



# Trends in Volleyball Research in School Education Context: A Bibliometric Analysis

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## ABSTRACT

The development of volleyball as one of the most popular sports in schools requires an in-depth scientific investigation to support effective teaching practices. This study aimed to analyse the trends in scientific publications on volleyball within the school-based education context by using a bibliometric approach. Data were collected from the Scopus database covering the 2014 to 2024 period. The research method involved keyword-based searches, selection based on inclusion and exclusion criteria, and bibliometric analysis using several tools, namely Microsoft Excel for quantitative data processing, VOSviewer for visualizing collaboration networks and keyword analysis, and Publish or Perish for citation and author metrics analysis. A total of 467 relevant articles were analysed in this study. The results indicate a significant increase in the number of publications and citations each year, peaking in 2022. Patterns of collaboration among countries and institutions also appeared strong, particularly in the United States, Japan, and Indonesia. Furthermore, research focus had shifted over time from injury and health issues to pedagogy, student participations, and the integration of digital technology in learning. This study provides a comprehensive overview of the scientific development of volleyball in schools and highlights the importance of innovation in physical education to make learning more effective and relevant to students.

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## INTRODUCTION

Physical education plays a crucial role in the development of student physical, mental, and social aspects at school (Sariva et al., 2024; Rimansyah, 2023; Kurniawan & Rahayu, 2022). One of the most popular sports in physical education is volleyball (Adhi et al., 2023; Abadi & Kuntjoro, 2023; Taufik & Kosasih, 2020). This sport not only improves physical fitness but also trains teamwork and strategic thinking of students (Ramadhan et al., 2023; Martini et al., 2024). Therefore, volleyball has become an important part of the physical education curriculum (Arimbawa et al., 2021; Ngula et al., 2021).

The development of volleyball teaching methods in schools continues to undergo innovations in line with advances in science and technology (Purwanto et al., 2023; Esser, 2019). Research in this field is urgently needed to determine the effectiveness of the teaching methods applied (Gustiawati et al., 2025; Widodo & Wandono, 2025). Through the research, teachers can develop more targeted teaching strategies (Mulya et al., 2025; Kosasih, 2020). This is important to ensure that the volleyball learning process in schools is optimal and enjoyable for students (Sujarwo & Widayat, 2020; Esser 2019; Jia & Guoging, 2025).

In addition to physical aspects, volleyball also plays a role in developing student motivations and participations in sports (Aji et al., 2019; Satiasih 2021). In the context of education, volleyball can be an effective and enjoyable learning medium (Susanto et al., 2021; Putra; 2021). Therefore, understanding research trends related to volleyball in schools can help improve the quality of education (Alfani et al., 2023; Supriyadi, 2019). Ongoing research can provide a foundation for the development of more adaptive curricula (Imamudin et al., 2025; Martini et al., 2024).

Research trends in volleyball education indicate an increasingly broad focus, not only on techniques and tactics, but also on psychological and pedagogical aspects (Samsudin et al., 2019; Putra, 2021). Researchers have been initiating to examine how volleyball instructions can shape student characters and enhance their social skills (Arwin et al., 2023; Widhiasto et al., 2020). This indicates that volleyball research is now becoming more holistic (Isman et al., 2019; Irfandi & Rahmat, 2020; Defrizal & Suharjana, 2019). With a comprehensive approach, volleyball education can provide greater benefits for students (Rukmana et al., 2021; Ridho & Anggara, 2024; Satiasih, 2021; Zhang et al., 2025).

Previous studies have made important contributions to this field. Rudi & Arhesa (2020) investigated the effect of specific training methods on volleyball serving skills in high school students and showed positive results. Ginting & Helmi (2020) explored a game-based learning approach that successfully increased motivation to learn volleyball in elementary schools. Meanwhile, Supriyadi (2019) investigated the relationship between volleyball trainings and social skills and teamwork in junior high schools, which also yielded significant results.

The novelty of this research lies in the purpose of the research that aimed to examine the trends of research on volleyball technical aspects, pedagogical approaches, and the use of up-to-date digital technologies through a descriptive bibliometric analysis. In addition, the research explored the challenges and opportunities in implementing digital technologies within the field of physical education. In addition, this study also aimed to identify factors influencing the effectiveness of volleyball learning and to determine how digital technology could support the learning process. The main objective of this study was to provide a comprehensive overview of the development and innovation of volleyball learning in schools.

## **METHODS**

This study employed a descriptive bibliometric analysis method consisting of four main stages, namely identification, screening, eligibility selection, and inclusion stages (Srilesnawati et al., 2024). Bibliometric analysis is a statistical method used to measure and analyse various scientific publications, such as books and journal articles (Dewi et al., 2019).

### **Data Source and Search Strategy**

In the identification stage, the researchers conducted a literature search by using the Scopus database, which initially yielded 7,597 articles. The search was further refined by using the keyword "Volleyball" for the 2014 to 2024 period, resulting in additional 5,017 articles.

### **Data Processing and Inclusion Criteria**

During the screening stage, the researchers selected relevant literatures based on specific criteria, narrowing the results down to 510 articles focused on the school-related field. In the eligibility stage, a more stringent selection was applied by using defined eligibility criteria, including the requirement that publications should be in English, which resulted in 467 articles. In the final inclusion stage, these 467 eligible articles were deeply analysed and included in this study.

### **Bibliometric Indicators and Analysis**

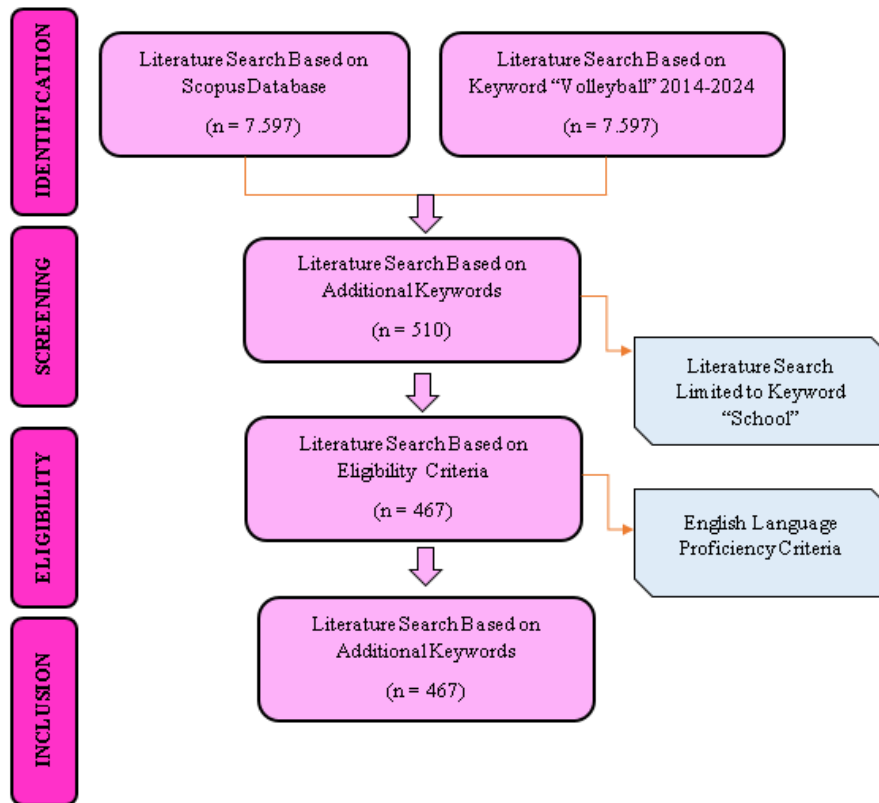
This analysis involved several indicators, including number of publications, citations, journal impact factors, author collaborations, and geographical distributions of the research (Michale et al., 2021).

### **Tools and Visualizations**

The tools used in this study included VOSviewer, Microsoft Excel, Scopus Analytics, and Publish or Perish. The types of visualizations used included network maps, density maps, trend graphs, and others.

### **Limitations**

The study utilized only one database (Scopus) and included only English-language articles with the time frame limited from 2014 to 2024.



**Figure 1.** The Article Search and Selection Process

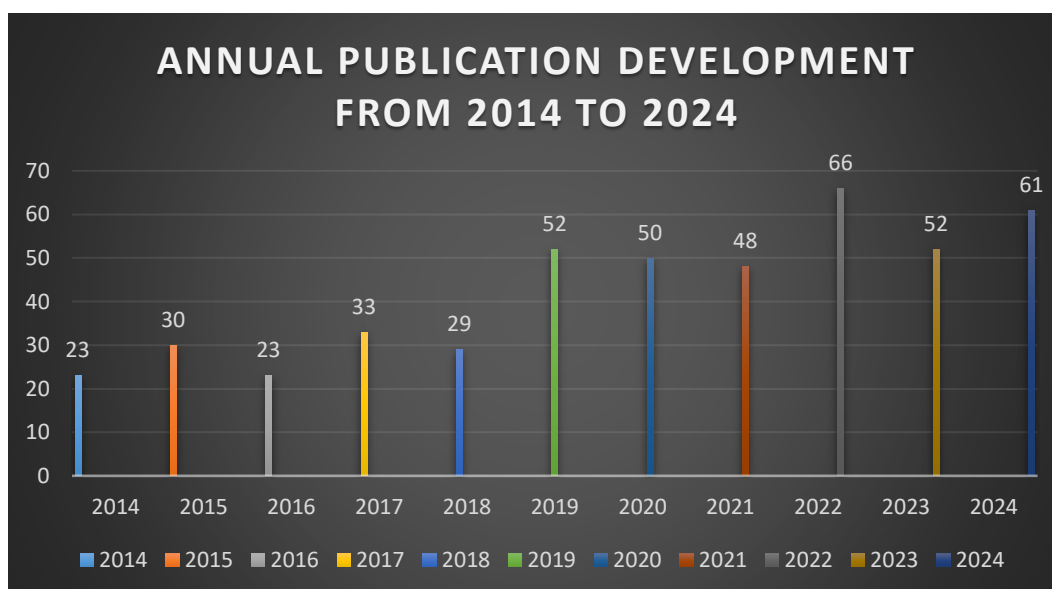
Researchers utilized various software tools in the research data processing, one of which was Microsoft Excel, used to create tables illustrating publications and citation trends. The VOSviewer application was employed to visualize inter-country collaboration networks and the research focus in the field. Additionally, PoP was used to analyse citation trends by calculating indicators, such as NCP, C/CP, h-index, and other parameters.

## RESULTS

This section discusses trends in the number of publications and citations, as well as bibliographic collaborations among countries, institutions, and journals related to Volleyball in the Context of Education in Schools from 2014 to 2024. Publication trends indicate the development of research in this field, while citation trends reflect the influence and acceptance of these works within the scientific community. Inter-country and inter-institutional collaborations illustrate international and institutional cooperations, while journal bibliographic pairs indicate journals that actively publish related research. The research focus refers to the main areas of interest in this study during the period.

### Publication Number Trends

Graph 1 illustrates publication trends by organizing the number of publications based on their year of publication. The graph shows the pattern of research publications related to Volleyball in the Context of Education in Schools from 2014 to 2024.



**Graph 1.** Publication Trends from 2014 to 2024

The publication of articles on volleyball in the context of school education shows an upward trend from 2014 to 2024. At the beginning of the period, the number of publications was relatively low, around 23 to 30 articles per year, indicating the early stages of research interests in this field. However, from 2017 to 2019, there was a significant increase, with the number of publications reaching 52 in 2019. This indicates that academic attention to the role of volleyball in education is growing. From 2020 to 2024, the number of publications remained high and relatively stable, with a peak of 66 articles in 2022. This trend reflects that the topic of volleyball in physical education at schools is increasingly becoming a key focus of research and sport curriculum development. Overall, the data underscore the importance of volleyball as a part of school education and demonstrate a positive growth in academic interests in this field.

### Trends in Number of Citations

Table 1 shows the pattern of development in the number of citations for research on volleyball in the context of school education during the 2014 to 2024 period. Based on Table 1, the highest TC (Total Citation) was recorded in 2013 with 886 citations. However, the number of TP (Total Publication) and NCP (Number of Cited Publications) reached its peak in 2015. The h-index value peaked in 2019, while the g-index reached its highest point in 2015. This indicates that the articles published in 2015 had a significant impact on the development of research in this field. In other words, these works were frequently cited by other researchers, thereby being considered important to the advancement of related studies. Therefore, 2015 can be seen as an important year in encouraging the growth of publications that enrich knowledge and understanding of volleyball in the school education context. Furthermore, Table 2 shows the top four studies from 2015 based on the number of citations.

**Table 1.** Trends in Number of Citations

Year	TP	TC	NCP	H	G
2024	61	86	37	5	5
2023	52	248	36	9	13
2022	42	396	35	5	19
2021	48	592	42	14	22
2020	50	537	46	11	21
2019	52	652	50	15	23
2018	29	284	25	9	16
2017	28	635	28	13	25
2016	23	640	22	13	23
2015	26	1055	23	12	26
2014	17	948	14	9	17

TP: Total Publications; TC: Total Citations; NCP: Number of Cited Publications; H: h-index; G: g-indeks

**Table 2.** List of Publications with The Highest Number of Citations in 2015

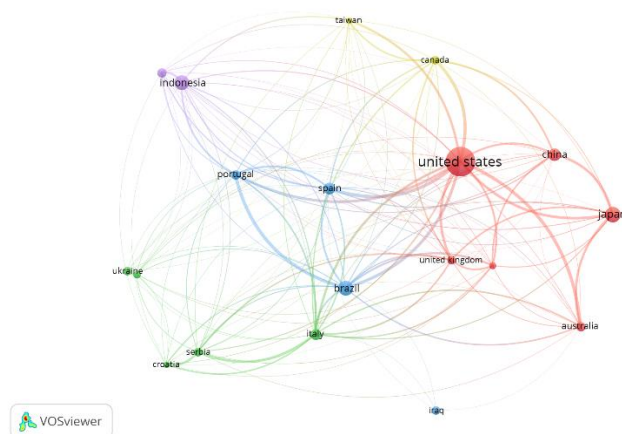
Author	Title	Journal Name	Citation
(Myer et al., 2015)	High Knee Abduction Moments Are Common Risk Factors for Patellofemoral Pain (PFP) and Anterior Cruciate Ligament (ACL) Injury in Girls: Is PFP Itself A Predictor for Subsequent ACL Injury?	Britihs Journal of Sport Medicine	222
(Randon et al., 2015)	Sport Specialization's Association with an Increased Risk of Developing Anterior Knee Pain in Adolescent Female Athletes	Journal of Sport Rehabilitation	206
(Hebert et al., 2015)	Organized Sport Participation Is Associated with Higher Levels of Overall Health-Related Physical Activity in Children (CHAMPS Study-DK)	Tenth International Congress on Peer Review and Scientific Publication (PlosOne)	119
(Pereira et al., 2015)	Training Strategy of Explosive Strength in Young Female Volleyball Players	Medicina	67

Research conducted in 2015 made an important contribution to understanding injury risks and trainings in adolescent athletes, particularly females. Myer et al. (2015) in the *British Journal of Sports Medicine* (222 citations) highlighted that high knee abduction moments were common risk factors for patellofemoral pain (PFP) and ACL injuries and questioned whether PFP could predict ACL injuries. Randon et al. (2015) in the *Journal of Sport Rehabilitation* (206 citations) also found that the early sport specialization increased the risk of anterior knee pain in adolescent female athletes.

Another focus is shown by Hebert et al. (2015) in *PlosOne* (119 citations), who found that participation in organized sports was associated with higher physical activity levels in children. In addition, Pereira et al. (2015) in *Medicina* (67 citations) investigated explosive strength training strategies for young female volleyball players. Overall, these four studies highlight the relationship between training, injury, and health in the context of adolescent sports.

### Collaborative Bibliography between Countries

Figure 2 shows a network visualization depicting international collaborations in research on volleyball in the context of school education. In the figure, each circle represents the contribution of the countries involved in scientific publications related to this topic. This analysis used a minimum threshold of seven documents, so only countries with at least seven publications were shown in the visualization.



**Figure 2.** Bibliographic Pairs Collaboration between Countries

This visualization of the bibliographic collaboration network between countries illustrates patterns of international research collaborations based on joint publications. Each point on the network represents a country, with the size of the point reflecting the number of publications or research contributions from that country. In this image, the United States stands out as the country with the largest contribution, as seen from the size of its node, which is larger than that of other countries. The connecting lines between nodes indicate research collaborations between two countries, with the thickness of the line reflecting the intensity of the collaboration. The thicker the line, the more joint publications produced. For example, the collaboration between the United States, Canada, and Japan is very strong, marked by thicker lines between them.

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Out of 76 countries that met the predetermined threshold, 19 countries were included. The United States ranks first with 2,221 total link strength, 3,444 citations, and 144 publications. In the second place, Japan recorded 694 link strength, 340 citations, and 39 publications. Other countries will be ranked based on the number of publications first, followed by the number of citations, and finally the total link strength. These countries include Indonesia (38,162,417), Brazil (35,205,1063), China (27,142,531), Spain (24,323,770), Italy (20,257,869), Portugal (16,256,864), Turkey (16,65,255), Australia (14,227,591), Canada (13,186,659), United Kingdom (12,108,654), Serbia (12,94,473), Ukraine (12,133,048), Iraq (12,20,006), Poland (11,77,097), Germany (9,115,454), Taiwan (7,106,315), and Croatia (7,74,228). Figure 3 below displays the information described by the researcher regarding research collaborations between countries in the context of volleyball in school education.

Selected	Country	Documents	Citations	Total link strength
<input checked="" type="checkbox"/>	united states	144	3444	2221
<input checked="" type="checkbox"/>	japan	39	340	694
<input checked="" type="checkbox"/>	indonesia	38	162	417
<input checked="" type="checkbox"/>	brazil	35	205	1063
<input checked="" type="checkbox"/>	china	27	142	531
<input checked="" type="checkbox"/>	spain	24	323	770
<input checked="" type="checkbox"/>	italy	20	257	869
<input checked="" type="checkbox"/>	portugal	16	226	864
<input checked="" type="checkbox"/>	turkey	16	65	255
<input checked="" type="checkbox"/>	australia	14	227	591
<input checked="" type="checkbox"/>	canada	13	186	654
<input checked="" type="checkbox"/>	united kingdom	12	108	600
<input checked="" type="checkbox"/>	serbia	12	94	473
<input checked="" type="checkbox"/>	ukraine	12	133	48
<input checked="" type="checkbox"/>	iraq	12	20	6
<input checked="" type="checkbox"/>	poland	11	77	97
<input checked="" type="checkbox"/>	germany	9	115	454
<input checked="" type="checkbox"/>	taiwan	7	106	315
<input checked="" type="checkbox"/>	croatia	7	74	228

**Figure 3.** Inter-Country Bibliographic Pairs

### Inter-Institutional Bibliographic Pairs

Figure 4 shows an overlay visualization of inter-institutional bibliographic pairs. Researchers set a threshold requiring each institution to have at least four publications. Of the total 1,353 institutions, only six met this criterion. Next, the researchers ranked the institutions based on their total link strength. The Graduate School of Information, Product and System (Japan), ranked first with a total link strength of 0 and 28 citations from five publications. The following institutions are presented in a format where the first number

indicates the total link strength, the second number indicates the number of citations, and the third number indicates the number of publications. For example, the Department of Kinesiology, University of Wisconsin-Madison (United States) (107, 106, 4), the Department of Orthopaedics and Rehabilitation, University of Wisconsin-Madison (United States) (107, 151, 4), The Micheli Centre for Sport Injury Prevention (United States) (11, 51, 4), School of Kinesiology, Auburn University (United States) (1, 164, 4), and Kherson State University (Ukraine) (0, 61, 4).

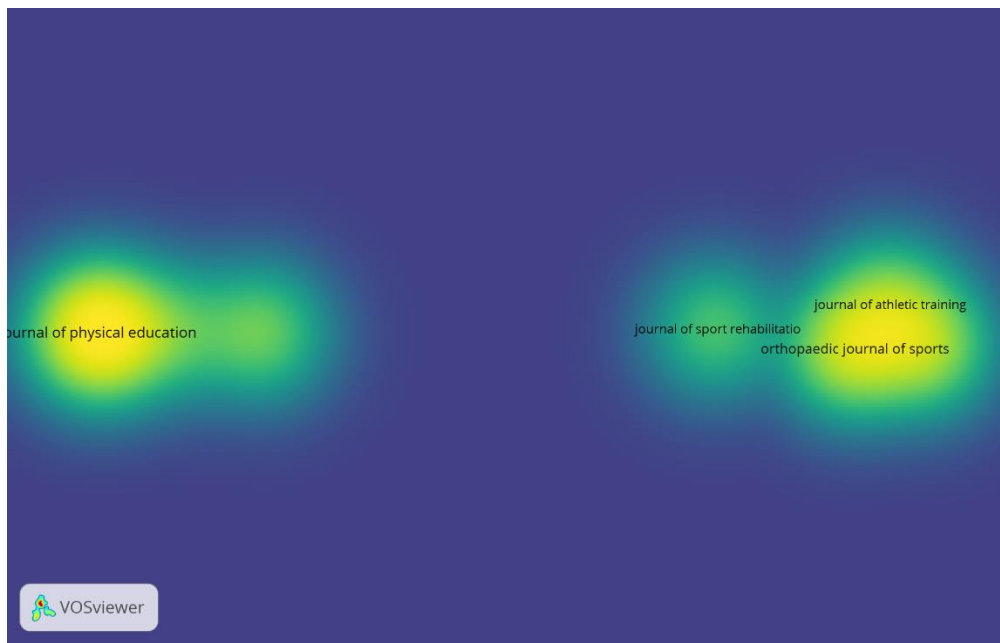


**Figure 4.** Overlay Visualization of Institutional Bibliographic Pairs

This bibliographic overlay visualization shows collaboration between institutions in research on volleyball in the school education context, with nodes representing institutions and colours reflecting the average year of publication. It can be seen that the School of Kinesiology, Auburn University, is the most recently active institution (around 2020), marked in yellow, while institutions such as the Department of Kinesiology and Department of Orthopaedics contributed earlier (around 2018–2019), coloured light blue. Inter-institutional relationships are indicated by lines signifying scientific collaborations, particularly in the fields of kinesiology and orthopaedics. This reflects the growing academic interest in volleyball education, with institutions contributing at different times and intensities.

### Journal Bibliography Pairings

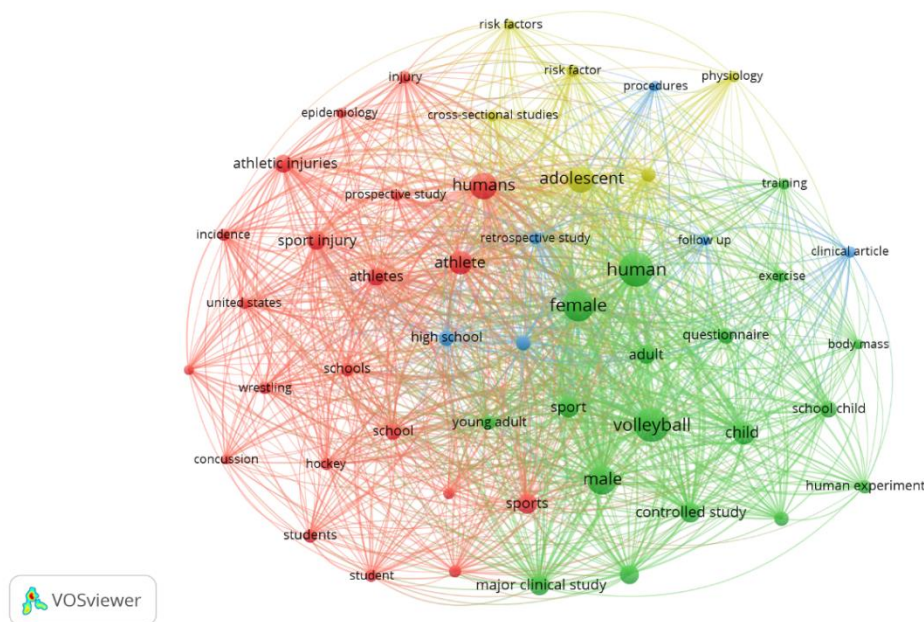
Figure 5 shows journal bibliography pairings with density visualization. Yellow indicates the density level of a journal and a change to dark yellow indicates a higher number of publications in that journal. Researchers applied a threshold requiring each journal to have at least 7 publications. Out of 250 journals, 8 met this criterion. The researchers then ranked the journals based on the highest number of publications, with the *Journal of Physical Education and Sports* ranking first with 20 publications, 218 citations, and 46 total link strengths. This means that the journal has published 20 articles discussing volleyball in the school education context. The order of most publications includes the *Orthopaedic Journal of Sport Medicine*, *Clinical Journal of Sport Medicine*, *International Journal of Human Movement and Sport Science*, *Journal of Athletic Training*, *International Journal of Environmental Research and Public Health*, *Journal of Sport Rehabilitation*, and *Retos*.



**Figure 5.** Density Visualization of Journal Bibliographic Pairs

**Research Focus**

The research focus on volleyball in the school education context is reflected in Figure 6. The novelty of this research is shown in Figure 7. The visualization used the Vosviewer application with a threshold of 22, which means that the keywords displayed have appeared in at least 20 different documents.



**Figure 6.** Network Visualization of All Keywords

In this keyword network visualization, there are four clusters with different numbers of items. The largest cluster is red with 21 items, containing keywords related to sports injuries and epidemiology such as sport injuries, athletic injuries, and concussions, indicating a research focus on health aspects and injury risks in school volleyball. Next, the green cluster with 18 items focuses on student characteristics and experimental studies, including



## DISCUSSION

This study shows that publications on volleyball in the context of school education have increased significantly from 2014 to 2024. This increase indicates that volleyball has become an important topic in physical education, particularly due to its ability to improve the student physical and social health. The rise in the number of publications also indicates that many researchers are interested in examining aspects of learning, injuries, and the effectiveness of volleyball teaching methods in schools. Bibliometric data confirm the growing scientific interest in developing more targeted learning strategies through this sport.

Several previous studies support these findings. For example, research by Myer et al. (2015) highlighted the importance of structured training programs in reducing the risk of injury among young athletes, while Randon et al. (2015) emphasized the benefits of sport education in fostering leadership and character development in students. In the volleyball learning context, Hebert et al. (2015) demonstrated that teaching skills through a tactical approach was more effective than traditional methods. These studies form the foundation for developing more contextualized teaching strategies that align with student learning needs.

Collaboration between countries and institutions is a key element in the advancement of this research. The United States, Japan, and Indonesia are among the countries with the highest contributions to publications and scientific collaborations. This collaboration highlights the importance of international cooperation in expanding perspectives and approaches to sport education. Visualizations of collaboration networks also show how educational and research institutions contribute through joint research to explore various aspects of volleyball within the context of school education.

In addition to collaboration, the focus of research has also evolved. Initially, much of the research focused on injury risks and health factors in volleyball. However, over time, the focus has shifted to pedagogical aspects and character development of students through more specific training approaches. Keyword visualization indicates that the researcher attention has expanded to include student participations, learning effectiveness, and teaching methods utilizing digital technology. This reflects a paradigm shift from merely physical activities to a holistic character-based learning.

The results of this study show that volleyball is not just a sport, but a complex and multidimensional educational medium. Through bibliometric analysis, researchers can map development trends and identify strengths and weaknesses in existing scientific publications. This is an important basis for educators, researchers, and policymakers in designing a more comprehensive and adaptable physical education curriculum suited to contemporary needs.

## CONCLUSION

Based on the result of bibliometric analysis, it concludes that research on volleyball in the school education context has undergone a significant development over the past decade. The increase in the number of publications and citations indicates a high level of interest in exploring volleyball as an effective learning medium. The focus of research has shifted from issues of injury and health to the development of innovative and technology-based learning methods. The international collaboration has also played a crucial role in enriching insights and enhancing the quality of scientific publications in this field. The novelty of the research is evident in the integration of pedagogical, physiological, and digital approaches that complement each other in volleyball education. This reflects the need for innovation in

physical education that is more contextual and relevant to the development of today students. Researchers and educators in the field of physical education are advised to continue exploring more integrative approaches to volleyball instructions by leveraging technological advancements. The use of digital media, interactive applications, and project-based learning can be effective strategies for increasing student participations in sports. Additionally, broader collaboration between educational institutions, research organizations, and the government is needed in developing policies and teacher training programs. This is important to ensure that volleyball instructions in schools not only emphasize physical aspects but also support the development of student characters and social skills.

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