Education and sport: identifying most productive research topics related to muscle with bibliometric analysis

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Abstract:

Research in Siedentop's sport education model has shown its robustness and strengths, however not much is known about the role of the muscle in the context of the model. The aims of this paper are to evaluate the volume, dynamics and spread of the research literature production and to identify the most productive research topics in the combined fields of sport education and muscle by using bibliometric analysis. The results show that this combined research is widely spread, and that the scientific literature production exhibits a positive trend until the year 2008 and then declines sharply. The most productive topics researched within our study include some of the important topics already proposed by the Siedentop sport education model; however some additional important topics not directly related to the model were also identified. Nevertheless, there are important sport education research topics that are still not covered deeply enough in the current research.

Key words: articles as subjects; research topics; scientific literature production; text analysis.

Introduction

Siedentop's sport education model is a curriculum and syllabus tool that is used in sport education study programmes/curriculums from elementary to high school levels. It was developed by Daryl Siedentop in 1984 and since then has been adapted and successfully implemented on an international level (Siedentop, 1994). The model is intended to provide children and youths with more authentic and enjoyable sport experiences. The three major goals that guide study programme development in sport education are for students to become competent (skilful and knowledgeable in various sports and able to execute strategies in complex games), literate (able to understand and value the rules, rituals and traditions of sport and to distinguish between good and bad sport practices) and enthusiastic players (preserve, protect, and enhance the culture of sport) (Siedentop, 1994). Wallhead and O'Sullivan (2005) have reported varying degrees of accomplishment of these goals, focused on various indices of student learning. The recent development of sport education research has shown the robustness and strengths of the model of sport education in providing richer experiences to students in the context of physical education (Florin, 2010). Nonetheless, research is still sparse and several knowledge gaps exist, that need to be filled via future research (Araújo, Mesquita & Hastie, 2014). One of the gaps is related to the combined research on sport education and muscle. The importance of this research has been previously recognized (Löfgren, Daly, Nilsson, Dencker & Karlsson, 2013), however beyond this, the correlation has not been explored.

The aim of the study was to undertake a bibliometric analysis on a corpus of articles broadly concerned with research in sport education and muscle. The goals of the analysis were first, to evaluate the volume, dynamics and spread of the research literature production and second, to identify the most productive research topics in the field.

Material & methods

Bibliometric analysis is a very useful method for discovering interesting information about important research topics; research literature production dynamics; scientific progress; and the most prolific researchers, institutions and countries in research and other fields (Pritchard, 1969; Garfield, 2006; De Bellis, 2009). Various bibliometric studies have already investigated information sources in sports medicine including analysing the history of the *Journal of Orthopaedic & Sports Physical Therapy* (Fritz, Macdermid, & Snyder - Mackler 2011), top cited articles in orthopaedic surgery (Lefaivre, Shadgan & O'Brien, 2011) and research literature production

on leisure time sports injuries (Vitzthum, Spallek, Mache, Quarcoo, Scutaru, Groneberg & Schöffel, 2010). In addition, two bibliometric studies on sport education were also found (O'Connor, French, Sherrill & Babcock, 2001; Barczyński, 2013). The first study, carried out by O'Connor et al. (2001), analysed whether adapted physical activity pedagogy adhered to information science laws (i.e. Bradford law and Price law) while Barczyński (2013) used bibliometrics in his study to rank Polish physical education higher schools.

In our study data were retrieved from the Scopus database (Scopus, Elsevier), on 8th December, 2014. The following search terms string was used: 'sport AND education AND muscle' in the title, abstract and keywords defined by the authors. The search was limited to information sources (article, review, conference paper, short communication and others) written in English. For each information source, the nationality of the author's institutional affiliation, the year of publication and the abstract were extracted. The most prolific countries and journals were identified by Scopus built-in services. The extracted bibliographic data were exported to an Excel document, preprocessed by using built-in Excel (Microsoft Office, Microsoft Corporation, USA) functions and then transferred into VosViewer (Leiden University, the Netherlands) (Van Eck & Waltman, 2013) for further analysis (descriptive methods and text mining).

Results

The search with the term 'sport education' resulted in 16141 information sources. Restricting the search with the term 'muscle' reduced the yield of the final corpus to 1763 information sources. Among them there were 1243 articles, 346 reviews, 45 conference papers and 29 short communications.

Volume and Dynamics of Research Literature Production

The volume and dynamics of the research concerned with sport education and muscle is shown in Fig. 1. The first information sources were published in 1963. A steady growth began in 1967 and lasted until 1983. Over the period of years 1984 to 1993 the literature production was constant, however after 1994 the growth was exponential. Literature production in the area of sport education and muscle reached its peak in the year 2008. After then we can see a steep decline in the number of published information sources.

Fig. 1: The volume and dynamics of research literature production in the area of sport education and muscle

Spread of the Research Literature Production

Information sources were published in 66 different countries, located on all continents. Far in advance, as shown in Fig. 2, the most productive country was the United States (n=525), followed by Australia (n=129) and the United Kingdom (n=114).

Fig. 2: Most productive countries (n>50)

Information sources in the area of sport education and muscle were published in 197 journals, with seven of the top 10 journals coming from the sports medicine category (Table 1). Notably, despite the fact that the term education was part of the search string and that four journals from sport education are indexed by the Scopus database, none of the top productive journals belong to the sport education category. The journal which has published most of the information sources is the Journal of Strength and Conditioning Research (n=204), followed by Medicine and Science in Sports and Exercise (n=99) and Sports Medicine (n=89).

Table 1: The list of 10 most productive journals

Journal title	Number of information sources
Journal of Strength and Conditioning Research	204
Medicine and Science in Sports and Exercise	99
Sports Medicine	89
Journal of Sports Medicine and Physical Fitness	80
International Journal of Sports Medicine	64
British Journal of Sports Medicine	63
Clinics in Sports Medicine	48
Journal of Sports Sciences	48
European Journal of Applied Physiology and Occupational Physiology	45
American Journal of Sports Medicine	34

Most Productive Research Topics

Text mining of the abstracts for the information sources was performed using VosViewer, and revealed three important clusters of topics/terms (Fig. 3):

- **Physical education topic cluster** (light grey colour) combines education with two general terms, namely ‘physical activity’ and ‘sports medicine’. These three terms are linked with various performance indices (physical fitness, body mass, muscular strength, VO₂ max, health) and various stakeholders of sport education (child, boy, young athlete, woman, man);
- **Education topic cluster** (mid grey colour) could be divided into two sub-topics namely ‘education’ and ‘rehabilitation’. The education topic links information, technique, coach and competition while the rehabilitation topic combines injury, pain, intervention, physician, patient and various anatomical terms like lower extremity, arm and ankle;
- **Training session topic cluster** (dark grey colour) could also be divided into two sub-topics, namely ‘jump’ and ‘game’. The first combines athletic skills like velocity, speed, power and strength, while the second links terms like player, skills, movement and training load.

Fig. 3: Topic clusters derived from information sources abstracts

Discussion

Volume, Dynamics and Spread of Research Literature Production

The dynamics of research literature production show an increase in research endeavours until the year 2008. The start of the exponential growth of literature production was probably triggered by the introduction of a formal sport education model (Siedentop, 1994). The decline over the last five years might be a consequence of the global financial crisis which is also reflected in a reduction in various sporting endeavours (Dietl & Franck,

2007) and their sponsorships (Humphreys, 2010). The broad spread of the literature production is evident: first by the large number of countries to which authors are affiliated, and second, by the large number of different journals in which the information sources are published. This large spread exhibits an awareness of the relevance of sport education related to muscle research by scientists all around the world. The most productive countries belong to the most economically developed countries, which are also very successful in team and individual sport competitions at various levels.

Research Topics

The three most important clusters of topics/terms, produced by the text mining of abstracts, partially coincide with the research terms defined in the Siedentop sport education model (Siedentop, 1994). The terms covered (Table 2) mostly belong to the first goal of the model, namely the requirement of the student to become competent. Topics belonging to the other two goals of the model (for the student to become literate and enthusiastic) are also covered, but very superficially. These observations are quite logical due to the fact that our study was focused on the muscle in the context of sport education and not on sport education in general. Moreover other topics/terms not directly related to sport education in general were well covered by the research presented in information sources included in our analysis (Laparidis, Lapousis, Mougios, Tokmakidis, & Petsiou, 2010; Brøgger, Mathisen, & Pettersen, 2013). The most productive of these other research topics were concerned with anatomical terms, performance indices, sport education stakeholders and injury rehabilitation.

Table 2 Overview of the research topics and terms defined by Siedentop which are covered by the research in sport education related to muscle

Research topics from Fig. 3	Sub-topics from Fig. 3	Terms from the Siedentop sport education model covered by terms from Fig. 3
Physical education	Physical education	Skill
Education	Education	Knowledge, sport
	Rehabilitation	Knowledge
Training session	Athletics	Skill
	Game	Skill, complex games

Conclusions

Our bibliometric study showed that the research in sport education related to muscles is widely spread, meaning that scientists are well aware of its importance and its influence on various sport endeavours. The research literature production exhibited a positive trend until the year 2008 and then declined sharply, which might be a consequence of the global financial crisis. The most productive topics that are being researched cover some of the important topics proposed by the Siedentop sport education model and also include additional topics that focus on the importance of muscle knowledge in sport education. However, there are important sport education research topics that are not adequately represented in the current literature. Based on the results of this study, the first directive would be to focus future research on topics concerned with understanding and valuing the rules, rituals and traditions of sport; protecting and enhancing the culture of sport from the viewpoint of muscle research; and integrating the findings into the holistic inquiry of sport education in general. Concerning the use of bibliometric research in future studies, we would advise the use of additional advanced methods like data mining and citation analysis, country trend analysis and other similar methods to gain additional insight from different viewpoints and thus assure the further development of research in this important area.

Conflicts of interest

Authors declare no conflict of interest.

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