles in Fig. 1, contains all five other model articles (Abbott & Collins, 2004; Bailey & Morley, 2006; Côté, 1999; Durand-Bush & Salmela, 2002; Morgan & Giacobbi, 2006). Of the most central non-model articles presented in Table 3, only one (Stambulova, 2000) is located within the first faction. All others are located within the second faction (see Fig. 1).

Discussion

The use of citation network analyses in the present study proved helpful in identifying prominent English-language models of athlete development and understanding the interconnectedness of the models and their associated literature in the field of sport psychology. The results of this study suggest that not all of the identified models have received equal attention in the English-language sport psychology literature. The citation analysis found the Developmental Model of Sport Participation (DMSP; Côté, 1999) to be the most prominent conceptualization in the literature, with an in-degree centrality score more than three times the next most cited model (Durand-Bush & Salmela, 2002) and the highest number of substantive citations. An important caveat to this finding is that the three most cited models in the citation network including the DMSP (Côté, 1999; Durand-Bush & Salmela, 2002; Stambulova, 1994) are the three oldest in our study population. An argument has been made that the older, more 'senior' models have

Table 2
Centrality scores, and citation usage data for models of athlete development in chronological order.

Initial model conceptualization	In-degree centrality	Out-degree centrality	Substantive citation	Passive citation
Stambulova (1994)	11	0	4	7
Côté (1999)	50	1	21	29
Durand-Bush and Salmela (2002)	17	2	7	10
Wylleman, Alfermann, and Lavallee (2004)	5	3	1	4
Abbott and Collins (2004)	9	7	3	6
Bailey and Morley (2006)	0	5	–	–
Morgan and Giacobbi (2006)	0	5	–	–

Note. Numbers in the substantive and passive citation columns refer to number of articles citing the model article in either substantive or passive form.

Table 3
Most frequently cited articles of the athlete development article population.

Rank	Article [identification number in Fig. 1]	Type	In-degree score
1	"The influence of the family in the development of talent in sport" (Côté, 1999) [15]	Empirical qualitative	50
2	"The development and maintenance of expert athletic performance" (Durand-Bush & Salmela, 2002) [20]	Empirical qualitative	17
3 (tie)	"Psychological characteristics and their development in Olympic champions" (Gould, Dieffenbach, & Moffett, 2002) [28]	Empirical qualitative	13
3 (tie)	"Sport-specific practice and the development of expert decision-making in team ball sports" (Baker, Côté, & Abernethy, 2003) [7]	Empirical quantitative	13
5	"Developmental sports career investigations in Russia: A post-Perestroika analysis" (Stambulova, 1994) [62]	Empirical qualitative	11
6	"Talent identification and development in soccer" (Williams & Reilly, 2000) [72]	Review	10
7	"Eliminating the dichotomy between theory and practice in talent identification and development: Considering the role of psychology" (Abbott & Collins, 2004) [2]	Theoretical	9
8	"The developmental activities of elite ice hockey players" (Soberlak & Côté, 2003) [61]	Empirical quantitative	6
9 (tie)	"Athlete's crises: A developmental perspective" (Stambulova, 2000) [63]	Theoretical	5
9 (tie)	"Career transitions in sport: European perspectives" (Wylleman, Alfermann, & Lavalley, 2004) [75]	Review	5
9 (tie)	"Tracing the development of athletes using retrospective interview methods: A proposed interview and validation procedure for reported information" (Côté, Ericsson, & Law, 2005) [16]	Methodology	5

a higher likelihood of being cited in comparison with their newer counterparts due to their longer duration in the literature (Barabási & Albert, 1999). A study by Chubin and Moitra (1975) supports this argument as they found that it took approximately four years from the date of publication for 70 percent of the articles in their study population to be cited.

The advantage of seniority, however, cannot account for the prominence of the three older athlete development models alone. It is possible that a related mechanism, *preferential attachment*, may have contributed to the emergence of the prominent models in the network (Barabási & Albert, 1999). In the network literature, it has been postulated that newer nodes in a network prefer to link to the more connected hubs. According to this hypothesis, articles with more links in the literature will be more visible and thus more likely to be selected and cited than their less connected peers (Barabási & Albert, 1999). That is, the more citations an article has, the higher the likelihood it will be cited in the future. While neither mechanism can fully account for the prominence of certain models, the combination of seniority and preferential attachment may explain how citation structure characteristics can influence the visibility of articles, beyond purely content.

It is important to note, however, that although the DMSP appears to be leading the way via its transfusion amongst the English-language athlete development research and its number of substantive citations, the present paper is simply presenting a 'snapshot' of the literature on athlete development in sport at the present time - i.e., its current *structure*. With time and a potential broadening of the scope of the literature to consider additional cultural contexts (cf., Arnett, 2008), other models may receive more support and potentially become more central to the field. In addition, the high citation counts of the DMSP do not necessarily infer the model's veracity or validity but rather that it transcends or permeates the literature with greater influence (Scott, 2006).

Further analysis of the entire study population (75 articles) provided an indication of the most prominent and influential works (Table 3). Given our criteria for article selection it comes as no surprise to find five of the athlete development models included in the eleven most frequently cited articles, while six articles making the list come from outside the model population. Although the two most frequently cited articles are models, the third, fourth and sixth most frequently cited article(s) are not model articles (Baker, Côté, & Abernethy, 2003; Gould, Dieffenbach, & Moffett, 2002; Williams & Reilly, 2000). Their relatively high in-degree centrality scores suggest that they can be classified as hubs in the network, both prominent and influential in steering English-language research in the athlete development realm (Barabási & Bonabeau, 2003, Scott, 2006).

These results remind us that knowledge is socially constructed (Moore et al., 2005) and it is through citation practices that researchers assist their peers, the public and the field in the construction of that knowledge. It is therefore incumbent upon researchers to be aware of the reasoning behind their citation of specific articles within the athlete development literature. Are the articles we choose to cite the best representation of what we are trying to discuss? Or have prominent articles simply become concept symbols (Small, 1978), representative of general ideas without reference to their individual content or specific knowledge claims?

The study's second research question sought to unveil how the models of athlete development and their associated literature were connected within the field of sport psychology. The faction analysis revealed a structure of two cohesive subgroups, working independently and in relative isolation from one another (Fig. 1). The first subgroup or faction is centered around the Stambulova (1994) and Wylleman et al. (2004) models while the second faction contains all five of the remaining sport development models. Moore et al. (2005) suggest that a consequence of such fragmentation is that there is little development, growth, or networking of perspectives within a body of literature. Our findings support such a notion as Fig. 1 suggests that there is very little connection between both research groups. We note that only two citations emerge leading from faction one to faction two (Stephan, Bilard, Ninot & Delignières, 2003 cites Durand-Bush & Salmela, 2002; Wylleman et al., 2004 cites Côté, 1999) and only one citation leading from faction two to faction one (Côté, 1999 cites Stambulova, 1994). Interestingly, each of the crossovers that do occur (albeit only three) involve a model article. In trying to discern a plausible explanation for the disconnect, we turn to the multi-disciplinary nature of our field in terms of the various areas from which athlete development research is both being generated and used. Resultantly, we highlight the fact that both the Wylleman et al. (2004) and Stambulova (1994) models are firmly rooted in a career- or transition-based emphasis while the remaining five models approach athlete development from a talent or expertise perspective. As such, each of the two factions appear to be approaching development in sport from different perspectives, which may help explain the little discourse occurring between them.

Table 2 also provides additional support for the apparent disconnect of the athlete development literature in sport. Eight of the most frequently cited articles are found in faction two, while only three are from faction one. Two of the three most frequently cited articles from faction one are model articles (Stambulova, 1994; Wylleman et al., 2004), suggesting that aside from the models very little research from that faction is permeating the English-language literature. This implies, as is apparent from Fig. 1, that in terms of athlete development across the life-span, most of the published research in English is being generated from

a stage-based perspective with an emphasis on talent and expertise development.

The phenomenon of relative intellectual isolation is not limited to aspects of athlete development in sport. Research by [Samdahl and Kelly \(1999\)](#) affirms its presence in other leisure research domains and demonstrate how it can even go so far as to pervade journals. In their example, [Samdahl and Kelly \(1999\)](#) provide compelling evidence which suggests that fewer papers than expected published in the *Journal of Leisure Research* and *Leisure Sciences* cite or are cited by journals published in outside sources. This pervasive disconnect in the literature is surprising given that there is little disagreement among scientists, historians and philosophers that any empirical science operates under the aim of building a systematic and cohesive body of knowledge ([Nagel, 1979](#); [Overton, 2006](#)). How can we accomplish such a feat when we fail to link the relationships among phenomena and processes of the experienced world? [Moore et al. \(2005\)](#) suggest that what constitutes a field of research is more than just an amassed collection of articles; a field has structure and its structure is a product of the citation practices of the researchers. We suggest that our current structure or body of knowledge may have a systematic flaw; with minimal knowledge transfer among differing schools of thought, we may be impeding our understanding of the phenomenon of athlete development. Would integrating knowledge on sport expertise rooted in the talent development literature not help us to better understand sport transitions? Similarly, would we not benefit from integrating the sport psychology literature about transitions in attempting to improve models of talent development? However, in attempting to answer these questions researchers must be mindful of the appropriateness of such 'cross-pollination'. The study findings should not be interpreted as suggesting that all talent and expertise-focused studies of athlete development must cite transition-based literature or vice versa. Rather, we are suggesting that all researchers studying athlete development should think critically about their citation practices so as to not overlook relevant contributions from related perspectives. In doing so, it is hoped that we, as a field, can avoid theoretical isolation and work productively toward a more systematic and cohesive understanding of athlete development ([Nagel, 1979](#); [Overton, 2006](#)). Further research is necessary to account for and explain the presence of the two separate factions in the network on athlete development and to explore their potential integration.

The study findings should be viewed within the context of its limitations. First, we limited our search criteria to articles published in academic journals as research suggests they represent an appropriate account of an area's scholarship ([Silverman & Skonie, 1997](#)). We realize that there are several articles published in conference proceedings, books, and book chapters but they are often not readily accessible and are not always subject to rigorous review. Second, it is possible that some articles citing the original model papers may have been missed if they were not in either the Web of Science or Scopus databases. We do, however, feel that the selected article population accurately represents the athlete development literature and its resulting citation structure to date, as both databases archive an extensive collection of major peer-reviewed academic journals. Another limitation pertains to the article search criteria to include only English-language articles. This restriction may limit the generalizability of the study findings to some socio-cultural contexts. As the design of this study also precluded the examination of the influence of the location in which the models and related articles were developed (e.g., North America vs. Europe), it is plausible that socio-cultural context may be an important factor contributing to the creation and relative isolation of the two factions of texts in the citation network. An examination of the origins of the lead authors for the articles

among factions offers partial support for this possible explanation. Thirteen of 14 lead authors in Faction 1 were European while approximately half of the 61 lead authors in Faction 2 were North American (33 –North American, 20-European, 5-Australian/New Zealand, 2-Israel, 1-Kuwait). Thus, there is a lack of understanding of the degree to which socio-cultural context may affect the relative salience of different conceptualizations of athlete development. This observation aligns with the recent review of [Ram, Starek, and Johnson \(2004\)](#) who identified a general need for further research examining the role of culture in the area of sport and exercise psychology.

While acknowledging these limitations, we hope that our work stimulates discussion around models of athlete development and encourages subsequent research in the area. Further work should focus on understanding the context, content and nature of each of the models. For instance, some preliminary research has begun to examine the origins or genealogies of athlete development research ([Bruner, Erickson, McFadden, & Côté, 2009](#)). By drawing attention to the historical and theoretical roots of the athlete development literature, we will be better able to understand current models and identify fruitful avenues of future study.

In sum, the seven developmental sport models examined in this study are representative of our current understanding of athlete development in sport from childhood through to adulthood. Each of the models examined have a similar objective; to bring order and organization into the complex developmental flux that occurs in sport. That is, all of the models in the current study operate under the assumption that there is both continuity and developmental change across athlete developmental stages. This shared ideology is compatible with [Lerner's \(2002\)](#) definition of development which suggests that systematic and successive change is an integral component of development. Prior to the present study, however, the transcendence of different conceptual approaches to the study of athlete development had not been evaluated. The use of citation network analysis, a research synthesis approach new to sport psychology, revealed the prominent models and articles shaping the sport psychology literature. The method offered an often neglected 'big picture' approach to understanding how scientists are attempting to unravel the complexity of athlete development. By highlighting the prominence of specific models and the citation structure in which they are embedded, citation network analysis draws attention to the implications of our citation practices. If we accept that our citation choices will influence both how much attention specific articles and ideas will receive in the future, as well as define disciplinary and theoretical boundaries, we take more conscious control of the knowledge creation process. Researchers in other areas of sport and exercise psychology are encouraged to take a step back from the reductionism predominantly driving science ([Barabási, 2003](#)) and consider synthesizing bodies of literature using a citation network approach.

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