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Bibliometric Analysis: Physics Online Learning in Indonesia (2020-2021)

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Abstract

This study aims to identify research trends in online learning physics subjects from 2020 to 2021, as well as research recommendations to improve the quality of online learning physics. The method employed is quantitative and includes bibliometric analysis. It was obtained from the Google Scholar database using Harzing's publish or perish application, and data was analyzed using VOSviewer. Searches with online learning physics yielded 70 articles, which were then examined. According to the research findings, quantitative research is the most commonly employed method, followed by qualitative research. The collected study focuses mainly on learning, physics, online learning, and learning outcomes. The conclusion of this study is learning challenges, effectiveness, critical thinking, Google Classroom, learning media, interest in learning, and motivation to study are suggested research subjects for possible online physics learning.

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INTRODUCTION

Phenomena throughout a specific period indirectly impact the topic of the investigation. As a result of the Covid-19 outbreak in Indonesia, most physics education in 2020-2021 was done online. Educational research never stops, and this has now become one of its research subjects. Even if face-to-face learning is permitted in some places beginning in the middle of 2022 (Kemendikbudristek, 2022), research into online learning will continue.

In today's world, bibliometric data analysis that is visually presented is required (Al Husaeni & Nandiyanto, 2022; Nandiyanto et al., 2020). One advantage of bibliometric data is that it may be used to determine the relevance of research topics and measure their recentness (Triwahyuningtyas et al., 2021). The ease with which different types of information can be obtained creates a hurdle in determining how to transform existing information into knowledge through the analysis process. A lot of information will be easier to understand if it is presented visually through tables or data mapping. In this circumstance, the function of researchers is required.

Researchers must identify trends in a specific research field, such as this study on online physics learning. So that an overview of numerous subjects that have been widely discussed and little addressed related to online physics learning and ideas for future research opportunities may be viewed, it can also be utilized as supporting literature for other scholars studying physics online learning.

It is well known that scholars frequently debate physics education, physics, students, computer-aided learning, and medical education. For the past 30 years, researchers have conducted and analyzed 100 studies on physics education worldwide (Suprapto et al., 2021). Furthermore, Dewi and Jauhariyah (2021) investigate the bibliometric trend of STEM-based physics learning from 2011 to 2021. According to the study's conclusions, STEM-based physics learning research has to be

expanded further in terms of comprehension, communication, cross-cultural, profession, and learning self-reliance abilities. Other research involving Scientific Technology and Society (STS) in science learning has been conducted utilizing VOSviewer (Okta, 2022). Resolving physics learning challenges has also been researched (Putri, 2021). The topic of building problem-solving tools for physics disciplines (Kusuma & Setyarsih, 2021).

Bibliometric research on learning, particularly physics learning, has also been conducted over the last two decades (Bitzenbauer, 2021). Among the research is artificial intelligence in educational research (Prahani et al., 2022), multimedia in physics learning (Nyirahabimana et al., 2022), ethnoscience in physics learning (Hidaayatullah et al., 2021), Prezi media in physics learning (Zakhiyah et al., 2021), e-module for physics (Dewantara et al., 2021), STEM-integrated PjBL in physics learning (Solihin et al., 2019), STEM learning (Sánchez et al., 2021), competence assessment related to physics learning (Suliyanah et al., 2021), and misconception in science (Kurtuluş & Tatar, 2021).

There has already been researched that particularly refers to online physics learning. However, the analysis relies on literature studies and does not use VOSviewer (Suyatna, 2020). According to the study's findings, there are various problems and opportunities for learning physics during the epidemic. To develop 21st-century abilities and science process skills, begin by designing strategies, models, techniques, learning media, teaching materials, and learning resources. One of the study options available to academics is to conduct studies on the issues, impacts, and effectiveness of learning physics online.

Furthermore, research on the trend of online learning studies has been conducted addressing online learning and its efficiency (Iskandar et al., 2021; Tauhid et al., 2020). It is not, however, limited to physics online study. The Scopus database was used to research the topic of online learning physics using VOS viewer analysis (Jatmiko et al., 2021). Because some new studies only use the Scopus database, there are still options to conduct research using other databases such as Google Scholar. As a distinction from the past study, the Google Scholar database was chosen. Furthermore, the scope of the research investigated includes online physics learning in Indonesia via Indonesian-language research published by Indonesian publishers. As a result, Google Scholar becomes the database source for this study.

According to the explanation above, a bibliometric analysis of physics learning, online learning, and physics, online learning has been performed. There is, however, no mapping of bibliometric study of online physics learning using Google Scholar. As a result, this study aims to identify research trends in online learning physics in Indonesia between 2020 and 2021, as well as research recommendations to improve the quality of online learning for physics courses. This study focuses on publishing online physics learning research and adopting distance learning policies during the epidemic. The distinction from previous studies is found in online physics learning and articles compiled from Google Scholar, beginning with the 2020-2021 edition. The year of publication was chosen based on the Indonesian government's online learning program from March 2020 to the end of 2021. The titles under consideration are Indonesian-language publications published by Indonesian publishers.

METHOD

Analyze the development trend of physics online learning publications utilizing Al Husaeni and Nandiyanto's stages (2022). This study applied quantitative research methodologies using a bibliometric analysis methodology. The data was taken from the Google Scholar database and visualized using Harzing's publish or perish application and VOSviewer. The stages of this research are presented in Figure 1.

The first stage was determining the topic, namely physics online learning, and then followed by a literature study as a preliminary material. The next stage was collecting data from the Google Scholar database with Harzing's Publish or Perish application and data storage. The collected data was analyzed using the VOSviewer application and then followed by data visualization. In the following stage, the researchers analyzed the results of visualization and compared them with the results of other studies. The last stage was formulating the conclusions of the study.

The search results were relevant to the title of the publication which contained the word "physics online learning" based on the Google Scholar database. The findings were then stored in .csv format to be analyzed with the VOSviewer application. The data obtained were divided into several categories, namely: (a) the number of publications based on the type of document and the type of research; (b) VOSviewer visualization of the publication progress map; (c) VOSviewer visualization of the publication progress map by the author.

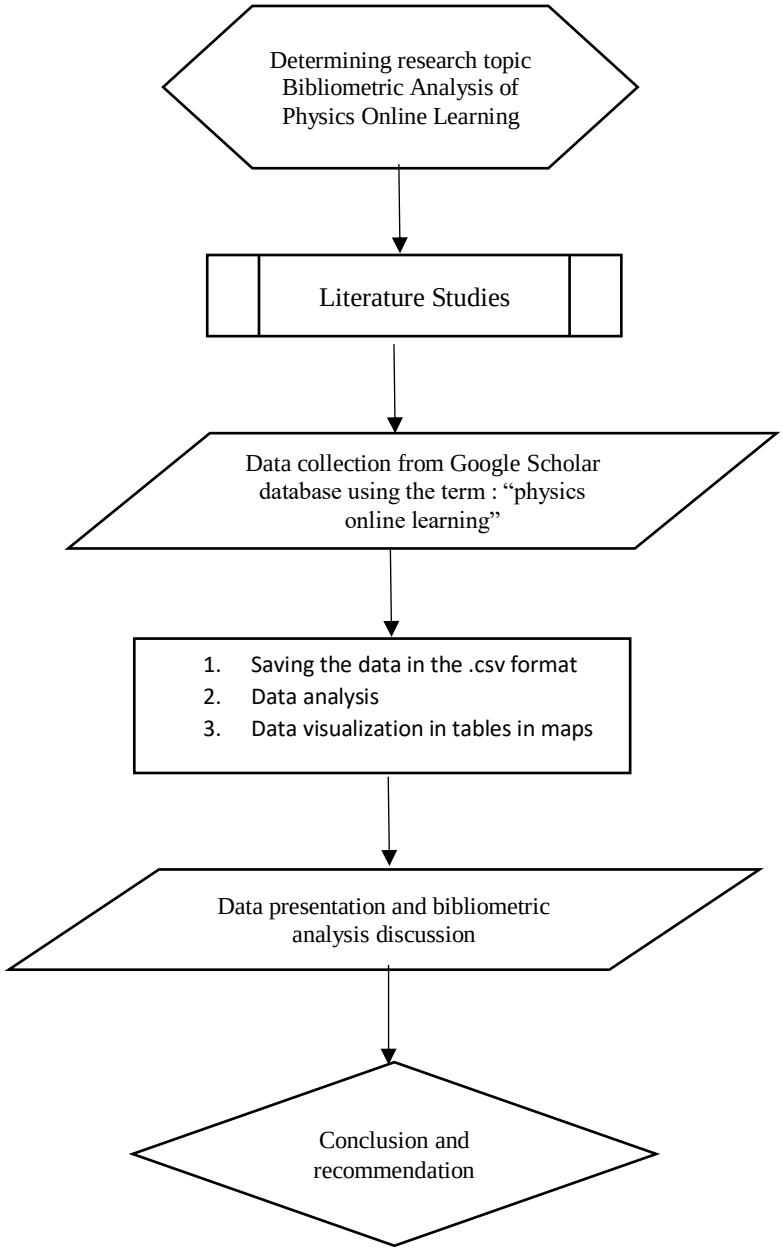

Figure 1. Research Flowchart

RESULTS AND DISCUSSION

The publications retrieved from Google Scholar totaled 79, which were filtered since the same publications were detected, yielding 70 suitable documents. The data was collected on May 18, 2022. The figure was derived from Harzing's publish or perish software search results for publication titles with the phrase "physics online learning" in the title. One of the disadvantages of this study is that no keywords in English were obtained because the research was conducted in Indonesia and required human filtering. Furthermore, before evaluating it with VOSviewer, it must be translated.

When looking at publications by year of publication, it is known that there will be 18 publications in 2020 and 52 publications in 2021. Table 1 shows the five papers with the highest citation rates based on the 70 publications that have been collected.

Table 1. List of Five Most Cited Publications on Physics Online Learning

No	Publication Title	Writer	Number of citations
1	Situation analysis of using google classroom in physics online learning	Mahardini, (2020)	68
2	The effect of virtual laboratory-assisted online learning on interest and cognitive physics learning outcomes	Dewa, et al., (2020)	51
3	Analysis of the situation of learning science physics with online methods during the covid-19 outbreak	Napsawati, (2020).	43
4	Physics Online Learning Through Whatsapp, Google Form, and Email in Active Attendance Achievements and Student Learning Outcomes	Mulyadi, (2020).	33
5	The effectiveness of using the Quizizz application in online Physics learning on work and energy materials for class X MIPA at Masehi Kudus High School for the 2019/2020 academic year	Kusuma, (2020)	22

Number of Publications by Document Type and Research Type

Based on the search results of 70 published publications, consisting of 49 journals, 13 theses, and eight proceedings. Categories of research method types are presented in Table 2.

Table 2. Types of Research Methods

Research methods	Amount
Quantitative	40
Qualitative	25
CAR	5
Meta-analysis	1

VOSviewer visualization of the publication progress map

Abstract keyword analysis from documents regarding online physics learning obtained 109 terms. If using a threshold of at least three times the term appears in the title, only 13 terms can be visualized in Figure 2.

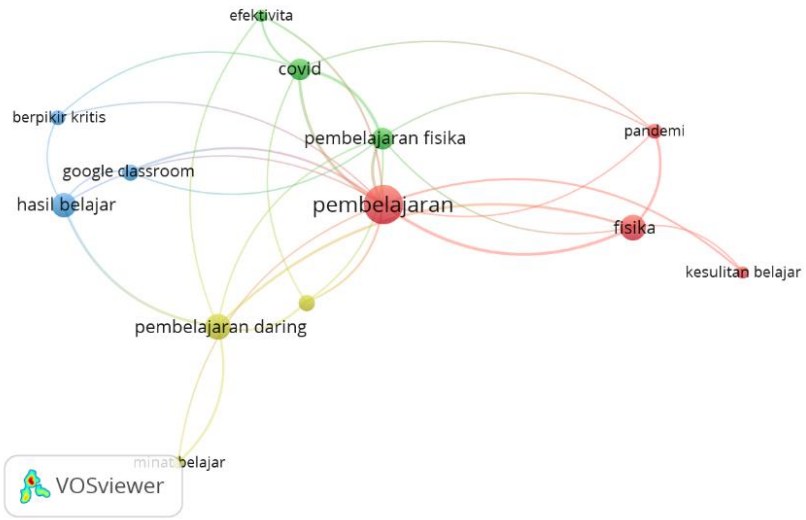

Figure 2. Map of Co-Occurrence Terms in Titles about Physics Online Learning

Figure 2 depicts the terms that appear in each publication title together. The four most frequently occurring terms are "learning" (28 times), "online learning" (13 times), "physics" (12

times), and "learning outcomes" (11 times). In addition, there are four color-based themes (clusters). Cluster 1 (red) concerns learning, physics, pandemics, and learning difficulties. Covid, efficacy, and physics learning comprise Cluster 2 (green). Critical thinking, Google Classroom, and learning outcomes are the focus of Cluster 3 (blue). Cluster 4 (yellow) includes learning themes of interest, learning motivation, and online learning.

Based on the study data and visualization of the analyzed articles, it is known that no development research on learning media to assist online physics learning has been conducted. However, online physics learning necessitates the use of learning material in its operations. The only study on applying several existing learning media for implementing online physics learning has been conducted. It is also feasible that inspiration for developing a learning media will come from current learning media.

VOSviewer Visualization of Publication Progress Map by Author

Mulyadi (2020) was the only author who authored two research papers. The rest are individual research documents. Figure 3 depicts a map of the growth of physics online learning articles based on researchers' findings.

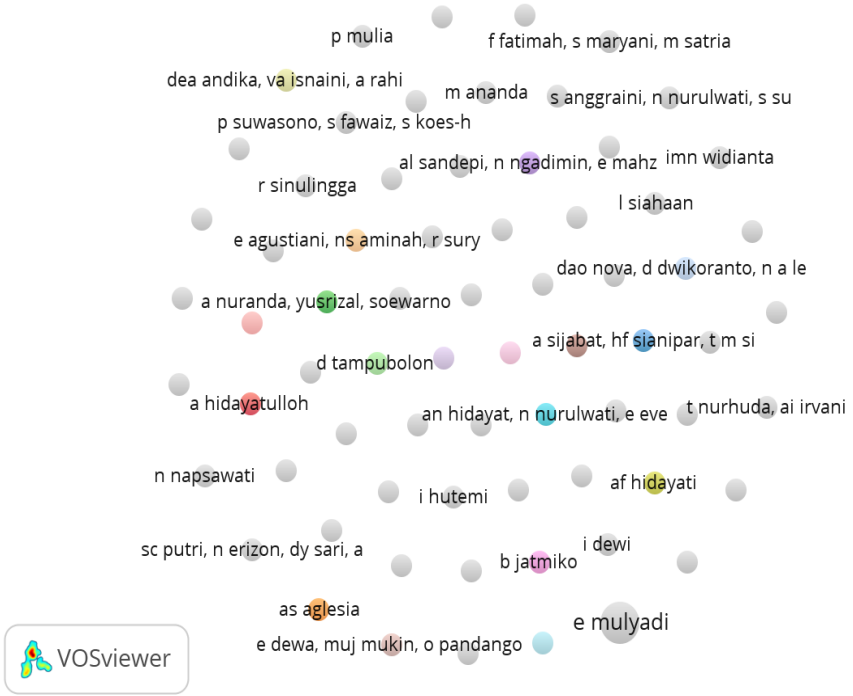

Figure 3. Visualization of the Distribution of Physics Online Learning by Author

Discussion

This study's methodologies are primarily quantitative research, followed by qualitative research, one meta-analysis study, and no development research. The same findings were discovered in other studies; the findings revealed that online learning was higher with quantitative research, with qualitative coming in second (Tauhid et al., 2020). As a result, research using methodologies other than quantitative and qualitative methods for online physics learning is still very much possible. Indeed, the development of learning media for online physics learning is a topic that has received little attention in Indonesia. Technology in online learning is still restricted to readily available internet media such as Google Classroom, Whatsapp, and Quiziz. Each program plays a unique function in the learning process, each with its advantages and disadvantages, particularly in online physics study. The emergence of online media can be an alternative for researchers looking at the scarcity of available media based on previous research findings.

In physics online learning research, the use of keywords is divided into four major groupings. Cluster 1 (red) emerges from each cluster as the cluster with the most terms. Learning was the

keyword in Cluster 1 that became the dominant theme, followed by physics. These findings indicate that physics online learning researchers are more concerned with these terms. Furthermore, the researchers emphasize learning outcomes, learning effectiveness, and critical thinking skills.

Keywords associated with physics online learning studies have not seen much of students' psychological state, with just interest in learning appearing as one of the keywords. Research on student psychology in online learning is needed since online learning will continue even after the Covid-19 pandemic is over. To keep it going, a reasonably sophisticated review of student psychology is required so that it may be used as material for evaluation and improvement in the online learning process. Understanding student psychology can assist teachers in better understanding their students' situations, allowing them to gauge learning accomplishments more efficiently (Kulsum, 2021; Basruddin, 2018).

Similarly, the findings of other studies demonstrate that the Scopus database's dominance of online learning research is about students, research, data, systems, models, frameworks, education, and online learning (Jatmiko et al., 2021). Many issues have yet to be extensively studied by Indonesian researchers.

According to the findings, research by Mahardini (2020) on using Google Classroom in online physics learning has been the most referenced research compared to other studies collated. However, the analysis findings show that the topic of Google Classroom is less addressed. This is undoubtedly potential for additional research on Google Classroom learning resources connected to online physics learning.

The second most referenced work (Dewa, et al., 2020) discusses learning outcomes, which are frequently investigated issues. However, other topics, such as interest in learning and virtual laboratories, were also discussed, which have received little attention. Further research might be conducted on the idea of a virtual laboratory that also serves as a learning medium.

The two most cited studies tackle the topic of learning media, specifically Google Classroom and Virtual Laboratory. As a result, the topic of learning media has the potential to be extensively researched. For example, the development research approach is not generally employed. As a result, the possibility of building learning media for physics online learning remains quite real.

Development research is one of the many research avenues to pursue. This is due to the lack of research on the development of the evaluated publications of this study. It is believed that through various research advances, they will be able to offer items such as learning media, techniques, learning models, etc.

The findings of this study are expected to serve as one supporting resource for other studies on online physics learning. However, the analysis does not include publications from Indonesian publishers who publish in English, which is one of the study's weaknesses. As a result, it is suggested that keywords be used in English searches in future studies.

CONCLUSION

This study is a bibliometric study of physics online learning for the scope of Indonesian language publications from Indonesian publications. The Google Scholar database was used to get this study data, and 70 publications were collected from the 2020-2021 publication year. According to the research findings, learning challenges, effectiveness, critical thinking, Google Classroom, interest in learning, and motivation have received little attention. The collected study focuses mainly on learning, physics, online learning, and learning outcomes. The most common method is quantitative research, followed by qualitative research. There is still a demand for numerous physics online learning researches, one of which is development research. Based on this study's outcomes, research into online physics learning is still very much in the early stages. Development research is one of the research methodologies available to other scholars interested in online physics learning. Learning challenges, effectiveness, critical thinking, Google Classroom, learning media, interest in learning, and motivation to study are suggested research subjects for possible online physics learning.

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