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Bibliometric Analysis of Research Development in Sports Science with VOSviewer

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ABSTRACTS

A study on trend analysis of the development of research in the field of instrumentation was carried out in 2018 - 2022. The study aims to find out how to carry out a bibliometric analysis of research in the field of sports science using mapping analysis and VOSviewer software. Data collection was carried out by searching through Google Scholar with the keyword of "sports science" in the 2018-2022 period. Data in the form of the number of publications per year, journals containing sports science articles, authors, authors' origins, and subjects were analyzed using Microsoft Excel 2019. Meanwhile, the development trend of international sports science publications was analyzed using VosViewer software. To retrieve publication data using Publish or Perish software. The results of the study show that the development of growth in the field of instrumentation in 2006 - 2016 which was indexed on Google Scholar was highest in 2018 and reached 181 publications (30.68%). Writers who are considered productive in research in the field of sports science are Davids and Araujo. The map of the development of the field of instrumentation was based on co-words grouping into 5 clusters and co-authors grouping into 7 clusters.

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1. INTRODUCTION

Sport comes from two syllables, namely sports and sports. Sports means training oneself to become a skilled person while body means body. So, sport is a form of individual and community education that prioritizes physical movements that are carried out consciously and systematically towards a higher quality (Prasetya *et al*., 2022). Based on Undang-Undang about the main provisions of the sport in 1997 no 1, sport is all physical activity based on the spirit to tire oneself and others, which is carried out in a chivalrous manner so that sport is a means towards improving the quality and expression of a more noble life with fellow human beings.

Research is a scientific activity of an institution, both large-scale institutions (state, government, and private institutions) and small-scale institutions (faculties, universities, and research groups). Evaluation of research results is highly dependent on the availability and reliability of data resulting from scientific research activities. Bibliometric indicators are knowledge that has a role in evaluating scientific research results, examining the interaction between science and technology, producing mapping of fields of knowledge, tracking/tracing the development of new knowledge in a particular field, and is an indicator in the future in providing a more competitive advantage and in making strategic plans. Bibliometric indicators are calculated over a certain period (usually 3 - 5 years) (Devos, 2011). Several forms of analysis can be carried out in this bibliometric, one of which is a co-word analysis which is used to calculate the number of keywords from a research document that appear simultaneously in the article under study. The keywords used are determined by the author. The more keywords appear in a predetermined group of documents, the stronger the relationship between these documents (Al Husaeni and Al Husaeni, 2022; Al Husaeni, 2022).

Mapping is a process that allows one to recognize elements of knowledge and their configuration, dynamics, mutual dependencies, and interactions (Yayavaram & Ahuja, 2008). Knowledge mapping is used for technology management purposes, including defining research programs, and decisions regarding technology-related activities, detailing the structure of the knowledge base and creating education and training programs. Science mapping is a method of visualizing a field of knowledge. This visualization is done by creating a landscape map. On the map appear topics from science, the input is bibliographical data, keywords, and citations.

Research on bibliometrics has been carried out by several previous researchers (see **Table 1**). Even though many have researched bibliometrics, there are still very few, even if seen from **Table 1**, no one has conducted research on bibliometrics with the keyword sports science spanning 2018-2022. With this research, it is hoped that it can help and facilitate the determination of research subjects to be studied in the future for both us and other researchers.

Table 1. Previous research on bibliometrics.

Authors	Title	Keyword
Al Husaeni *et al*. (2023)	Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research.	Educational
Nandiyanto *et al*. (2021)	A bibliometric analysis of chemical engineering research using VOSviewer and its correlation with covid-19 pandemic condition.	Chemical Engineering
Ragadhita and Nandiyanto (2022)	Computational bibliometric analysis on publication of techno-economic education.	Techno-Economic

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Table 1 (continue). Previous research on bibliometrics.

Authors	Title	Keyword
Nandiyanto & Al Husaeni (2021)	A bibliometric analysis of materials research in Indonesian journal using VOSviewer.	Materials
Nandiyanto and Al Husaeni (2022)	Bibliometric Analysis of Engineering Research Using Vosviewer Indexed by Google Scholar.	Engineering
Al Husaeni and Nandiyanto (2023)	A bibliometric analysis of vocational school keywords using VOSviewer.	Vocational School
Nandiyanto *et al.* (2022)	Resin matrix composition on the performance of brake pads made from durian seeds: From computational bibliometric literature analysis to experiment.	Brake Pads
Al Husaeni and Nandiyanto (2022)	Bibliometric computational mapping analysis of publications on mechanical engineering education using VOSviewer.	Mechanical Engineering
Sudarjat (2023)	Computing bibliometric analysis with mapping visualization using VOSviewer on "pharmacy" and "special needs" research Data in 2017-2021.	Pharmacy

2. METHODS

This study uses data from international publications in the field of sports science which are sourced from the Google Scholar database. Data was collected by searching publications on Google Scholar with the keywords sports science in the category article title, abstract, and keywords in the period 2018 – 2022. Data were processed using Microsoft Excel 2019 and data was collected using the Publish or Perish application. Meanwhile, the development trend of international publications in the field of sports science is analyzed using VosViewer software. Before mapping the data that has been collected is stored in two formats, namely *.ris and .csv.

3. RESULTS AND DISCUSSION

3.1. Publications with the ten most citations

Table 2 shows several articles that occupy the top 10 based on the number of citations on Google Scholar. Larsson *et al*. with the article titled Sarcopenia: aging-related loss of muscle mass and function occupies the first position with a total of 563 citations, followed by Harriss *et al*. with a total of 506 citations. Then Hammami *et al*. (492 citations), Impellizzari *et al*. (488 citations), Slomian *et al*. (454 citations, Kellmann *et al*. (449 citations), Schinke *et al*. (369 citations), Narici *et al*. (332 citations) and Araújo *et al*. (246 citations).

3.2. Development of Publications in the field of sports science

The development of growth in the field of sports science in 2018 - 2022 has experienced a significant decline. The development of sports science publications indexed by Google Scholar was the highest in 2018, reaching 181 publications (30.68%). The complete growth of international publications in the field of sports science is presented in **Table 3**.

The development of the growth of international publications in the field of sports science based on **Table 1** and **Figure 1** shows that 2018 - 2022 the highest growth occurred in 2018, namely 181 publications (30.68%). Then it continued to decline in the following years, namely 2019 (139 publications or 23.56%), 2020 (132 publications or 22.37%), 2021 (100 publications or 16.95), and 2022 (38 publications or 6.44%).

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Table 2. Publications with the top 10 citations.

Cites	Authors	Title
563	Larsson *et al*. (2019)	Sarcopenia: aging-related loss of muscle mass and function
506	Harriss *et al*. (2019)	Ethical standards in sport and exercise science research: 2020 update
492	Hammami *et al*. (2022)	Physical activity and coronavirus disease 2019 (COVID-19): specific recommendations for home-based physical training
488	Impellizzeri *et al*. (2019)	Internal and external training load: 15 years on
454	Slomian *et al*. (2019)	Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes
449	Kellmann *et al*. (2018)	Recovery and performance in sport: consensus statement
391	Schinke *et al*. (2018)	International society of sport psychology position stand: Athletes' mental health, performance, and development
369	Thijssen *et al*. (2019)	Expert consensus and evidence-based recommendations for the assessment of flow-mediated dilation in humans
332	Narici *et al*. (2021)	Impact of sedentarism due to the COVID-19 home confinement on neuromuscular, cardiovascular and metabolic health: Physiological and pathophysiological implications and recommendations for physical and nutritional countermeasures
246	Araújo *et al*. (2019)	Ecological cognition: expert decision-making behaviour in sport

Table 3. Year of publication in sports science on Google Scholar.

Year	Total Articles	Percentage (%)
2018	181	30.68
2019	139	23.56
2020	132	22.37
2021	100	16.95
2022	38	6.44
Total	**590**	**100**

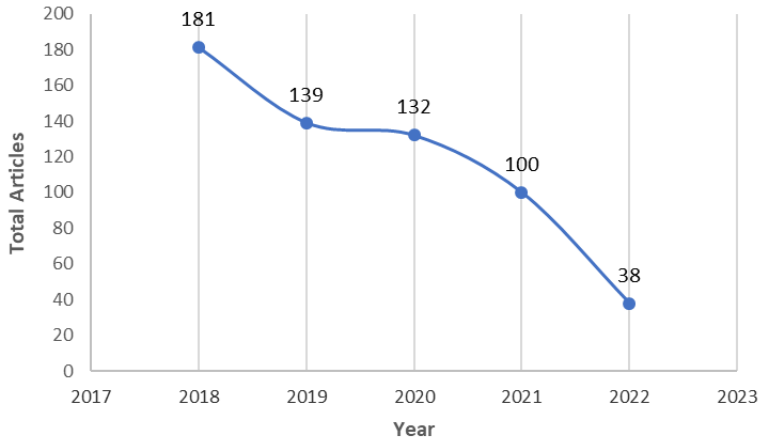

Figure 1. Year of publication in sport science on Google Scholar.

3.3. Map of publication development based on keywords

Figure 2 shows that based on the keywords (co-words), the development map of research publications in the field of instrumentation indexed by Google Scholar in 2018 - 2022 forms 5

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clusters. Cluster 1 is colored red, and consists of the terms age, athlete, competition, effect, influence, performance, physical fitness, present study, reliability, study, training, and year. Cluster 2 is colored green, consisting of the term's analysis, article, development, field, research, review, role, science, sport, and sport science. Cluster 3 is blue, consisting of the terms change, country, covid, exercise, health, impact, physical activity, physical education, student, and university. Cluster 4 is yellow, consisting of the terms coach, elite sport, factor, importance, knowledge, practice, relationship, researcher, sport science, and sport science research. Cluster 5 is purple, consisting of the term's application, exercise science, injury, quality, risk, systematic review, and use.

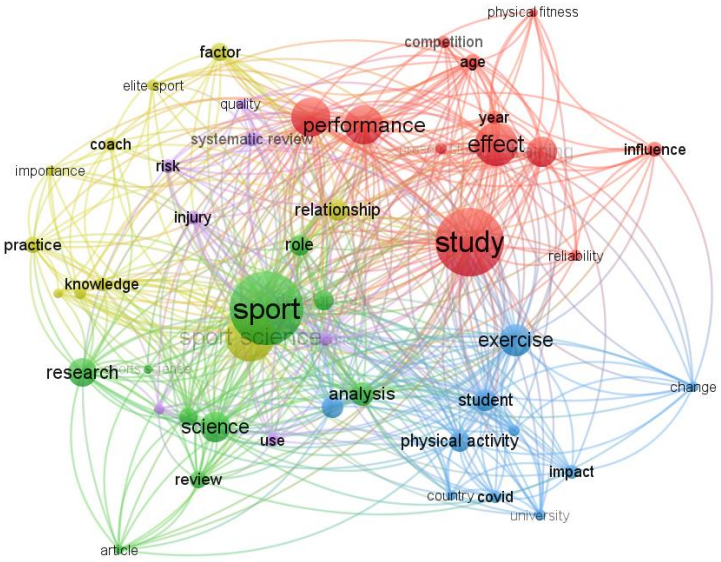

Figure 2. Co-word map of sports science publications.

3.4. Publication development map based on the term sport science

Figure 3 shows that the term sports science is in cluster 4 which is marked in yellow. The term sports science is connected to the other 9 terms in cluster 4 which were previously described (sub 4.2). the term sports science has a total link strength of 370 with occurrences of 121.

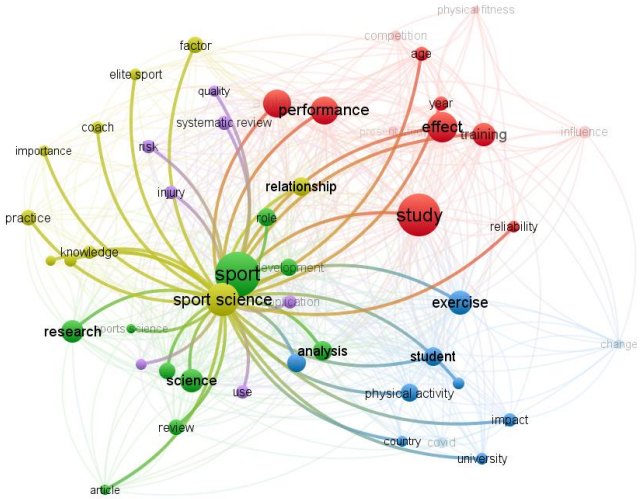

Figure 3. Bibliometric map of sport science terms.

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3.5. Map of publication development by author

Figure 4 shows that based on the author (co-author), the instrumentation research is divided into 7 clusters. Cluster 1 is red, and consists of Byne, H., Bezodis, Ne., Feser, Eh., Loubser, I., and Popocockl, C.. Cluster 2 is green, consists of Mkeown, I., Rebertson, S., Rudd, J., Shuttleworth, R.J., and Woods, C.T. Cluster 3 is blue, consisting of McCosker, C., Newcombe, D., Renshaw, I., and Roberts, W.. Cluster 4 is yellow, consisting of Carvalho, J., Correia, V., and Pereira, E. The 5 purple clusters consist of Aaoujo, D., Hristovski, R., and Seifert. I.. Cluster 6 is light blue, and consists of Davids, K., North, J.S., and Strafford, B.W. Cluster 7 is orange, and consists of O'sullivan, M., Rothwell, M., and Stonde, J.

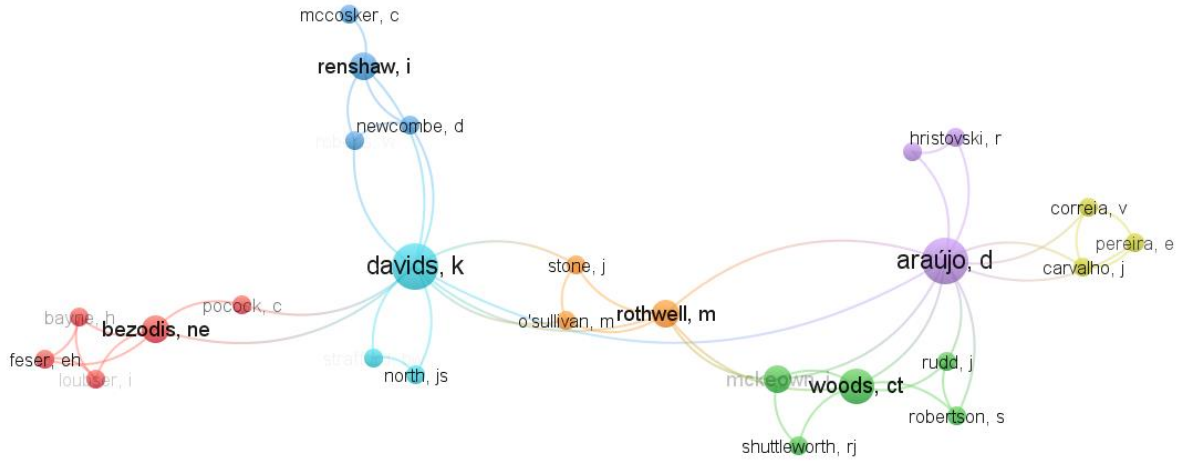

Figure 4. Map of co-author publications in sports science.

4. CONCLUSION

The purpose of this study was to conduct a bibliometric analysis of sports science research using mapping analysis and VOSviewer software. We identified 50 items in the search results that were published between 2018 – 2022. Based on the results and discussion it can be concluded that the development of growth in the sports science field in 2018 - 2022 which was indexed by the highest Google Scholar occurred in 2018 reached 181 publications (30.68%). Davids, K. and Araujo, D. are the most productive writers in the field of sports science with a total of 5 documents. The development map in the field of sports science based on co-words is grouped into 5 clusters and the co-authors are grouped into 7 clusters with different colors and terms. There are several terms related to sports science such as coach, elite sport, factor, importance, knowledge, practice, relationship, researcher, and sport science research.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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