Bibliometric Analysis on Physics E-Book Development During the Last Five Years (2018-2022)

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Abstract. The development of physics e-books needs to be developed in line with the development of technology. Bibliometric analysis research is being conducted to discover trends in physics e-book research during 2018-2022. This research examines the types of publications, authors, and countries that contribute to physics e-book research. Bibliometric analysis was executed using the Vosviewer application to read data obtained from the Scopus database. There were 42 publications based on the Scopus database in 2018-2022. Based on the research, the most publications were Conference Papers, and the country with the most publications was Indonesia. However, publications still need to be improved. There need to be more papers on the topic of physics e-books for future researchers to develop physics e-books. Physics e-books can be developed to train 21st-century skills to be more effective in learning physics.

1. Introduction

Physics is one of the subjects taught at the senior high school level. Physics is a subject that studies natural phenomena and various things that occur in everyday life (Anesia et al., 2018). Physics education is a discipline related to studying material objects and energy and the interaction between the two. Physics education is closely related to the teaching and learning of physics in schools intending to introduce students to the basic concepts of physics and provide the skills needed to use these concepts in everyday life. The physics learning process is more focused on student activeness. Teachers generally tend to convey information in only one direction through lectures (Siswono, 2017). Several aspects are essential in learning physics at school, including practical learning methods, an appropriate curriculum, a comfortable environment, professional educators, and learning media. According to Prahani et al. (2022), with the development of technology, it is necessary to develop educational technology, especially in learning media such as web learning, learning applications, e-books, and others.

An e-book is an electronic version of a book (Putri and Fauzi, 2022). E-books are a medium for sharing information and facilitating understanding of the material (Aprillia et al., 2021). According to Vorotnykova's research (2019), it is necessary to develop a new generation of electronic textbooks or electronic books, including content, semantic improvement, and case studies. There are advantages to using e-books in the classroom, according to Embong et al. (2012), such as lightening the burden that students bring to school because e-books are lighter than physical books, making learning more enjoyable because of the features in it, the price is lower, maintenance is more manageable, and can improve learning methods to improve student learning outcomes.

Based on the results of Prahani et al. (2022), the level of researcher interest in digital learning is increasing every year in the form of various publications. The research also provides an understanding of the importance of bibliometric analysis to find out the trends of research that are being carried out and those that still need improvement. Therefore, there is a need for continuous research in bibliometric analysis to determine the research trends happening each year. This research is sustainable with previous research conducted by Dawana et al. (2022) entitled E-Book Learning Research in Physics Education During the Last Five Years: A Review and Bibliometric Study. This study used two types of databases: the Scopus and Google Scholar databases for 2017-2021. Based on this research, research on physics e-books still needs to be done, with most authors coming from Indonesia and many publications being conference papers.

In the last five years, numerous electronic books have been produced to facilitate physics learning. As part of our research project, we will meticulously scrutinize scientific publications related to the advancement of physics e-books between 2018 and 2022 using the Scopus database and the keywords "physics" and "e-books." This analysis aims to gain valuable insights into the trends and developments in physics e-book creation during this period. Our approach for this research involves utilizing a literature review method encompassing bibliometric analysis. The information gathered through this research will be instrumental in analyzing future innovation in physics e-book development.

2. Methods

This research uses a bibliometric analysis method which is carried out by looking at the distribution of publications to assess the contribution of articles to the development of knowledge of various works of literature using statistical methods, including quantitative analysis (Suprapto et al., 2021). Through bibliometric analysis, a comprehensive understanding of the entire discipline can be obtained. The research methodology utilized secondary data in the form of metadata. The following stages were performed for the bibliometric analysis in this research.

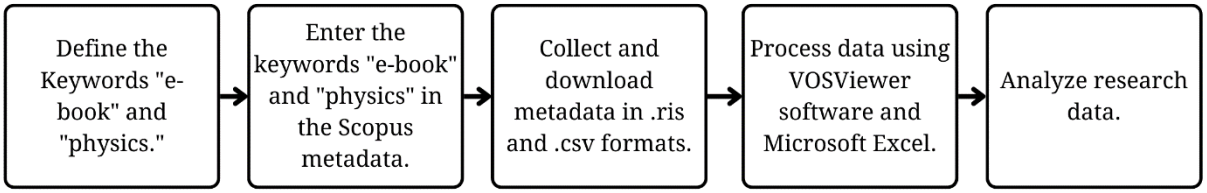

Figure 1. Stages of Bibliometric Analysis

3. Results and Discussion

In June 2023, a search was conducted on the Scopus database using the keywords "physics" and "e-book." The search yielded 62 relevant documents published between 2014 and 2022. A filter was then applied to a .csv file to determine the number of publications made annually from 2018 to 2022. The resulting data is presented below.

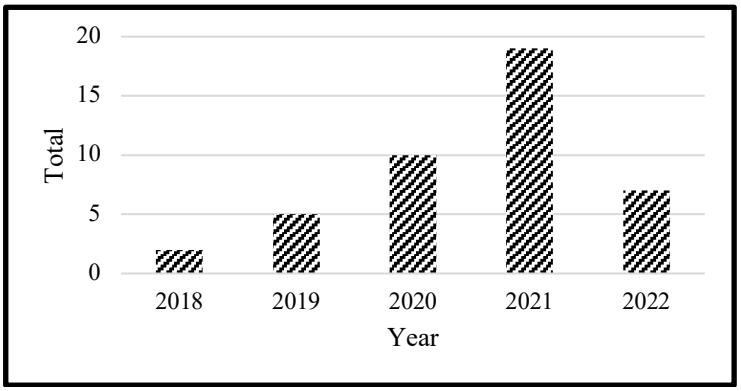

Figure 2. Number of Publications per Year

Figure 2 shows a consistent increase in publications from 2018 to 2021. However, in 2022, the research on "e-books" and "physics" witnessed a significant decline. The decline of research in 2022 indicates that the topic of physics e-book development peaked in 2021 with 19 publications. The data provided can be used to chart the different types of publications for physics e-books and the countries that contribute to these papers. See below for a map of the types of physics e-book publications and their respective countries.

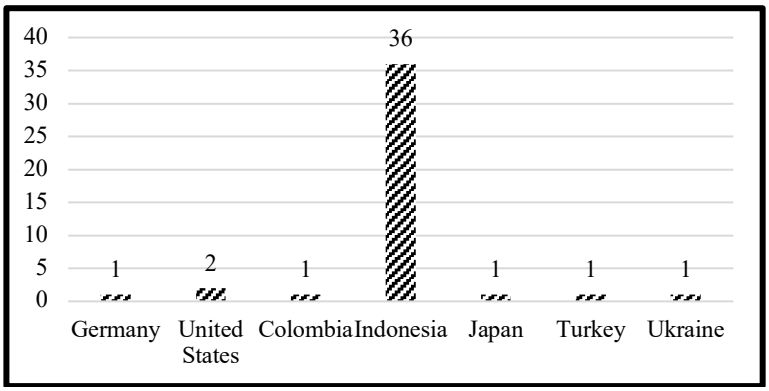

Figure 3. Publication Types and Total Contributions per Country in 2018-2022 from Physics E-book Research

Based on Figure 3, 84% of the publications made for physics e-book keywords in 2018-2022 are conference papers. Then, 14% of the publications are articles, and 2% are books. From the figure, most researchers prefer to publish their research results in conference papers rather than articles and books. Furthermore, the country with the most considerable contribution to Physics E-book publications is Indonesia, with 36 documents, the United States with two documents, and other countries with 1 document.

Table 1. Top 5 for Physics E-books on Scopus Database: Source Title, Affiliate, Authorship

Top Source Title		Top Affiliate		Top Authorship	
Source Title	*Total*	*Affiliation*	*Total*	*Author*	*Total*
Journal of Physics Conference Series	27	Universitas Negeri Padang	21	Fauzi A.	9
AIP Conference Proceedings	6	Universitas Negeri Jakarta	3	Rifai H.	5
International Journal of Emerging Technologies in Learning	2	Universitas Negeri Surabaya	3	Adawiyah R.	2
Educational Technology and Society	1	Anadolu University	1	Gunawan G.	2
Springers	1	Kyoto University	1	Harjono A.	2

Table 3 contains information on the origin of the publication title, publication affiliation, and author based on search results from the Scopus database. The top-ranked publication origin is "Journal of Physics Conference Series" with 27 publications, followed by Padang State University, with 21 publications for affiliation. Fauzi A. is the top-ranked author with nine publications.

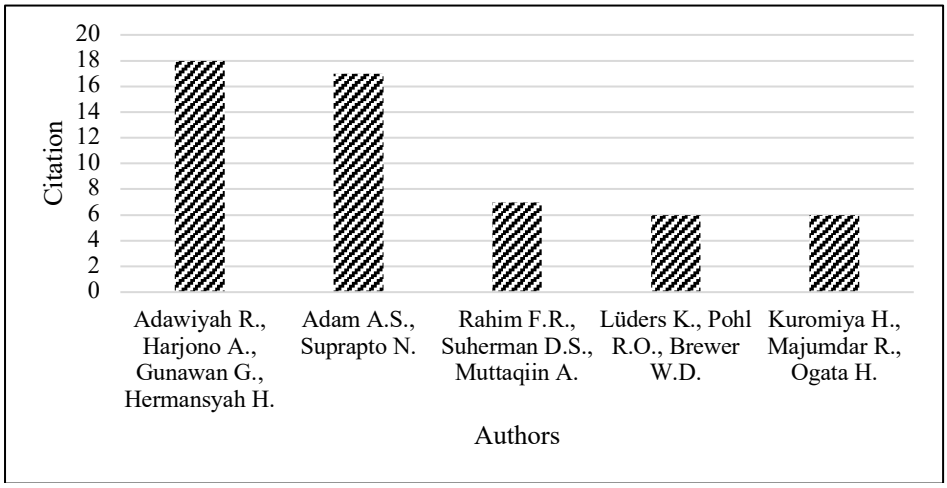

Figure 4. Top Citated Authors

In 2018-2022, the publication by Adawiyah et al. received the highest number of citations on Scopus, according to Figure 4. The researchers developed a physics e-book to enhance creative thinking skills and validated it with experts. The e-book can help students improve fluency, originality, flexibility, and elaboration in physics learning. It received 22 citations, making it the most cited publication during that period. Based on Figure 4, it can also be seen that several other publications were cited. However, the top 3 cited publications are from Indonesia. From the data, it can be seen again that physics e-books are often used in learning in Indonesia.

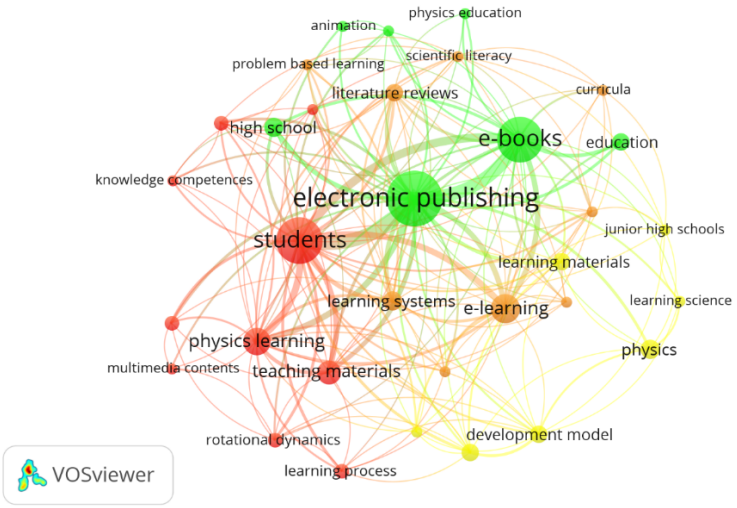

Figure 5. Co-Occurrence Visualization Map based on Metadata for Physics E-books

The visualization mapping in Figure 5 displays Physics E-book trends from 2018-2022, resulting in four distinct clusters. Cluster 1, highlighted in red, consists of ten keywords related to students, physics learning, and teaching materials. Cluster 2, highlighted in orange, comprises eight keywords dominated by e-learning and learning systems. Cluster 3, marked in yellow, has seven keywords, with physics being the most important word. Lastly, cluster 4, highlighted in green, consists of seven keywords dominated by electronic publishing and e-books.

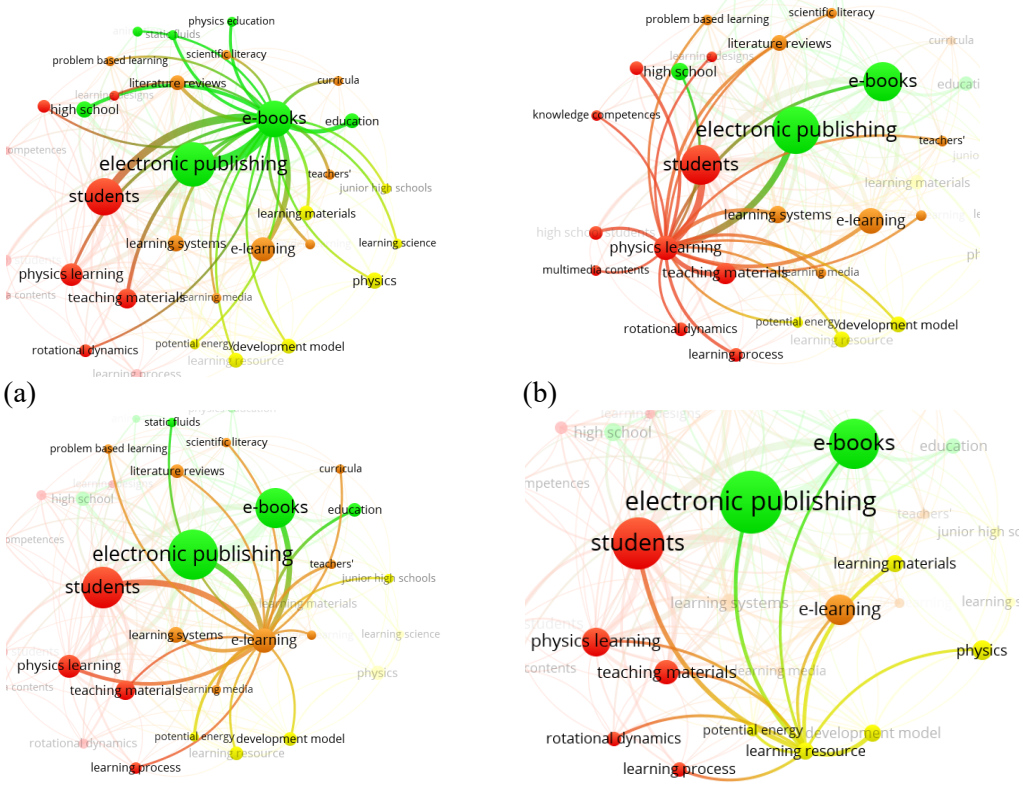

Figure 6. Focused Keyword Mapping Results (a) e-book, (b) physics learning, (c) e-learning, and (d) learning resource

The relationship between e-books and other keywords is illustrated in Figure 6a, with e-learning, students, electronic publishing, and education having the most robust associations. Figure 6b shows that physics learning is closely related to students and electronic publishing and has a moderate connection with learning systems and e-learning. Additionally, Figure 6c highlights the strong links between e-learning, students, electronic publishing, and e-books. Meanwhile, Figure 6d reveals that learning sources have a weaker connection to other keywords, with students and the development model being the most significant. Overall, the figures suggest that e-books, physics learning, e-learning, and learning resource are somewhat interrelated, albeit not very strongly.

Table 2. Top 10 Keywords Used in The Last 5 Years

Keyword	*Occurences*
Electronic Publishing	25
Students	22
E-books	17
Physics Learning	9
Teaching Materials	7
E-learning	6
High School	5
Learning Systems	4
Development Model	4
Learning Resource	4

Table 2 lists ten keywords commonly used in physics e-book research over the past five years. The keyword that appeared most frequently, with 25 occurrences, was electronic publishing, followed by

students, e-books, physics learning, teaching materials, e-learning, high school, learning systems, development models, and learning resources. This table clearly shows the most commonly used keywords in physics e-book research.

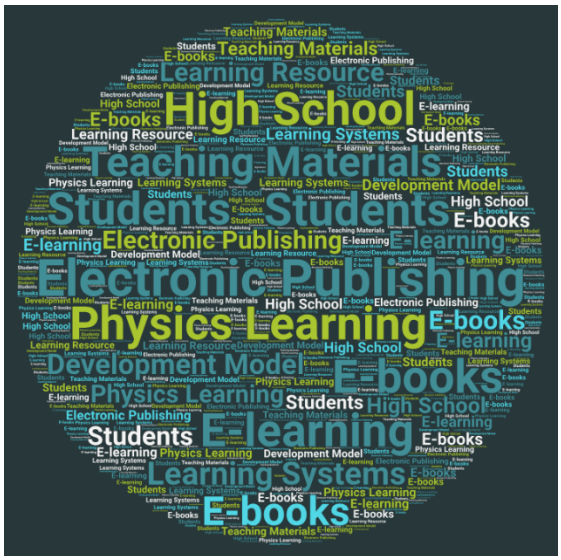

Figure 7. Visualization of Most Relevant Keywords about Physics E-books

By analyzing Figure 6 more specifically, it becomes evident that intensive research is being conducted. The research is focused on various keywords such as e-books, electronic publishing, students, e-learning, physics learning, teaching materials, learning systems, physics, learning sources, learning media, problem-based learning, curricula, blended learning, teachers, education, physics education, knowledge competences, learning physics, development models, and scientific literacy. It is noteworthy that physics research directly related to e-books is still uncommon.

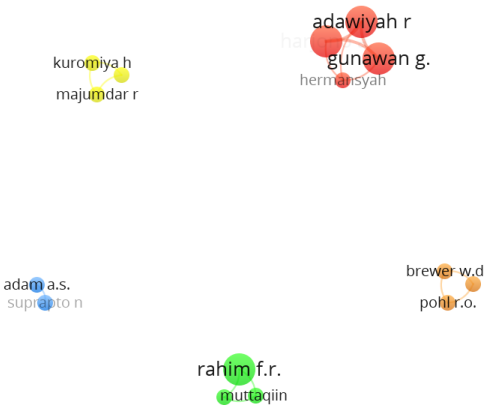

Figure 8. Author's Network Visualization

The results of the publication author mapping for physics e-book topics are illustrated in Figure 8. Based on these results, there are 5 clusters which are written in Table 3.

Table 3. Top 5 Highest Cited Papers Showed the Contribution of E-Book Physics Research in International Journals

Author(s)	SJR	Finding	Total Cited
Adawiyah R., et al	0.183	The author successfully developed an interactive physics e-book that can improve students' creative thinking skills on expert-validated rotational dynamics material.	18
Adam A.S., Suprapto N.	0.536 Q2	Researchers have successfully developed physics learning media through a bilingual e-book called Beboo, which experts have validated. In this development, Beboo teaches about the topic of static fluid. Beboo can help schools that do not have a laboratory to be able to conduct experiments.	17
Rahim F.R. et al.,	0.183	Researchers get data on the effectiveness of e-books in learning from several studies. This research found that digital media can increase student learning motivation, more explicit learning material, more varied learning methods, and reduce boredom in reading books.	7
Lüders K., Pohl R.O., Brewer W.D.	0.131 Q4	This book provides electrodynamics and optics material and several illustrations related to the text.	6
Kuromiya et al.,	1.049 Q1	Based on this research, the processing flow of extracting data from student learning logs, the mixed-effects model used for automated case extraction, and the extraction model used in LEAF make evidence-based practice accessible to practitioners with actual case studies.	6

Based on the information presented in Table 3, research on physics e-books has yet to be extensively discussed in articles. The table details the author, journal ranking in the Schimago platform, a summary of article content, and the number of citations for the top 5 articles with the keyword physics e-book. There is a need for further development in this area for future research. After reviewing the top 5 articles, it has been found that physics e-books can significantly enhance physics learning outcomes in schools. These e-books offer features like videos, illustrative photos, experiments, and more, which can make learning more engaging and exciting for students. Moreover, physics e-books can seamlessly integrate with different learning models to help students develop essential 21st-century skills.

4. Conclusions

According to research on the trend of physics e-books, research has decreased from 2021 to 2022 in the Scopus database. The research focused on keywords such as e-books, physics learning, learning materials, and e-learning. The most common form of publication was conference papers, with 36 papers. The State University of Padang had the largest affiliation in physics e-book publications, with 21 papers. Indonesia contributed the most internationally to this topic, with 36 publications. However, these publications still need numbers. The most cited publication was Adawiyah et al.'s, with 18 citations. Based on the database obtained, research on physics e-books still needs to be widely conducted, and there is a need for innovation in physics e-book learning. Researchers suggest that future research should focus on integrating 21st-century skills training and online and offline practicum activities.

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