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Conceptual structure analysis with Bibliometrix package in R: A scientific communication of sport education

Análisis de estructura conceptual con el paquete Bibliometrix en R: Una comunicación científica de educación deportiva

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Abstract. Many studies on sports education have been conducted, some of which are published and disseminated through scientific journals. Publication by scientific journals is a part of scientific communication. It demands a review of the existing research to understand the conceptual structure of certain studies, especially the time they intersect with one another, such as sports education. In the database, sport education articles are commonly categorized into the subject of Education & Educational Research and/or Sport Sciences. This study aimed to obtain an overview of the similarities and differences in the conceptual structure of sport education studies included in the subject of Education & Educational Research and Sport Sciences. It employed a database from the Web of Science using the bibliometric method. Bibliometric analysis was performed with Bibliometric Package, a Built-in R tool. One of our key findings lies in the similarities and differences between the two. We also explored some implications in the discussion section. This paper completed the existing kinds of literature with additional insights for researchers and practitioners of sports education to consider and find future research directions. The results suggested similarities and differences in mapping between the two subjects, including timespans, percentages of annual growth rate, average ages, average citations per doc, references, keywords, and international collaboration.
Keywords: bibliometric analysis; conceptual structure; scientific communication; sports education; Sport Sciences.

Abstracto. Se han realizado numerosos estudios sobre educación deportiva, algunos de los cuales se publican y difunden a través de revistas científicas. La publicación en revistas científicas forma parte de la comunicación científica. Exige una revisión de las investigaciones existentes para comprender la estructura conceptual de determinados estudios, especialmente en el momento en que se cruzan entre sí, como es el caso de la educación deportiva. En la base de datos, los artículos sobre educación deportiva suelen clasificarse en temas de investigación educativa y/o ciencias del deporte. Este estudio tuvo como objetivo obtener una visión general de las similitudes y diferencias en la estructura conceptual de los estudios de educación deportiva incluidos en la materia de investigación en educación y ciencias del deporte. Se empleó una base de datos de Web of Science utilizando el método bibliométrico. El análisis bibliométrico se realizó con Bibliometric Package, una herramienta incorporada en R. Uno de nuestros hallazgos clave radica en las similitudes y diferencias entre los dos. También exploramos algunas implicaciones en la sección de discusión. Este artículo completó los tipos de literatura existentes con ideas adicionales para que los investigadores y profesionales de la educación deportiva consideren y encuentren futuras direcciones de investigación. Los resultados sugirieron similitudes y diferencias en el mapeo entre los dos temas, incluidos períodos de tiempo, porcentajes de la tasa de crecimiento anual, edades promedio, citas promedio por documento, referencias, palabras clave y colaboración internacional.
Palabras clave: análisis bibliométrico; estructura conceptual; comunicación científica; educación deportiva; ciencias del deporte.

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Introduction

A lot of studies have been conducted by researchers from diverse fields of study. Some publish their research results through scientific publications, including journals. Information and communication technology development facilitates the dissemination and utilization of research results. Practically, the findings can be reviewed and benefitted by policymakers who need consideration in decision-making.

Academically, they can be searched, read, used, adopted, and even cited easily. Over time, more and more publications of research results offer novel theories, concepts, approaches, and methods. The emergence of new thoughts in the academic world provides opportunities for researchers to explore their respective fields. However, there sometimes found a difference in intensity between one field of study and another. The trending fields tend to be full and saturated, while some others can be scarcely studied. Therefore, it demands a review of the results of studies from the existing researchers.

The review of the previous research can help subsequent researchers to understand the conceptual structure of a particular study. The conceptual structure in scientific studies leads to how researchers encode the results of their construction on certain topics (Jackendoff 1989). The conceptual structure can be seen through the categorization of a concept. It is required to identify the structure of knowledge that has been generated by researchers. In order to avoid any subjective view, this study employed the bibliometric method to recognize and demonstrate intellectual and conceptual structures, including the dynamic development of a field of knowledge (Zupic and Čater 2015).

It covers topics related to sports, especially sports education. The process of sports education has things in common with that of education of other courses, which is learning knowledge and abilities in a planned and directed way given by teachers on ideological and ethical standards. However, sports education poses its own characteristics. The goal of sports education is to transfer students'

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knowledge and functions of sports, so they are well-informed and skillful for lifelong learning, then develop thinking and strengthen innovation initiatives. Achieving those goals requires repeated training, an understanding of accurate body training, and the correct use of knowledge to guide body training (Tang 2011).

Furthermore, the rapid development of information and communication technologies presents new challenges for sport education. Technology, including multimedia will bring a new revolution in sports education (Belfiore, Ascione, and Di Palma 2020; Sanabria-Navarro, Silveira Pérez, and Cortina–Núñez 2023; Tang 2011). Experts in the field of sports education have sought to answer this challenge by organizing several conferences to identify new trends, different perspectives, strong points, and vulnerable aspects, as well as factors that require optimization (Ploesteanu et al. 2014).

Different sport-themed research results have been published in some international journals indexed by reputable indexation agencies. The phenomenon that draws the attention of researchers is related to sport education. Since the field of related study is a hybrid between sport and education, the publication falls into two categories/subjects. However, exploring further, the researchers found some articles attached to a single subject, only in Education & Educational Research, per se, or on Sport Sciences. The exploration results allowed the researchers to study further to acknowledge the differences in research results in each subject.

Therefore, each categorization must be intended to distinguish one category from another. This problem initiated the study with a bibliometric analysis of some publication data related to sport education. The bibliometric analysis applied Bibliometrix Package, built-in R (Aria and Cuccurullo 2017). Meanwhile, the concepts underlying this research are scientific communication, educational research, and sports science.

Literature Review

Scientific communication

Improved communication between scientists, the authority, and the public has received much attention from the scientific community. Improvements to content, accessibility, and delivery of scholarly communications have been the focus of the current efforts (Iyengar and Massey 2019). Researchers are required to disseminate intermediate and related products of the research process, such as raw data, secondary data, and publications, in the context of modern scientific communication paradigms, so others can find them, relate them meaningfully, and reuse them (Castelli, Manghi, and Thanos 2013).

During this time, researchers have sought to present information from their research through diverse narrative styles to help readers gain a greater understanding of the complexity of the research problem. Narrative can increase audience engagement and attention to science communication, so the information presented is expected to be more easily remembered and processed as a form of scientific communication (National Academies of Sciences Engineering and Medicine. 2017).

Scientific communication is an integral element of sciences which constantly grow and evolve. Scientific research and writing create the foundation for the future of humanity and the environment (Debnath and Venkatesh 2015). Given the strategic position of scientific work, it is necessary to channel and supervise. Journals are the most vital channel for formal scientific communication (Bran et al. 2021). They have peer reviewers; peer review is a well-established process that has become a formal part of scientific communication. It 'provides control in scientific communication' (Kelly, Sadeghieh, and Adeli 2014). After the digital age, the number of new articles and journals on different scales tends to experience accelerated growth.

The dynamics of growth in the number of new articles and journals is a healthy phenomenon in scientific communication (Garfield 1972), as well as opportunities for the emergence of research methods and tools. One of them is the document analysis method. This type of study is useful for practitioners and policymakers in policy formulation, while for experts and researchers, it helps in information processing of research results in different fields of science.

Educational Research

The field of scientific study known as "educational research" focuses on how people learn and how they are educated, as well as how these processes are influenced by institutions, organizations, and interactions among people. It includes how to increase the impact of transfer and the translation of educational research into better practice. Where possible, research should guide educational decisions. Educational research should be treated as a public good for further educational purposes.

The use of research in practice, or the problem of knowledge utilization in education, is complex. The establishment of the Institute for Education Sciences (IES) and the focus on the study of educational engineering with a rigorous research design are two examples of the significant efforts made to improve the quality of research on education on the one hand (Farley-Ripple et al. 2018). In addition, it affirms the need to develop design principles and theories that will direct, support, and advance practice and research in educational contexts (Anderson and Shattuck 2012).

Research on the educational benefits of sports education has yielded clear findings in terms of students' personal and social growth (Araújo, Mesquita, and Hastie 2014). Therefore, it is vital to examine more deeply the fundamental role of educational research in sports education to obtain broader information and give a real contribution to the development of science.

Sport Sciences

A valued profession that is often misinterpreted is sport science. Several scientific studies have repeatedly

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demonstrated the benefits of exercise for human life in physical, mental, and social terms (Berk Güngör and Çelik 2020; Boente-Antela, Leirós-Rodríguez, and García-Soidán 2020; Jermaina et al. 2022). This particular discipline can exert a huge impact on the achievements of sportsmen in the game (Haff 2010; Marheni et al. 2021). When applied to exercise, research on sports science seeks to help coaches and athletes attain excellent and flawless performance (Coutts 2017). As a result, more and more experts are studying Sport Science for improvement in sport achievement.

The growth of published articles has been accelerated along with the advances in technology used in Sport Science (Rico-González et al. 2022). However, although research on Sport Science has been on its trend (Harding, Fajardo, and Berenguer 2021; Malone et al. 2019), many are concerned about how it's used in the elite sports environment (Fullagar et al. 2019). Therefore, analyzing the growth and development of publications between Sport Sciences and Education & Educational Research subject is novel.

Materials and Methods

Study organization

To analyze large amounts of scientific data from different databases, such as Scopus and the Web of Science, bibliometric analysis has proven to be an efficient technique. The bibliometric analysis method helps researchers, either those working in the pure sciences or social sciences, gather the most relevant information for Future Analysis and track the development of the subject (Nuñez, Navarro, and Pérez 2023; Supriadi et al. 2023). Therefore, it is expected that this approach can understand the development of publications and summarize the current state of established or developing research issues in the management of scientific communication of sports education.

In this study, bibliometric analysis was performed using Bibliometrix Package in R-tool (Aria and Cuccurullo 2017). The bibliometric tool was created with R-programming language, which, according to the creators, is an open source with powerful statistical features useful for Scientific Computing (Ghosh and Satya Prasad 2021). In contrast to other open-source programs, such as CiteSpace and VOSViewer, Bibliometrix places more emphasis on statistical accuracy and completeness (Dervis 2019).

Bibliometric analysis began with identifying keywords, leading to accurate information regarding the research question. On December 9, 2022, data were collected on the Web of Science (WoS) database with search terms based on the topic: "sport* education*," and they were sorted only to research articles.

Next, the aspects that need to be highlighted is that WoS groups each document based on categorization. Each categorization is definitely intended to differentiate between one category and another. The results of the data search show that several of publications on the topic 'sport education' are only included in the Education & Educational Research or Sport Sciences category, but there are also a number of publications which are included in the two Education & Educational Research and Sport Sciences categories at once. So, we excluded documents that fell into both categories at once in our analysis, because the aim of this research was to find out the differences in research results in these two different categories. Figure 1 illustrates the flow chart of data collection and analysis.

The classified data were then processed using Bibliometrix Package, Built-in R, to generate main information, co-occurrence network, thematic map, country scientific production, and collaboration world map. The researchers employed SankeyMatic to process data distribution based on subject classification and Scientopy to process data distribution based on the year of publication. Each process is made based on data for each subject, which are Education & Educational Research and Sport Sciences.

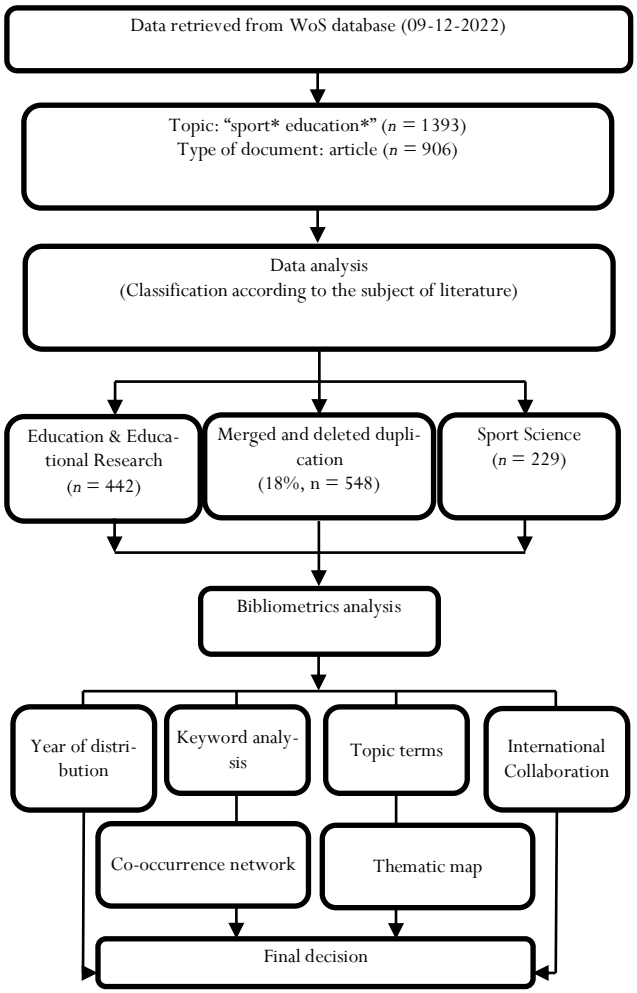


Figure 1. Stages of Data Retrieval and Analysis

Results

The data search in WoS, with the keyword "sport* education*," obtained 1393 data.

As a journal article is a scientific work with more rig-

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orous peer review processes, this study decided to examine journal articles only. Having limited the data search to only journal articles, 906 articles were found. Then, referring to the purpose of the study, the researchers limited the search to articles that belong to the subject of Education & Educational Research and Sport Sciences. Therefore, 671 articles were obtained. The next step was the mapping process using SankeyMatic, and 319 articles were included in the subject of Education & Educational Research and 106 belonged to Sport Sciences. The results of data distribution mapping can be seen in Figure 2

During the data collection, the researchers found that the number of articles included in the subject of Education & Educational Research was almost twice as much as the articles included in the subject of Sport Sciences. After an advanced search process, some articles belonged to both subjects. A total of 123 articles belonged to the subject of Education & Educational Research and Sport Sciences at once.

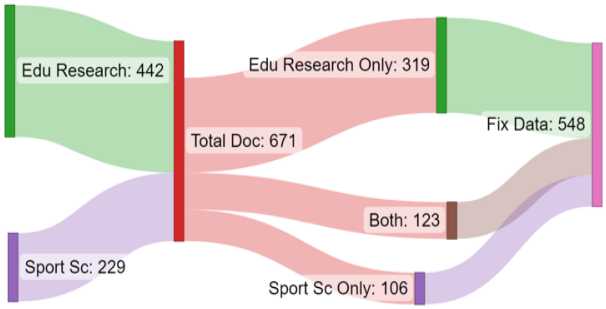


Figure 2. Distribution of Articles by Subject

Based on the advanced search results, the number of articles that only belonged to the subject of Education & Educational Research was three times as many as those included in Sport Sciences. Therefore, the researchers decided to perform data processing using the final data, the articles that only belonged to the subject of Education & Educational Research (319) and those that belonged to Sport Sciences (106). After the data processing, the researchers processed each group of data using Bibliometrix Package, built-in R. The processed data were BibTeX.

The data on time span demonstrated that the oldest article on the subject of Education & Educational Research was published in 1976, while the oldest article on the subject of Sport Sciences was published in 1997. Thus, there is a difference of 21 years between the oldest existing article on the subject of Education & Educational Research and the subject of Sport Sciences in the WoS data source. This difference can be caused by the historical context of research trends and subject grouping carried out by Journal managers and indexation institutions. The first data processing generated the main information. The results are presented in Table 1.

The percentage of the Annual Growth Rate for Education & Educational Research subject is higher than the article in the Sport Sciences. The document's average age of the articles on Sport Sciences subject is higher than the Education & Educational Research. In terms of co-authors per doc and international co-authorships, articles in Sport Sciences are higher than the Education & Educational Research. The difference in the number indicated the trend of intra-country and inter-country collaboration in the Sport Sciences subject exceeds the trend of intra-country and inter-country collaboration in Education & Educational Research.

The analysis continued by mapping the trend. Researchers conducted trend mapping by year. Mapping trends by year is needed to determine the development of a particular study at a certain time. At this stage, the researchers performed data processing using Scientopy. Each group of data was processed by year. The data were extracted and exported into Excel, so they could be juxtaposed with other data groups. Figure 3 shows the mapping results.

All four data groups show an upward trend. The increase can be induced by the publication trends of research results through international journals indexed in the indexing institutions with a certain reputation. This increase might also be caused by the increasing attention of researchers in the field of sports around the world to produce and publish their scientific work (Sotudeh et al. 2012).

Trends in Education & Educational Research and Sport Sciences subject on WoS data sources are equally volatile. This fluctuation can be caused by research trends and the publication of research results in institutions and the authors' countries of origin in both subject groups. Another factor that cannot be ignored is whether the journal is indexed as a medium of publication because it could be that research and publication in both fields have been carried out in particular countries, yet the publications are not or have not been indexed in WoS.

Table 1.
Main information data by the subject of Education & Educational Research and Sport Sciences

MAIN INFORMATION		
Subject	Education & Educational Research	Sport Sciences
Timespan	1976:2022	1997:2022
Sources (Journals	Books	Books
Documents	319	106
Annual Growth Rate %	6.21	5.7
Document Average Age	6.09	6.71
Average Citations Per Doc	9.862	15.26
References	8328	3145
DOCUMENT CONTENTS		
Keywords Plus (ID)	365	240
Author's Keywords (DE)	746	350
AUTHORS		
Authors	600	257
Authors of Single-authored Docs	42	12
AUTHORS COLLABORATION		
Single-authored Docs	51	13
Co-Authors Per Doc	2.66	3.06
International Co-authorships %	18.81	20.75
DOCUMENT TYPES		
Article	295	99
Article; Book Chapter	12	1
Article; Early access	11	2
Article; Proceeding	1	5

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The next data processing result is a co-occurrence network in Education & Educational Research and Sport Sciences subject. A co-occurrence network is used to find out the dynamics of conceptual structures in a certain area, find topics related to a particular research path, and track the evolution of a concept (Zupic and Čater 2015). It agrees that the study of the conceptual structure is intended to find out what science talks about the main themes and trends (https://bibliometrix.org/biblioshiny/biblioshiny3.html). The results of the co-occurrence network mapping in Education & Educational Research and Sport Sciences subject are presented in Figures 4 and 5.

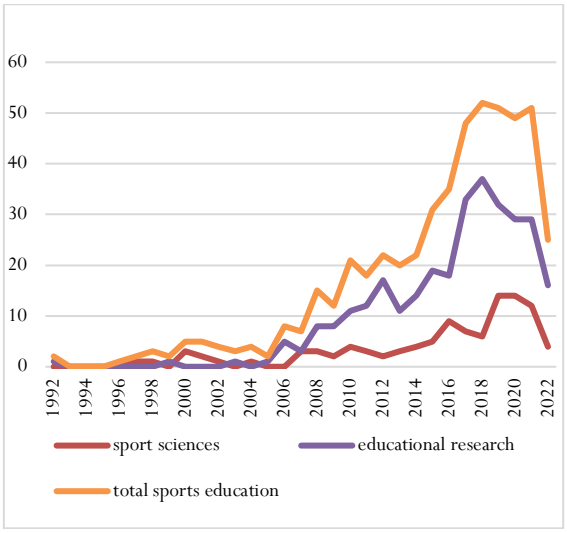


Figure 3. Publication trends by subject and year of publication

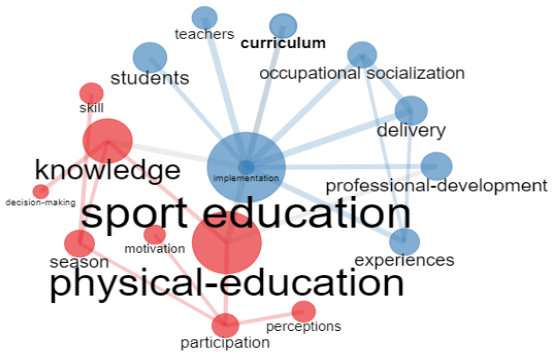


Figure 4. Co-occurrence network in Education & Educational Research subject



Figure 5. Co-occurrence network in Sport Sciences subject

The co-occurrence network in Figures 4 and 5 revealed that articles in Education & Educational Research and Sport Sciences subject have similarities in subject areas related to the topics: sport education, physical education, students, teacher, curriculum, knowledge, skill, participation, perceptions, experiences, and season. Both subjects also present the topic of motivation, yet the subject of Sport Sciences has a tendency towards intrinsic motivation.

There are several keywords that appear in one subject but do not appear in another subject once compared with the same parameter (number of nodes=30), for example, Education & Educational Research (occupational socialization, delivery, professional development, decision-making, and implementation) and Sport Sciences (self-determination, game performance, needs, school). The non-appearance of some keywords on the Co-occurrence network does not mean that they do not exist, but they are not dominant. In this study, the researcher seeks to present the density and development of each topic reflected in the keywords used by researchers to represent the main concepts used in their research. Clustering is exhibited in a particular plot, known as a strategic or thematic map (Cobo et al. 2011).

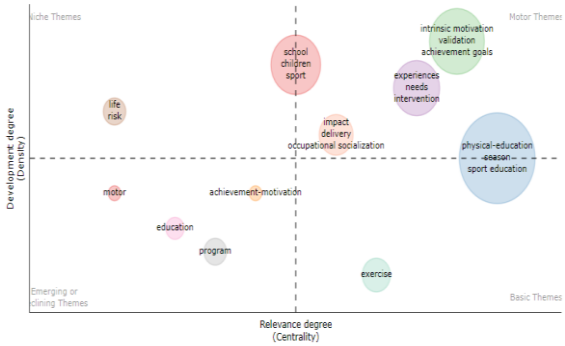


Figure 6. Thematic map of Education & Educational Research subject

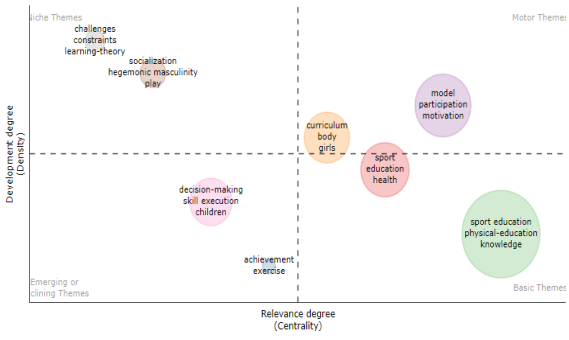


Figure 7. Thematic map of Sport Sciences subject

There are differences in the themes highly specialized in both subjects when compared with the same parameters (number of labels=3). Education & Educational Research subject promote highly specialized themes on challenges, constraints, learning theory, socialization, hegemonic masculinity, and play. At the same time, the subject of Sport Sciences has a very specialized theme about life and risk.

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Only for the topic of education, the subject of Education & Educational Research is in the fundamental quadrant, while the subject of Sport Sciences lies in the quadrant of emerging or declining themes. The similarity lies in the fact that the topic of sports education is equally in the fundamental quadrant of both subjects.

Furthermore, the researcher seeks to show the social tructure based on the country. It aims to find out international collaborations because the most common type of social structure is a co-authorship network (Peters and Van Raan 1991). Co-authorship networks by country are also intended to determine the country of origin of the authors' community with a particular field of research.

Table 2.
The Number of Articles by Collaboration Country in Education & Educational Research and Sport Sciences subject

Education & Educational Research				Sport Sciences			
Country	Articles	SCP	MCP	Country	Articles	SCP	MCP
USA	96	91	5	Spain	25	21	4
Spain	51	43	8	USA	19	14	5
United Kingdom	27	17	10	Italy	11	11	0
Australia	24	16	8	Portugal	8	3	5
Brazil	16	14	2	France	5	4	1
China	15	12	3	Germany	5	3	2
Portugal	9	2	7	Russia	4	4	0
Slovakia	9	8	1	Canada	3	1	2
Turkey	9	9	0	China	3	3	0
Ireland	7	5	2	Slovenia	3	3	0
France	6	4	2	Turkey	3	3	0
Canada	5	4	1	Ireland	2	1	1
Colombia	5	5	0	Latvia	2	2	0
Bulgaria	4	4	0	Slovakia	2	2	0
New Zealand	4	3	1	United Kingdom	2	0	2
Sweden	4	3	1	Austria	1	1	0
Argentina	3	3	0	Brazil	1	1	0
Belgium	2	1	1	Colombia	1	1	0
Israel	2	2	0	Croatia	1	1	0
Korea	2	1	1	Poland	1	1	0
Norway	2	0	2	Hungary	1	1	0
Slovenia	2	2	0	Indonesia	1	1	0
Ukraine	2	1	1	Iraq	1	1	0
U Arab Emirates	1	0	1	Czech Republic	1	1	0
Denmark	1	1	0				
Egypt	1	0	1				
Finland	1	0	1				
Germany	1	1	0				
Italy	1	1	0				
Latvia	1	1	0				
Netherlands	1	1	0				
Romania	1	1	0				
Cyprus	1	0	1				
Note: SCP/ Intra-country		MCP/ Inter-country					

Most authors of Education & Educational Research subject came from the USA, Spain, the United Kingdom, Australia, Brazil and China, while those on Sport Sciences are mostly from Spain, the USA, Italy, Portugal, France, and Germany. The findings showed that authors from the USA and Spain are equally intense on both subjects. In the subject of Sport Sciences, some authors are from Asia, while in Education & Educational Research, some are from Asia and Africa. The authors from Asia who recorded the highest are from the Republic of China.

Table 2 shows that in these two groups of documents, most of the authors come from Europe and America. Australia and New Zealand recorded a number of articles indexed in the subject of Education & Educational Research but until this research was carried out their articles had not been recorded in the subject of Sport Sciences alone. However, of course there is the possibility of articles by authors from productive countries have been documented in groups on two subjects at once.

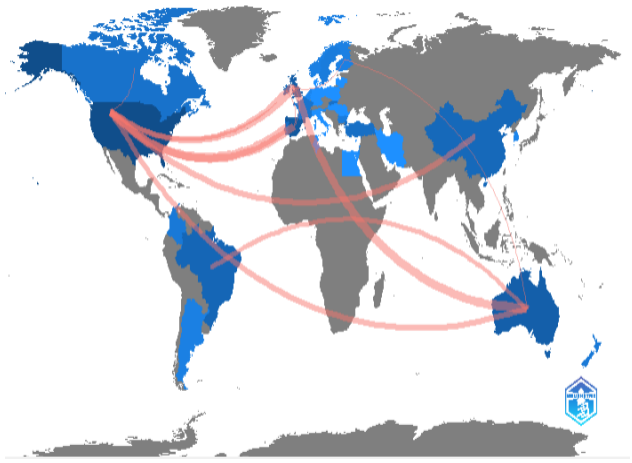


Figure 8. Inter-country collaboration network in Education & Educational Research subject

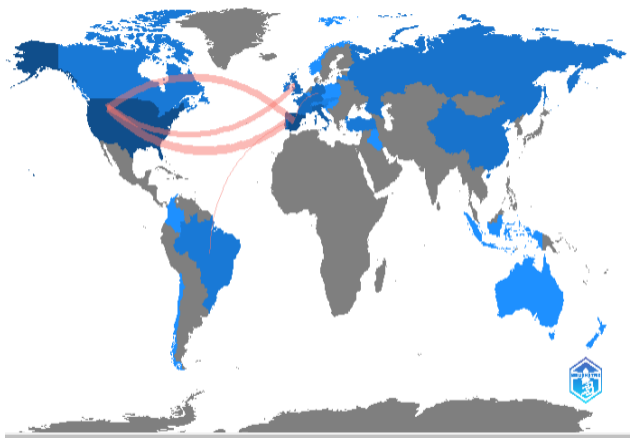


Figure 9. Inter-country collaboration network in Sport Sciences subject

Compared with similar parameters (minimum edges=2), the inter-country collaboration network in Education & Educational Research subject is more intense than in Sport Sciences. The intensity of the Inter-country collaboration network in both subjects also appears in the comparison of the total SCP and MCP of the Education & Educational Research (259: 60), which is higher (84:22) than the Sport Sciences. In terms of co-authors per doc and international co-authorships, articles in Sport Sciences subject have a higher percentage than those in Education & Educational Research.

Discussion

This study focuses on the evolution of research into the concept of sports education in Education & Educational Research, and Sport Sciences subject. Sport education is a

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concept commonly found in both subjects. Following the previous research on sports education, we conducted a bibliometric analysis of sports education involving two research subjects to help understand the evolution of two novel subjects in the field of sports education.

The bibliometric analysis aimed to provide a better understanding of the evolution of the sports education concept in a data source. Therefore, the researchers seek to explore further the conceptual structure in the study of sports education by using the bibliometric method through some analysis tools. Some articles adopted bibliometric to conduct systematic literature reviews (Punchoojit and Hongwarittorrn 2017; Randour, Perrez, and Reuchamps 2020), intellectual structure (Ki, Pasadeos, and Ertem-Eray 2019; Liu et al. 2015), and conceptual structure (Lis 2020; Tontodimamma et al. 2021). In this study, researchers employed bibliometric to perform conceptual structure in the field of sports education.

Based on the literature study, some articles are known to have used bibliometric to map research trends in the field of education (Shareefa and Moosa 2020; Sofyan, Abdullah, and Hafiar 2022) and some in the field of sport (Linsner et al. 2020). Also, some articles adopt bibliometric by using Vosviewer tools (Roziqin et al. 2022; Sofyan, Abdullah, Akinci, et al. 2022), Citespace (Díez-Martín, Blanco-González, and Prado-Román 2021; Ejsmont, Gladysz, and Kluczek 2020), Scimat (Cobo et al. 2012; Sabbah and Selamat 2015), and Biblioshiny (Alcoser et al. 2023; Bran et al. 2021; Hao et al. 2021). The study employed Biblioshiny.

This paper mainly exhibits the similarity of concepts reflected in the similar use of keywords in the study of sports education in Education & Educational Research, and Sport Sciences subject. This finding affirms the result of the previous research that a set of literature can contain results with topics at the intersection of two fields of study or more (van der Vegt 2018). Although the concepts in the use of keywords frequently used in the study of sports education show similarities, the keywords happen to be in different areas once applied in the thematic map. For example, the keyword "exercise" is a keyword that appears equally on the thematic map of both subjects, yet in the Education & Educational Research subject, the keyword is in the emerging/declining theme quadrant. While in the subject of Sport Sciences, the keyword "exercise " is in the fundamental/basic theme quadrant. This finding is also in line with the finding of the previous study of smart public governance, that the keyword "social media" is found in the study of smart city and smart government, yet it belongs to different quadrants (Vujković et al. 2022).

In terms of international collaboration, most authors of Education & Educational Research and Sport Sciences subject come from European and American continents. This result also reinforces the finding of similar research in the field of sports (Khoo, Ansari, and Morris 2021). Another study suggested that although some authors from several countries have shown to do an international collaboration, intra-country collaboration still proves the trend (Smolina, Khafizov, and Erlikh 2020). Based on these findings, the current study updated the research profile, especially in the field of sports education, which is useful for policymakers and relevant authorities. It is in line with the concept of scientific communication through the dissemination of information and knowledge by the scientific community to the public (Glänzel 2003). Moreover, the development of information technology has led to the emergence of digital traces of scientific communication (Katchanov, Markova, and Shmatko 2019), indicating the need to provide capacity building for academics to have a higher level of technological readiness (Harding et al. 2020), thus making it easier for the scientific community to access a variety of study results from diverse regions for comparison and benefit.

Therefore, the findings of this study bring some implications, among others: scientific production in sports has become a worldwide concern; although the study of sports appears to be within the community and limited scientific literature, a large number of countries have started to contribute (Sotudeh et al. 2012). Furthermore, the research development of sports education from year to year will exert a positive impact on society (Završnik et al. 2016) due to the significant correlation between their scientific productivity and the success of the country in the Olympic Games (Sotudeh et al. 2012). Research results in this area receive greater attention and reasonable prospects for the development of study in the future.

In terms of international collaboration, the research conducted collaboration with researchers from high-income countries tends to promote high visibility, but that conducted outside the region tends to encounter difficulty in applying within the region or in other regions with different conditions (Paraje, Sadana, and Salmela 2009). Visibility is one of the factors considered by the author in choosing a journal (Marta et al. 2019). On the other hand, international collaborative research and publication are one of the criteria in the ranking of universities (Zilincan 2015), so some university research centers attempt to establish cooperation with universities in other countries, especially those from the developed ones which have higher rankings. Hence, the ideal step is intra-country or intraregional collaboration through specific incentives involving authors from across the region to stimulate sports education research centers in smaller countries to specialize in their comparative advantages (Paraje et al. 2009).

This study also has limitations. The limitation lies in the fact that this study employs a single data source. The use of data sources based on international indexing institutions with a certain reputation allows some articles to be unprocessed in this study. However, as times progressed, English became common and widely used for international publication (Vujković et al. 2022), and it is the dominant language for international scientific communication (He, Zhang, and Teng 2005). Besides, scientific contributions should be visible in international databases (Vujković et al. 2022), so they can be reviewed and utilized widely. The limitation

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implies a great opportunity to conduct future studies to reach broader and more advanced findings.

Conclusions

This paper is a quantitative analysis and comprehensive evaluation of the literature on sports education from the Web of Science database. It aimed to map the overall picture of the topic from the two subjects that contain the most articles. Besides, it is intended to examine the developmental dynamics and enrich the research understanding of sports education. The results showed similarities and differences in mapping between the two subjects.

Works of literature in Education & Educational Research subject are known to have more timespans, documents, percentages of annual growth rate, average ages, average citations per doc, references, keywords plus (ID), author's keywords (DE), authors, authors of single-authored docs than those in Sport Sciences. Meanwhile, the works of literature in Sport Sciences subject have higher document average ages, co-authors per doc, and percentages of international co-authorships than those in Education & Educational Research.

Furthermore, the subject area of Education & Educational Research and Sport Sciences proves similarities in the topics related to sport education, physical education, students, teacher, curriculum, knowledge, skill, participation, perceptions, experiences, and season. There are several keywords that appear in a single subject but do not appear in the others once compared with similar parameters. However, it does not conclude their absence but rather that they are not dominant.

The inter-country collaboration network on Education & Educational Research subject seemed more intense than in Sport Sciences. In terms of co-authors per doc and international co-authorships, articles in Sport Sciences subject have a higher percentage than those in Education & Educational Research. In conclusion, this paper brings additional insights to research on sports education in the future.

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Conflicts of Interest

The authors state that there is no conflict of interest.

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