Sport education and society: bibliometric visualization of taxonomy

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Abstract:

Understanding contemporary society requires recognition of the role of sport. Sport is an important international phenomena associated with both societal problems as well as solutions. Positive effects of sport could be enhanced and negative effects significantly reduced by 'proper' sport education. Thus, improved understanding of the relation between sport, sport education and society seem to be essential for further development of the cross – disciplinary research between these fields. In this manner a topic taxonomy and topic interface matrix sustaining diversity and progress of individual research topics were established using bibliometric analysis and visualisation. Corpus was retrieved from the Scopus database using the search string 'sport AND education AND society' in the title, abstract and keywords. The search resulted in 1138 information sources, among them 917 with complete abstracts. First information sources were published in 1968 and the production was steady till 1994. After that period, the growth become linear and in 2002 exponential, with a plateau in the period 2005 - 2009. The descriptive bibliometric analysis showed that the most productive countries were United States of America, china, United Kingdom, Japan and Canada. The information sources were published in top ranked journals. From the bibliographical mapping and use of meta – synthesis four main and most productive topics emerged: health issues, training & competition, physical activity and education & research forming the basis of the derived taxonomy. A couple of interesting and not quite expected relations between topics become evident from the interface matrix. Taxonomy and topic interface matrix together with term maps present a framework which might be helpful to new researchers in the field trying to get involved in the research as well to those already engaged to foster and guide their future research activities. Additionally the framework gives insights into the current state of sport education and society research and might lead to new ideas to enhance its further development.

Key words: Sport, Education, Society, Bibliometric analysis, Bibliometric mapping, Taxonomy

Introduction

Understanding contemporary society without recognizing the role of sport is almost impossible. Sport is an international phenomenon, important for political leaders, countries, media and tourist industry. Sport is associated with societal problems like crime, violence, migration, and health (Jarvie & Thornton, 2012). Positive effects of sport and related activities could be enhanced and negative effects significantly reduced by 'proper' sport education (Siedentop et al., 2011). Hence, better understanding of the relation between sport, sport education and society seem to be essential for further development of the cross – disciplinary research between these three fields. Fortunately the spread of sport and society research literature production is now enough broad to allow a general analysis (Ciomaga, 2014). However, analysing a broad and dissimilar research area with fuzzy boundaries between topics could be very complex (Mingers & Leydesdorff, 2014). Establishing a taxonomy which should sustain diversity and progress of individual research topics on one hand and a topic interfacing matrix to holistically support the sharing of ideas, concepts, methods, and findings between topics on the other hand was the main aim of the study presented in this paper. We first used a descriptive bibliometric analysis to identify most productive countries, institutions and source titles. Next, a novel technique for visualizing the production of scientific literature, called bibliometric mapping was applied to create term maps. Meta – synthesising term maps enabled us to develop the taxonomy of most prolific research topics and interfaces between them. The established framework will give additional insights into the current state of sport education and society research and hopefully lead to new ideas enhancing its further development.

Review

When discovering interesting information about research topics, literature production dynamics, scientific progress on a specific field, most prolific researchers, institutions and countries in a research field and similar, bibliometric analysis proved to be a very useful method (Pritchard, 1969; Garfield, 2006; De Bellis, 2009). Previously researchers already used various bibliometric studies to investigate information sources in sports medicine for example analysing the history of the particular journal (Fritz et al., 2011), top cited articles in orthopaedic surgery (Lefaivre et al., 2011) or research literature production on leisure time sports injuries (Vitzthum et al., 2010). In addition a few bibliometric studies on sport education were also found (O'Connor et al., 2001; Barczyński, 2013; Završnik et al., 2015). A few years back O'Connor et al. (2001) in their study analysed if adapted physical activity pedagogy adhere to information science laws (i.e. Bradford and Price laws). Furthermore, Barczyński (2013) in his recent study used bibliometrics to rank Polish physical education in higher schools and Završnik et al. (2015) evaluated the volume, dynamics and spread of the research literature production and identified the most productive research topics in the combined fields of sport, education and muscle.

Bibliometric mapping represent the use of quantitative methods for visual representation of scientific publications which base on bibliographic data. With bibliometric mapping it is possible to produce different bibliometric maps with the purpose of getting an overview of the structure of the scientific publications in a specific research field. Researchers use bibliometric mapping for identifying specific research areas within a specific research field (van Eck, 2011) which helps them getting the broader aspects of their field of interest (Börner et al., 2012). Bibliometric mapping is also useful method for developing a broad perspective on particular research field and connections with other topics. Bibliometric maps in this study are created by VOSviewer software (Leiden University, Netherlands) (van Eck & Waltman, 2013) which has visualization capabilities. This means that bibliometric maps can be displayed in various different ways and consequently emphasize different aspects of a map (Blažun et al., 2015). The VOSviewer software can also merges terms that may be closely related into term clusters denoted by the same cluster colour (van Eck 2011) and the proximity of terms can be interpreted as an indication of their relatedness.

Material & methods

Procedure and Data collection

In our study, data were retrieved from the Scopus database (Scopus, Elsevier), on October 17th, 2016. Within the study the following search terms string was used: 'sport AND education AND society' in the title, abstract and keywords. The search was limited to information sources (article, review, conference paper, short communication and others) written in English language, for the period 1968 - 2014. For each information source, nationality of the author's institutional affiliation, year of publication and abstract were extracted. The most prolific countries, institutions and source titles were identified by Scopus services and then exported to an Excel document (Microsoft Office, Microsoft Corporation, USA). Excel built in functions was used for parsing, tabulation, producing graphs and cleansing of data. The basic bibliometric analysis (dynamic of literature production and most productive entities) was performed on all information sources. For the bibliometric mapping only the information sources with complete abstracts were exported to VOSviewer (Leiden University, The Netherlands) (van Eck & Waltman, 2013). Default VOSviewer parameter setting was used in creating the term maps (cluster and chronological map). All common words (country and city names, is, are, study, abstract, copyright, item, significance and similar) were filtered out of the analysis. Meta – synthesis approach (Walsh & Downe, 2005) was used to name the topics, derive the taxonomy of research topics and interface matrix of terms between topics. The methodology is schematically presented in Fig. 1.

Fig. 1. The flow diagram of the research methodology used in the study

Results

Volume and spread of the research literature production

The search resulted in 1138 information sources. Among them there were 612 original articles, 149 reviews, 230 conference papers, 45 editorials, 24 books, and 32 notes and short communications. After filtering out the information sources with incomplete abstracts, 917 information sources remained.

Information sources were published in 66 different countries, located on all continents. With advance, the most productive country was United States of America (USA) (n=317), followed by China (n=125), United Kingdom (n=119), Japan (n=55), Canada (n=54), Australia (n=52), Germany (n=35) and France (n=23). Loughborough University, UK (n=11), University of Birmingham, UK (n=9), Pennsylvania State University, USA (n=7), Norges idrettshogskole, Norway (n=7), Kyoto University, Japan (n=7), University of Toronto, Canada (n=6) and University of North Carolina, USA (n=6), University of Washington Seattle (n=6), University of Queensland (n=6) were most productive institutions among 231. The research is geographically widespread meaning that many countries and organisations generally recognize its importance (Dietl & Franck, 2007; Humphreys, 2010; Silk & Andrews, 2012).

Information sources in the area of sports education and society were published in 147 source titles (Table 1). Three of the most productive journals are coming from the sports category, one from education or society field and surprisingly two from engineering or computer science discipline (Table 1). Additionally, we present SNIP impact factor and SNIP scientific category (Science Edition (SE)/Social Science Edition (SSE)) for each journal, which provide information about the rank and scientific field of particular journal. The high impact factors and top ranks of majority of most productive source titles clearly state the importance of the research in sports education and society.

Table 1. The list of most productive source titles (n>10)

Journal title	Number of information sources	Impact factor for the year 2013 (SNIP*)	SNIP scientific category (SE/SSE) and rank of the source title in this category
American Journal of Sports Medicine	43	2.252	Orthopedics and Sports Medicine; 3/201 (SE) Physical Therapy, Sports Therapy and Rehabilitation; 2/145 (SE)
Sport Education and Society	24	1.747	Orthopedics and Sports Medicine; 16/201 (SE) Physical Therapy, Sports Therapy and Rehabilitation; 10/145 (SE) Education; 87/817 (SSE)
Chronicle of Higher Education	22		
International Journal of the History of Sport	18	0.661	Arts and Humanities (all) ; 53/157 (SSE)
	17	1.652	Pediatrics, Perinatology, and Child Health; 15/247 (SE)
Journal of Adolescent Health			Psychiatry and Mental health; 37/448 (SE) Public Health, Environmental and Occupational Health; 29/417 (SE)
Lecture Notes in Electrical Engineering	17	0.130	Industrial and Manufacturing Engineering; 191/209 (SE)
British Journal of Sports Medicine	15	1.784	Orthopedics and Sports Medicine; 13/201 (SE) Physical Therapy, Sports Therapy and Rehabilitation ; 8/145 (SE)
Mass Communication and Society	13	1.091	Social Sciences (all); 48/248 (SSE) Communication; 64/198 (SSE)
Advances in Intelligent and Soft Computing	12		
Journal of the pharmaceutical society of Japan	11		
International Journal of Sport and Exercise Psychology	11	0.402	Applied Psychology; 144/175 (SSE) Social Psychology; 152/195 (SSE)

* SNIP - source normalized impact per paper; SNIP corrects for differences in citation practices between scientific fields and is calculated by Leiden University's Centre for Science and Technology Studies (CWTS) based on the Scopus bibliographic database produced by Elsevier (Centre for Science and Technology Studies, Leiden University, 2014).

The evolution of research topics

The dynamics of the research literature production in sport, education and society is shown on Fig. 2. First information sources were published in 1968 and the production was steady till 1994. After that period, the growth becomes linear and in 2002 exponential, with a plateau in the period 2005 - 2009. All in all, the number of publications is increasing and this might imply the growing interest in this kind of research. This could be due to the fact that its implications are showing positive effects to society (see also Fig. 2), like number of Olympic medals (Sotudeh et al., 2012), better health (Craton & Leslie, 2014) and tourism development (Gennadijevna et al., 2014).

Fig. 2. The dynamics of research literature production in the area of sport, education and society

The early research (before year 2005) was concerned with public health issues like diseases prevention, rehabilitation, abuse of drugs, alcohol, smoking and similar (Fig. 3). In the next period (2005 – 2007) research was still linked to health issues, but mostly related to sports medicine. From 2008 till 2011 the research was mainly associated with physical activity and its education. The state of the art research is focused on sports science (Armour & Chambers, 2014; Lubowitz et al., 2014; Verberck, 2014), ICT (Couceiro et al., 2013; Rakovic & Lutovac, 2014; Xu, 2014) and teaching (Layne & Hastie, 2014; Roberts & Ryrrie, 2014; Stolz & Pill, 2014).

Fig. 3. Chronological view of the research topics trends

The taxonomy

Four clusters were formed in the term map shown in Fig. 4. Based on the meta - synthesis of cluster term and associated literature (most cited papers related to cluster terms) we assigned a topic to each cluster:

- Health issues (yellow): covers injuries, diseases, symptoms, prevention, treatment and rehabilitation.
- Training & competition (blue): covers various attributes of training like intensity, diversity, complexity, strength and psychology. Additionally, the cluster covers attributes of competition like success and fair play.
- Physical activity (red): covers various facets of physical activity related to activities, community and lifestyle.
- Education & research (green): covers teaching, technology, science and economics of sport education.

Fig. 4. Topic clusters derived from information source abstracts (term map)

More complex topics were further divided into subtopics as shown in Table 2. Based on the most important terms we identified, analysed and summarised three most cited papers for each topic/sub – topic and introduced the results in Table 3.

Table 2. The topics taxonomy

Topic/Sub - topic	Most important terms form term map
Health issues	
• Sport as health management activity	Chronic disease, prevention, public health, awareness
• Sport as health risk factor	Injury, sport medicine, patient, treatment, risk,
Training & competition	Training, policy, diversity, competition
Physical activity	
• Physical education	Secondary school, classroom, lesson
• Exercising	Activity, exercise, athlete, diet
• Preventing bad habits	Alcohol, drugs, smoking, obesity
• Social environment	Community, church, parents, home
Education & research	
• Teaching	Teacher, teaching, learning, course
• ICT use in sport teaching	Information technology, computer, engineering, engineering education
• Sports science research	Science, sports, sports science

Table 3. Topics/subtopics related research found in most cited papers

Topic/sub-topic	Most cited papers	Summary of paper contribution
Health issues	<i>Management of grown up congenital heart disease</i> (Deanfield et al., 2003)	Research shows many benefits of physical activity but also warns of its negative effects if not exercised correctly. The special focus is given to nutrition requirements especially for athletes, but also for recreational activities.
• Sport as health management activity	<i>The female athlete triad</i> (Nattiv et al., 2007)	
• Sport as health risk factor	<i>American College of Sports Medicine position stand. Nutrition and athletic performance</i> (Rodriguez et al., 2009)	Research is also related on health issues focused on proper biomechanics, training models and programmes and proper recovery to prevent injuries and improve success on competitions.
Training & competition	<i>Hamstring injury occurrence in elite soccer players after preseason strength training with eccentric overload</i> (Askling et al., 2003)	
	<i>Kinematic and kinetic comparison of baseball pitching among various levels of development</i> (Fleisig et al., 1999)	
	<i>Overtraining and recovery. A conceptual model</i> (Kenttä & Hassmén, 1998)	
Physical education	<i>Physical activity at 36 years: patterns and childhood predictors in a longitudinal study</i> (Kuh & Cooper, 1992)	Physical activity in childhood and adolescence not only affects participation in sports and recreational activities in later life, but also has positive effects on student scores and their latter social success. However young adults with physical disabilities are poorly integrated into sports activities.
	<i>Functional level of young adults with cerebral palsy</i> (van der Dussen et al., 2001)	
	<i>Secondary school extracurricular involvement and academic achievement: a fixed effects approach</i> (Lipscomb, 2007)	
Exercising	Same as in Secondary education	Same as in Secondary education
Preventing bad habits	<i>Prevention of soccer injuries: A prospective intervention study in youth amateur players</i> (Junge et al., 2002)	Proper training can greatly eliminate risk factors and prevent injuries or other health risk consequences. At the same time the lack of physical activity can have enormous health consequences.
	<i>American College of Sports Medicine. Position Stand. Physical activity, physical fitness, and hypertension</i> (American College of Sports Medicine, 1993)	
	<i>Is it possible to prevent sports injuries? Review of</i>	

Social environment	<i>controlled clinical trials and recommendations for future work</i> (Parkkari et al., 2001)	Various social environments factors influence the physical activity especially of marginal groups like older people (need for counselling, promotion of benefits) or young adults (material resources, increased number of facilities and choices). The rapidly changing times require a new 21st century oriented look to both physical activity as well as its education.
	<i>Physical Education: What Future(s)?</i> (Penney & Chandler, 2000)	
Teaching	<i>Is physical activity counselling effective for older people? A cluster randomized, controlled trial in primary care</i> (Kerse et al., 2005)	Teaching and learning should occur on all physical activity/sport/movement levels for all target groups. Motor skills and how to teach and learn them is of extreme importance.
	<i>Young people and physical activity: A systematic review matching their views to effective interventions</i> (Rees, et al., 2006)	
ICT use in sport teaching	<i>Modelling coaching practice: The role of instruction and demonstration</i> (Hodges & Franks, 2002)	ICT become an integral part of physical education and sport science curricula and there is a need that teachers and students become ICT proficient.
	<i>Learning from the experts: Practice activities of expert decision makers in sport</i> (Baker et al., 2003)	
Sports science research	<i>Enhancing Physical Education and Sport Science students' self-efficacy and attitudes regarding Information and Communication Technologies through a computer literacy course</i> (Papastergiou, 2010)	From the more theoretical and philosophical viewpoint emphasised the importance of collaboration of sport and education disciplines and pay special focus on ethics and society influences on sport and vice versa.
	<i>Physical education and sport science undergraduate students as multimedia and web developers: Moving from the user's to the creator's perspective</i> (Papastergiou, 2011)	
	<i>Cost of injuries from a prospective cohort study of North Carolina high school athletes</i> (Knowles et al., 2007)	
	<i>Sport, science, and society: Ethics in sports medicine</i> (Pipe, 1993)	

In the Table 4 we present the terms which are due to their proximity (Fig. 3) strongly associated, but belong to different clusters. These terms present cross - topic themes, through which research in different topics interferes and interfaces. A couple of interesting and not quite expected relations become evident:

- Research in Training & Competition and Education & Research interfaces through Success, economy and tourism;
- Education & Research and Physical activity interfaces among others Parent, adult, adolescent and community

Table 4. Cross topic terms

	Health issues	Physical activity	Education & research
Training & Competition	Intensity, injury, guideline	<ul style="list-style-type: none"> • Player, athlete, activity, movement, strength, training, intensity • Sport psychology, secondary school, fair play 	<ul style="list-style-type: none"> • Success, economy, tourism • Teacher, diversity, competition, discourse
Health issues		<ul style="list-style-type: none"> • Adolescent, school, smoking, exercise, sports medicine • Risk factor, hypoglycaemia • Sport activity, physician, injury, cardiology 	No interfacing terms
Physical activity			<ul style="list-style-type: none"> • Equipment, sports science, measurement • Sport, service, achievement • Parent, adult, adolescent, community

Discussion

The main purpose of this paper was to establish an effective framework for managing the complexity of research in the advanced interdisciplinary and holistic research field combining Sport, Education and Society. This was achieved using descriptive bibliometric analysis, bibliometric mapping and creating taxonomy of most productive and hot research topics with the purpose to understand the diversity of research disciplines and to support the exchange of ideas, concepts, methods, and findings across them. However, the performed research study has some limitations and the first one is the use of the Scopus database alone; therefore some significant research contributions indexed in other databases might be overlooked. Second limitation presents the selection of language of published articles since we only included articles written in English language, due to limitations of VOSviewer. It is possible that due to this decision some significant articles written in other languages might be also overlooked. Additional limitation is the authors decision to use the default parameters of the VOSviewer, if other parameters would be set the results of the bibliometric mapping could be different and consequently also the interpretation of the results.

The research study revealed that the publication trend increased significantly after the year 2000, which is probably due to the increased awareness of the importance of healthy lifestyle, the importance of recreational

sport activities and health and sport promotion. Inconsiderable is also the fact that in recent years we are faced with an increase in chronic diseases and obesity epidemic which additionally raises the awareness of people of the importance of sport activities, their education and their impact on society and vice - versa. The publication trend from 1968 till 2000 was relatively steady, implying that the society in this period was not so much aware of the importance of sport activities and education. Consequently in this period researchers did not show significant interest to explore this research field. By far the most intensive information source production was observed in United States of America, United Kingdom and China (almost half of all the information sources published), therefore economically highly developed countries. China for example just in the last ten years made remarkable economic boom (Rawski, 2011). Additionally, the above mentioned countries are also very successful in terms of sports achievements in various sports disciplines. Moreover, in United States of America and United Kingdom education is strongly connected with sport, meaning that many prestigious universities offer scholarships to top athletes. Despite the fact that Norway is not found among most prolific countries, the research study showed that among the most prolific institutions one origins from Norway (Norges idrettshogskole). This institution is obviously paying the far attention to holistic research combining fields of sport, education and society. On the other hand, research at other Norway institutions is more dispersed, nevertheless that Scandinavian countries in general foster a long tradition of culture of sport. Most articles are published in American Journal of Sports Medicine (USA) with high SNIP impact factor (2.177), additionally; this journal is ranked among top journals in the field of Orthopedics and Sports Medicine, as well in the field of Physical Therapy, Sports Therapy and Rehabilitation. A comparable journal is likewise the British Journal of Sports Medicine (UK) with high impact factor (2.008) and in which smaller number of articles are published. Mostly the more prolific journals are connected solely to sports medicine and not so much with combined topics of sport, education and society. The next also very prolific journal is Sport Education and Society (UK) with SNIP impact factor 1.388, which also ranks high in the field of Orthopedics and Sports Medicine and Physical Therapy, Sports Therapy and Rehabilitation, but lower in the field of Education. With bibliometric mapping and within the created taxonomy we detected four topics and additional nine sub-topics. Training & Competitions topics are mainly related to sport, while the other three are more cross – disciplinary oriented, and relate to sport, education, health, economy, tourism, community. The research within the topic health issues is focused on benefits and negative effects of physical activity, nutrition requirements (Deanfield et al., 2003; Nattiv et al., 2007; Rodriguez et al., 2009). Similarly the topic training & competition is concerned with health issues and proper training models, and especially in the injury reduction (Kenttä & Hassmén, 1998; Fleisig, Barrentine, Zheng, Escamilla, & Andrews, 1999; Askling, Karlsson, & Thorstensson, 2003). Physical activity covers four sub-topics which are mainly focused on classroom education, the importance of sports activities, risk factors which can cause dependency, and the importance of community and parents support (Kuh & Cooper, 1992; van der Dussen, Nieuwstraten, Roebroek, & Stam, 2001; Parkkari, Kujala, & Kannus, 2001; Junge, Rösch, Peterson, Graf-Baumann, & Dvorak, 2002; Kerse, Elley, Robinson, & Arroll, 2005; Lipscomb, 2007; Hodges & Franks, 2002; Baker, Côté, & Abernethy, 2003). Physical education should be supported by ICT. Accordingly, physical education and sport science curricula should adapt to this new requirements and conditions on one hand and on the other teachers and students should become ICT proficient (Pipe, 1993; Knowles, et al., 2007; Papastergiou, 2010; Papastergiou, 2011). The interface matrix revealed that Research in Training & Competition and Education & Research interfaces through terms like success, economy and tourism. That could imply that expanding touristic destinations with training and competition activities should be supported by more devoted research and that current physical education and tourism curricula should be extended with new 'sport & tourism economy' subjects to burst countries and regions economies. It is interesting to note, that recent research is mainly focused on sport science combined with technology and teaching (education), which could be due to the fact that technology is constantly evolving and many new ICT solutions are adapted for monitoring various sports activities. Logically, earlier research (before 2005) was aimed more at studying public health issues, prevention of diseases, rehabilitation, drug abuse, smoking etc. because at that time there was ongoing debate on doping, and detection of its use among active athletes.

Conclusions

Taxonomy together with topic interface matrix, term maps and most productive entities present a framework which might prove to be helpful to new researchers in the field trying to get involved in the research as well to those already engaged to foster and guide their future research activities. Additionally we believe that the framework gives additional insights into the current state of sport education and society research and will lead to new ideas to enhance its further development.

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