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Volleyball score sheet: Review and bibliometric analysis

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ABSTRACT

Point scoring is often used as a useful skill performance indicator for athletes and coaches in volleyball matches. There is still limited research on the recording of “score sheet” match reports. This study aims to conduct an extensive bibliometric literature review on the “volleyball score sheet”. This research is qualitative research using a literature review method with a bibliometric analysis. Articles were searched using Publish or Perish (PoP) software with the Google Scholar database as the data source. There were 21 out of 673 articles found from the Google Scholar database from 1966 to 2021 analyzed in this study. Those selected were then managed using reference manager software, namely Mendeley version 1.19.8. After the database had been managed, this research classified and visualized it using VOSviewer software. Based on the literature review analysis conducted, it was found that 5 articles were suitable for analysis from 673 articles obtained from the search results. These data allow this paper to answer the question of what research trends in score sheet volleyball have been in the last 10 years. Some words that are not used can be linked and investigated in future research. Therefore, more topics can be developed based on these keywords such as affiliation, city and country. The elements mentioned above can provide a more comprehensive analysis. Overall, this review provided an appropriate reference point for further research on 'the volleyball score sheet'. Based on the analysis of the literature review conducted, it was found that the development of a comprehensive volleyball score sheet is needed, to facilitate scoring and avoid errors or loss of scoring as occurs in manual recording using a score sheet.

KEYWORDS

Score sheet; volleyball; review; bibliometrics

1. INTRODUCTION

Since it first competed at the 1996 Olympics in Atlanta, volleyball has become a very popular sport in the world. In 1994 the International Federation of Volleyball (FIBV) stated there were 200 million players (Aagaard & Jørgensen, 1996). This number continues to increase until today there are around 800 million players worldwide who play volleyball at least once a week (Seminati & Minetti, 2013). The increasing number of athletes and the repetition of playing volleyball is also followed by the development of various research studies on volleyball. For example, the development of technology provides information on the results of player performance analysis (Yudiana et al., 2021). Previous studies have reported on technical and tactical actions related to team performance/match results (Palao, Santos & Espa, 2004; Eom & Schutz, 1992; Drikos, Kountouris & Laios, 2009). Research developments have also not only focused on elite men's level matches but also reported gender and age differences (Garcia de Alcaraz, Ortega & Palao 2020; Ciemiński, 2018).

Has been reported that there are various research publications on aspects of player and team performance, or on volleyball and the importance and popularity of the game of volleyball (Tillman et al., 2004); however, there is still limited research on the recording of “score sheet” match reports. Volleyball sports benefit greatly from a scoring system that can strengthen all aspects of more comprehensive player performance. Moreover, in volleyball matches, point scoring is often used as a useful skill performance indicator for athletes and coaches (Zetou et al., 2007; Andrés, 2008; Marcelino et al., 2010). The form of scoring points recorded in the match report is a 'score sheet'. Moreover, its function is not only to report the points earned by the Team but also to document everything happening during the match which has been filled in by the scorer of the match. Through the document, analysis of the included information can tell a team how many points it has won and lost in various game rotations and the tactical orientation of a team (Andrés et al., 2010; Andrés et al., 2005). Furthermore, it is important to know which skills in volleyball contribute the most to winning.

Researchers in sports and exercise science are interested in sports scoring systems, particularly in their efforts to obtain reliable systems for determining sports scoring. In recent years, a number of test cases to support sports utilize ICT (Information and Communication Technology). These efforts look promising for some types of sports. As ICT applications in general, we can find swimming applications to analyze swimmers' training conditions or plans based on image information and split time information. As for another example, volleyball has been supported by tactics based on statistical information (Masui et al., 2015). Volleyball matches leading to a digital technology system include a digital volleyball scoresheet which functions to display match results, change players,

determine libero, and connect to a central server to print out reports (Nurlina et al., 2017). Technological developments in sports are not only beneficial for players and coaches but also beneficial for match officials (Irfanny et al., 2021).

Sports research examining score sheets is nothing new. Previous studies on the sport of Baseball have been reviewed several times. The dissertation report from Barry, (1988) developed a method of scoring able to guide certain positions in baseball athletes who competed in the National Collegiate Athletic Association (NCAA). In 2014 Major League Baseball (MLB) introduced the results of the development of statistical calculations of the movement of each player position which was sourced on the score sheet (Phillips, 2019).

The question of how technology impacts coach activity relates to the general area of 'man-machine' or 'human-technology tool' interaction, and sports science research streams have drawn inspiration from ergonomics, particularly in terms of user experience (e.g., Ade et al., 2009; Poizat et al., 2010; Sève et al., 2011). Studies tend to focus on three main criteria: (a) utility (i.e. potential use), (b) usefulness (i.e. conditions of actual use), and (c) suitability (i.e. conditions for learning to use tools and conditions for transformation of tool-using activities) (Rabardel, 1995). The literature review and the sheer number of technological tools on the market attest to their usefulness. However, as Wright et al. point out (2012), usefulness remains under-studied. One way to address this gap in the literature is to analyze the activities of real trainers to identify what functions they use, in what situations, and with what constraints or resources. Various methods are suitable (Nielsen, 1993), but when a field is unknown, bottom-up, inductive, or grounded theory analysis is suggested to more clearly identify problem areas and boundaries of the analysis field (eg Côté et al., 1993).

There are no contemporary peer-reviewed articles providing a comprehensive evaluation of volleyball score sheet reports. This article focuses on how score sheets on volleyball match reporting are conceptualized in various research publications (literature) from 2000-2021. The novelty of this paper aims to fill a research gap by providing an extensive bibliometric analysis of the literature in relation to volleyball score sheets. The articles published and indexed by Google Scholar (GS) are analyzed and categorized by distribution and author affiliation. This analysis can see what research topics are the subject of more publications and the topic of 'score sheet volleyball' in the future which provides opportunities for further research.

2. METHODS

2.1. Study participants

This study is a literature review research with bibliometric analysis, so that the participants of this study are 5 articles obtained from analysis using Publish or Perish software.

2.2. Study organization

The methodology used to perform the analysis was bibliometric analysis, including method steps related to the implementation of GS data-based software and publish or perish (PoP). Then, the results were presented using the VOSviewer followed by a discussion session and conclusions from the literature study using the bibliometric analysis already carried out. The information approach using bibliometrics makes it easier to get a database as a basis for evaluation that is more concrete than assumptions (Suominen and Seppänen, (2014). This bibliometric literature review was based on a systematic method (Lindahl et al., 2015) or an idea mapping method emphasizing the boundaries of knowledge (Tranfield, Denyer, & Smart 2003). This research method adopted a five-step method (Tranfield et al., 2003; Hudha et al., 2020) as shown in Figure 1.

Figure 1. Research Method Flow

2.3. Defining keywords for search

The literature search was carried out in September 2021 with the keyword 'score sheet volleyball'. Google Scholar (GS) was chosen because it is currently the largest database, while Publish or Perish (PoP) was chosen because it proved to be the most effective way to search for articles on GS (Baneyx, 2008). The first search entered a query language into the PoP software with the keyword 'score sheet volleyball'.

2.4. Initial search results

This search for articles was conducted through the 'keyword' column only, and the years '1966-2021'. There were 1000 articles found in the initial search. The results were compiled in a Research Information Systems (RIS) format to include all important article information such as paper title, author name and affiliation, abstract, keywords, and references from the articles found.

2.5. Improving search results

Before the data was saved into the RIS format, the corresponding articles indexed in the GS database were filtered. Essays, theses and dissertations; newspapers, books, book reviews, and book chapters were not included in this data. Only journal articles and proceedings were selected. Due to the limited results of research on score sheets in volleyball, we also included articles 'in Indonesian' in the search results. Then to make appropriate repairs, the file was saved in the form of a RIS file. The RIS data was transferred into the Mendeley bibliography software.

2.6. Compiling initial data statistics

The collected data was stored in the form of RIS. In the initial stage, the components of the complete journal article (year of publication, volume, number, pages, etc.) were checked, and the necessary information was added when incomplete data was found. Data analysis was carried out so that articles could be classified based on the year and source of publication and publisher.

2.7. Data analysis

Bibliometric analysis in searching this data used PoP software (Baneyx, 2008; Jacsó, 2009), while to analyze and visualize the bibliometric network, Vosviewer software was used (Martínez-López, Merigo, Gázquez-Abad, & Ruiz-Real, 2020; Husaeni & Nandiyanto, 2022). VOSviewer was used because of its ability to work efficiently with large data sets and provide a variety of interesting visuals, analyses, and investigations (van Eck & Waltman, 2010). Vosviewer can also create publication maps, author maps, or journal maps based on co-citation networks or build keyword maps based on shared networks.

2.8. Statistical analysis

The statistical analysis of the obtained data was performed using PoP software, while to analyze and visualize the bibliometric network, Vosviewer software was used.

3. RESULTS

The research results were presented based on the search output from the PoP software and analyzed through the VOSviewer software to determine the keywords that appeared most often. In addition, the number of keywords appearing most often was adjusted to the needs of data collection and analysis. VOSviewer was used to visualize bibliometric maps. This software displays bibliometric mapping on three different visualizations namely, network visualization, overlay visualization, and density visualization.

Prior to sorting and refinement, it generated 1000 search results from various sources such as journals, books, thesis papers, proceedings etc. After initiating a search that focused on journal

articles and proceedings, 673 articles were obtained through the GS database. After improvement, 20 articles were identified and grouped from the GS database. This data had been well verified in the GS database from 1966-2021 with the keyword 'score sheet volleyball'. Approximately 673 articles were obtained in the initial results with 23086 citations (419.75 citations/year). The refinement results obtained 21 articles; the citation data also changed, with 76 citations and 1.38 citations/year. The complete results of the comparison of metric data from the initial search and refined search are shown in Table 1.

Table 1. Comparison Metrics

Metrics data	**Initial search**	**Refinement search**
Source keyword	'*score sheet volleybal*'	'*score sheet volleybal*'
Publication year	1966-2021	1966-2021
Papers	673	21
Citations	23086	76
Cites/year	419.75	1.38
Cites/paper	34.30	3.80
Author/paper	2.21	1.90
h_index	78	5
g_index	139	8
hI_norm	57	5
hI_annual	1.04	0.09

The researcher tried to present the most relevant contributions in this research. The step taken was to take 21 articles with the keyword "score sheet volleyball"' which had the highest citation value (the top 5 articles cited). The results obtained are in Table 2.

Tabel 2. Top 5 cited articles

No	**Year**	**Author**	**Title**	**Journal**	**Cites**	**Publisher**
1	2008	José Manuel Palao Andrés	Options for analysis of the volleyball score sheet	International Journal of Performance Analysis in Sport	20	Taylor & Francis
2	1996	Steven D. Martin	Multi-functional volleyball talking scorekeeper	United States Patents 5,574,422	11	Google Patents

3	1974	Gloria A Krug	Volleyball score display device	United States Patents 3,922,805	11	Google Patents
4	1961	Jr George Oscar Saile & Sr George Oscar Saile	Scoring device	United States Patents 3,254,433	10	Google Patents
5	1999	Michael Nally, David Rossi & Beth Shergalis	Net scoring system	United States Patents 6,234,918	7	Google Patents

The top 4 publishers who publish articles on this topic are presented in Table 3.

Table 3. Top 4 publishers who publish Score Sheet topic

No	Publisher	Articles
1	Google Patents	7
2	STKIP Citra Bakti	2
3	Universitas Negeri Semarang	2
4	Taylor & Francis	2

The data network visualization display on GS data related to the keyword ‘score sheet volleyball’ that has been refined in search can be seen in Figure 2, overlay visualization can be seen in Figure 3, and visualization of density in Figure 4.

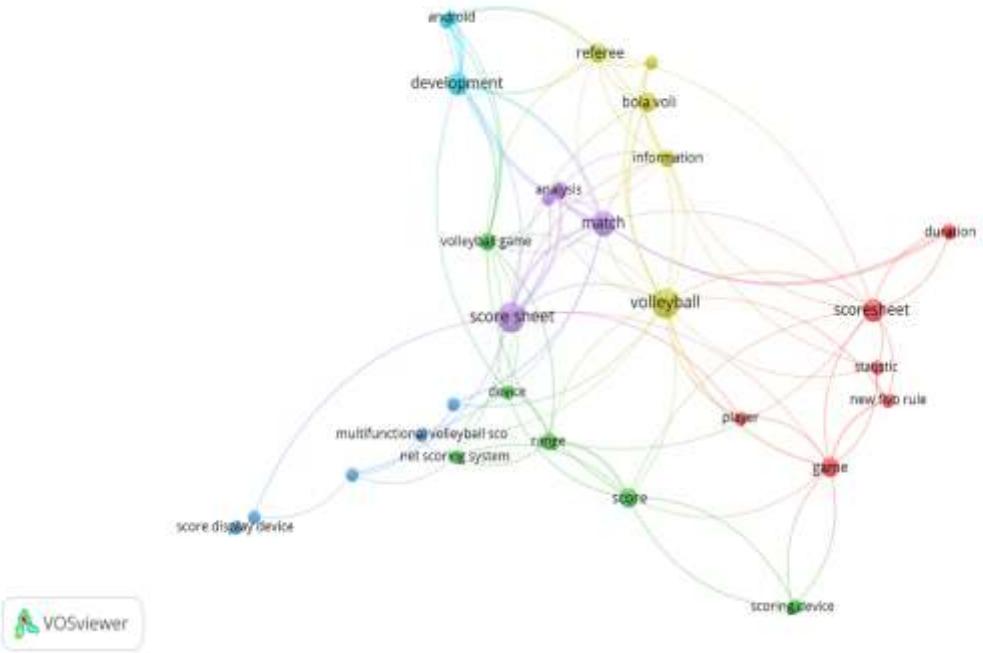

Figure 2. Overlay visualization of analisis Vosviewer

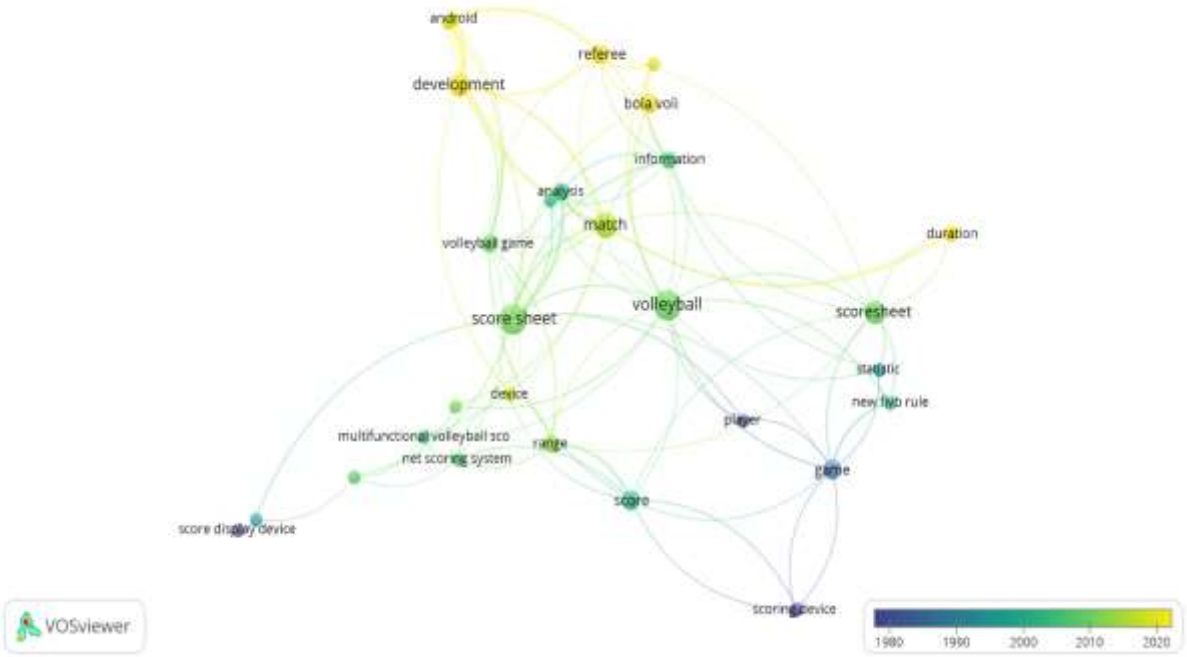

Figure 3. Visualization of overlays in the GS data base

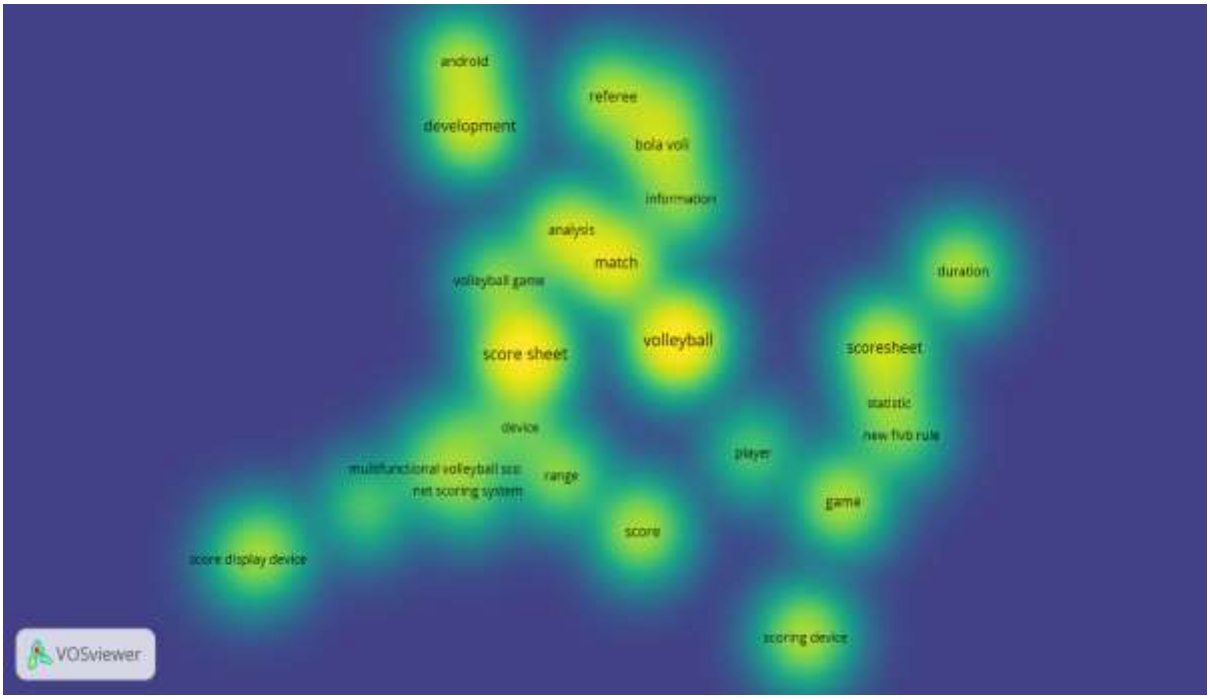

Figure 4. Visualization of density in GS data base

These results were found based on the title, keywords, and abstract with a complete calculation of the minimum number of events set to 3. There were 37 items that met the item criteria. Each of the items that represented a keyword was added, which was indicated by the node size. In other words, the node size indicated the frequency with which the keywords appeared together. There

were six groups identified in this analysis. The keywords that appeared in each cluster representing the flow of the study of low carbon education are shown in Table 5.

Table 5. Keywords representing each cluster.

No	Cluster	Element
1	The first cluster (red)	duration (2), game (4), new FIVB rule (2), player (2), Proliga volleyball team (2), scoresheet (5), statistic (2)
2	The second cluster (green)	device (2), net scoring system (2), range (3), score (4), scoring device (2), scoring sheet (2), volleyball game(3)
3	The third cluster (blue)	embodiment (2), multifunctional volleyball score sheet generator (2), portable score indicator (2), score display device (2), volleyball score display device (2)
4	Fourth cluster (yellow)	bola voli (4), information (3), referee (4), scoresheet volleyball (2), volleyball (9)
5	The fifth cluster (purple)	Analysis (3), match (6), score sheet (9), scorekeeper (2)
6	The six cluster (sky blue)	android (2), development (5), score sheet aplication (2)

4. DISCUSSION

This study obtains the main finding which is to describe the articles that are most relevant to the keyword "score sheet volleyball" and that are the number of citations owned by certain articles and journals. Based on table 2, the highest citation indexed by GS is the article by the writer José Manuel Palao Andrés in 2008. This article discusses how many points a team has earned and lost in various game rotations and matches through match reports recorded on the score sheet (Andrés, 2008). This article is also cited for about 20 research articles. Meanwhile, based on data, there is one publisher with the highest citation frequency, namely Google Patents. This can be identified based on our findings, because Google Patents is also the publisher that contributes the most articles to the score sheet topic, namely with 7 articles, followed by well-known publisher Taylor & Francis with 2 articles and 2 articles each from higher education institutions from Indonesia; Semarang State University and STKIP Citra Bakti. For other publishers, an average of 1 article was published on this topic. In addition to the number of articles per publisher, it was also analyzed based on the relevance of the journal. This shows that the research articles related to the score sheet are scattered in certain journals, although there are also other journals.

Visualization overlay analysis and density visualization were used to identify key themes in each study or scope of knowledge. This result was carried out by measuring the co-occurrence of

keyword pairs (Liu, Yin, Liu, & Dunford, 2015; Nagy, 2018). The analysis was carried out through Vosviewer software. It shows that each cluster is connected to other keywords, indicating that the development of research on this subject is related. Network analysis also allows the identification of author authority (Bilik, Damar, Ozdagoglu, Ozdagoglu, & Damar, 2019). Co-author analysis is a widely used bibliometric research technique that investigates co-authors conducting research from a particular field.

On the whole, these data allow this paper to answer the question of what research trends in low carbon education have been in the last 10 years. Some words that are not used can be linked and investigated in future research. Therefore, more topics can be developed based on these keywords such as affiliation, city and country. The elements mentioned above can provide a more comprehensive analysis.

5. CONCLUSIONS

Based on the analysis of the literature review conducted, it was observed that the development of a comprehensive volleyball score sheet is needed, to facilitate scoring and avoid errors or loss of scoring as occurs in manual recording using a score sheet.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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