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Literature review of android-based physics learning

G AAng*, dan H Muhammad
Study Program of Physics Education, Universitas Negeri Surabaya
*Email : aanggunaifi.21027@mhs.unesa.ac.id

Abstract. This study aims to analyze the mapping of research trends in Android-based Physics learning, the contribution of Indonesian researchers, and future research opportunities on the topic of learning physics. This research method uses a literature study through bibliometric analysis. In searching for articles, the VOSViewer software is used on the Scopus database. The search results consist of 258 selected documents from 2016 to 2020. The results of the analysis show that the publication of Android-based Physics learning articles in the last five years has increased, which means there is still potential for research. The author's keywords that are most used in this research topic are "Android, Physics, and Android Platform". Future research opportunities with the topic of android-based learning in physics learning have potential opportunities where this research increases every year and is still relevant for research.

1. Introduction

Physics has many benefits for human life, from the beginning of studying physics until now, physics has been proven to be able to help make it easier for humans to carry out their daily life activities [1]. Physics is a part of Natural Sciences (IPA), physics can be interpreted as knowledge that grows from experiences [2]. These experiences can be obtained by making observations in an experiment or trial. From experimental activities, data will be obtained which will then be processed so that conclusions can be drawn from these experiments which can bring up a new concept, law, proposition, or formula, and can even bring up a new problem that needs further research [3][21]. Based on this explanation it can be seen clearly that teaching Natural Sciences (IPA), especially physics places more emphasis on physical matters. Learning activities certainly require learning media so that the material being taught is more easily understood by students [4][23]. To be in accordance with learning competencies, teachers are required to have methodological abilities in terms of planning and implementing learning, including mastery in the use of learning media [5][26].

Based on the results of the literature study, the article entitled "Development of Android-Based Physics Learning Media on the Subject of Thermodynamics" explains that the results of interviews conducted with one of the physics teachers at SMA Negeri 7 Bekasi City" said that the books used were still lacking in feasibility, such as from In terms of the material presented in book form, it is minimal, so the material presented is unable to explain all the concepts of learning thermodynamics material [6]. Besides that, during this pandemic, students would rarely come to the library, never even because schools were closed [7][22]. From here students prefer to open gadgets to help them when studying. In addition, the article entitled "Development of Android-Based Mobile Learning Media as a Supplement to High School Physics Learning on Business and Energy Materials" explains that the results of observations that have been made at Kartikatama Metro High School, it is known that 67% of the 24 students in class XI IPA 2 stated that still experiencing difficulties in learning physics because it is less interesting and difficult to understand so that students experience difficulties in learning physics because learning is monotonous and tends to be boring [8]. This is different from the opinion of teachers who say that their students are enthusiastic when learning physics and only a few students are less enthusiastic [9][20]. This is due to the lack of variety of learning media used in learning. So, it can be concluded that there are still many students who experience problems in learning physics because learning is less interesting and students tend to prefer playing with their gadgets, media that utilizes smartphones as

learning media is needed in the form of interactive learning games that can increase students' motivation and interest in learning. participate in physics lessons enthusiastically [10][25].

During the last five years (2016-2020), learning has used media in the form of Android-based physics games. However, there are still students who think learning physics is a difficult subject. To find out how big and how far the development of Android-based physics game learning media is, an analysis of the results of previous studies was carried out using the literature review method using bibliometric analysis. Research on the topic of learning media based on Android technology is still rarely done. This is the novelty of this research, so this study aims to map research trends, authors, and journals that contribute most to research on the effectiveness of learning physics using Android-based physics games so that it can be used as a reference in following up research opportunities in the future.

2. Methods

This study 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 literature using statistical methods including quantitative analysis [11][12]. Bibliometric analysis can provide a broader understanding of an entire discipline. Research data collection techniques use secondary data in the form of metadata [13][24][19].

2.1. Search for keywords

Data collection and processing were carried out starting May 5, 2023, with the flow of activities as shown in Figure 1. This research uses filters to search for titles, abstracts, and keywords as follows: physics AND android

2.2. Mendapatkan Hasil Pencarian Awal

The data source was taken from Scopus in the last 5 years (2016 – 2020) and 258 documents that met the search criteria were obtained. Search results are downloaded in Excel and comma Separated Values (CSV).

Figure 1 Five Steps in Conducting a Bibliometric Analysis [14][15].

2.3. Sorting Search Results and Data Analysis

The bibliometric mapping results from the VOSviewer application apply calculations from Co-Occurrence and Co-authorship. Co-Occurrence analysis reveals research topics statistically, provided that the relationship between the authors of the keywords and the Co-Authorship analysis reveals article relationships based on the number of collaborations of the same authors [16]. From this analysis, it is known that some of the information obtained, such as the contributions of authors and journals, as well as the materials used are following the selected articles to get an explanation according to the purpose [17].

3. Results and Discussion

The research data obtained were analyzed using the VOSviewer application from the Scopus database to determine search keywords that are often used. 258 documents discussing Physics Learning research that utilized Android Technology were obtained from the Scopus database between 2016 and 2020 with the keywords "Physics AND android".

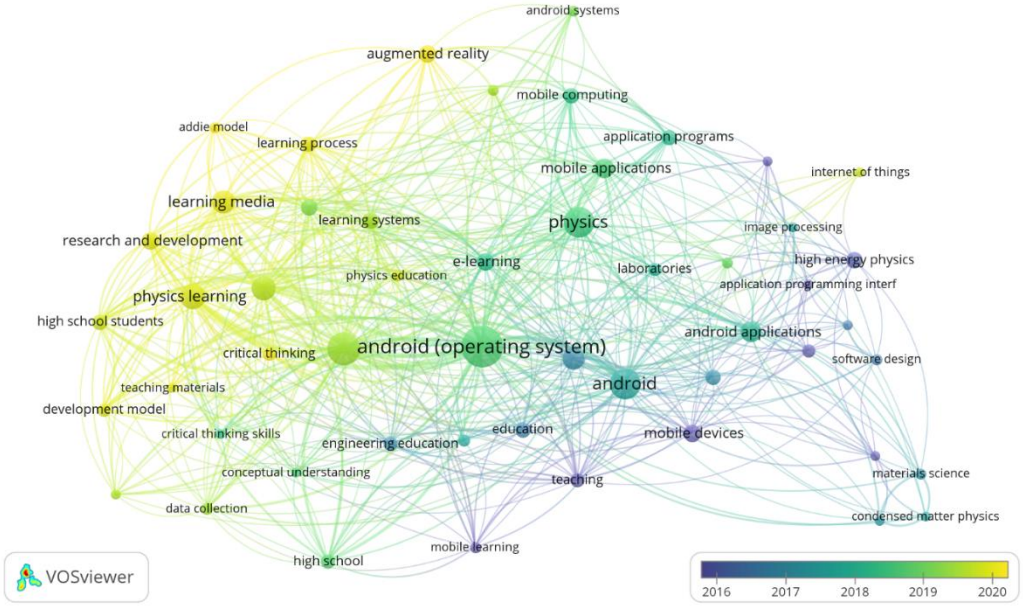

Figure 2. Overlay Visualization

From the visualization above, from year to year, it can be seen that more and more people are interested in Android-based learning media. In Figure 2 it can be seen that the brighter the color appears, the more people are doing research, and the darker the color, the less research is done.

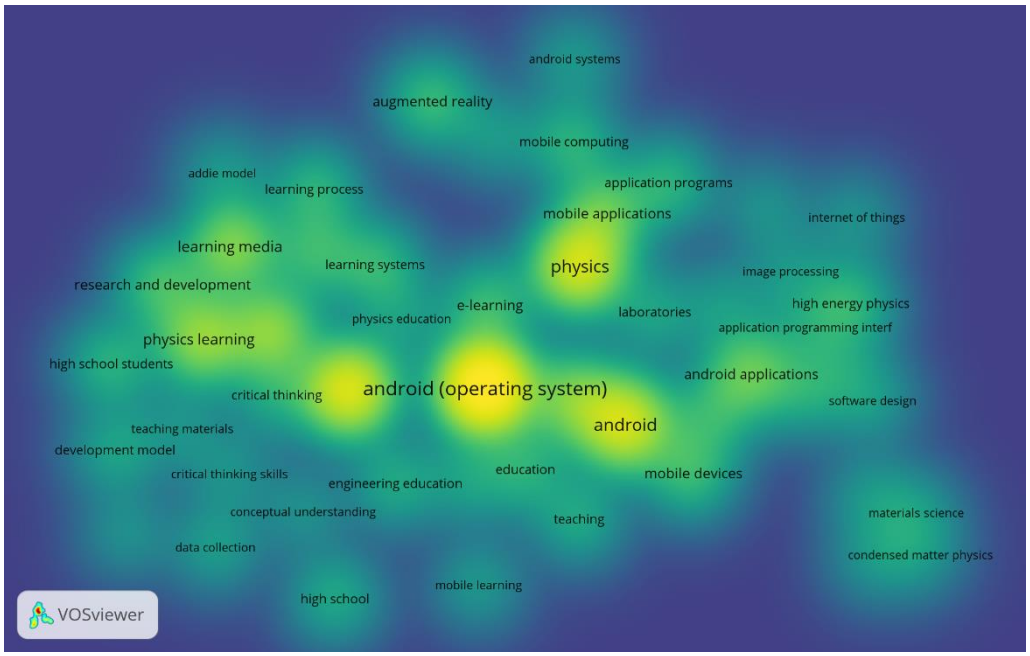

Figure 3. Density Visualization

Based on Figure 3, the results of searching for keywords in several research articles are marked by the appearance of the yellow keywords, meaning that android, physics, and critical thinking are keywords that appear a lot in the titles and abstracts of several scientific articles. In addition, keywords that rarely

appear are those that are still green, such as augmented reality, mobile learning, laboratories, and learning systems.

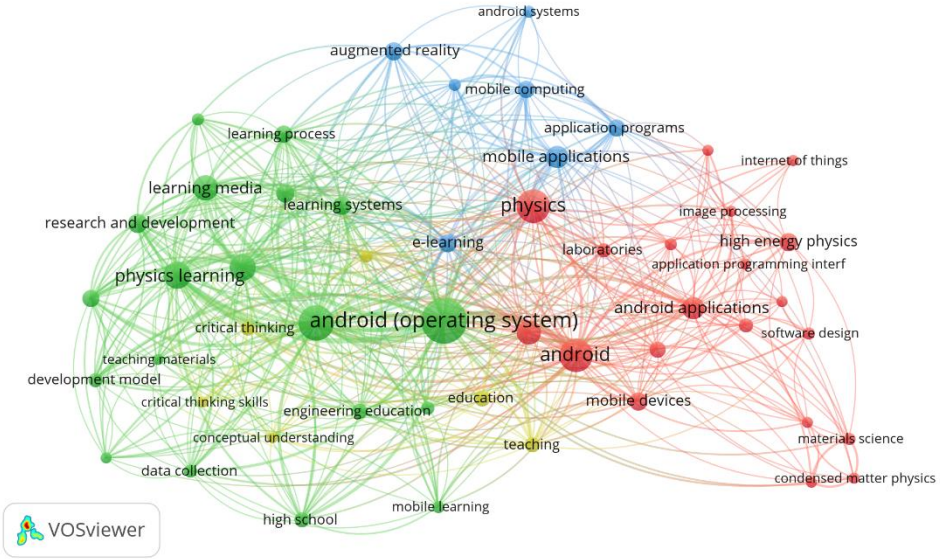

Figure 4. Visualization of Co-Occurrence on a Map Based on Text Data for Android-based Physics Learning

Based on Figure 4, there are 4 clusters with different colors, namely red, green, blue, and yellow. Each color indicates the cluster division and the number of keywords related to each other. Red has the most correlation, namely 20 items, followed by green with 19 items, blue with 7 items, and yellow with 6 items.

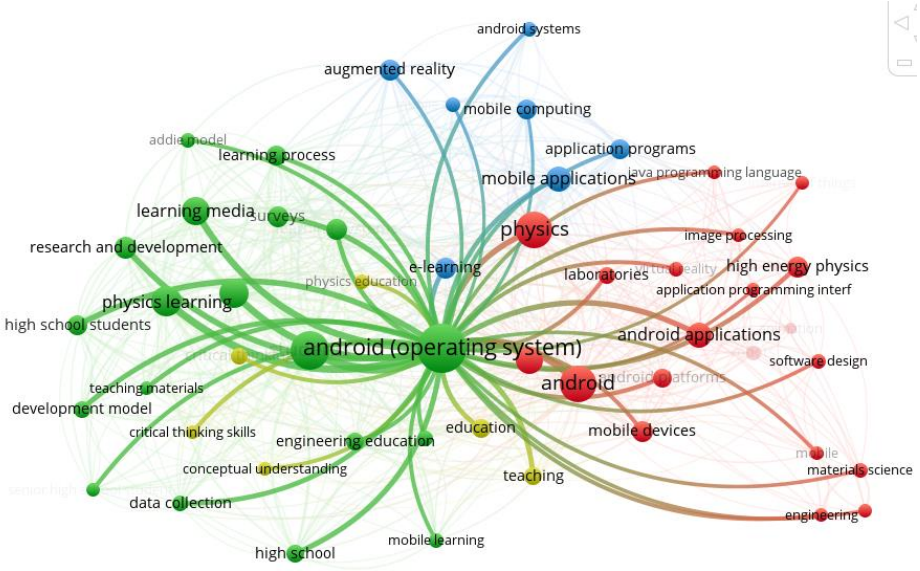

Figure 5. Visualization of the Mapped Network from the Keyword "Android"

Based on Figure 5, the keywords that meet the research objectives are learning using Android technology. This image shows the use of Android technology as a learning support medium. Android-based learning is considered more interactive and better at conveying material with its features than other learning media. Android-based learning media is believed to be able to increase the effectiveness of learning and help students understand concepts because Android can help explain concepts with

visualization and audio. In addition, Android can also be interacted with by students so they don't just see and listen. So, it is hoped that it can help students deepen abstract concepts and understanding through features from Android such as virtual labs, Augmented reality, and other features.

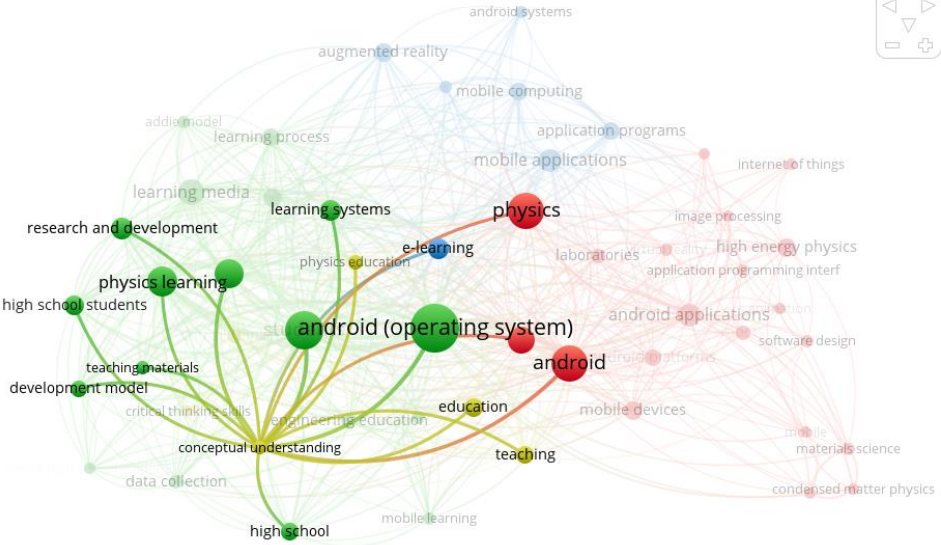

Figure 6. The Linkage of Conceptual Understanding

Figure 6 shows that the understanding of concepts in learning with Android devices is closely related. In addition, it is also closely related to learning physics. This can be seen in the figure where physics learning and android show a large circle and have a strong relationship.

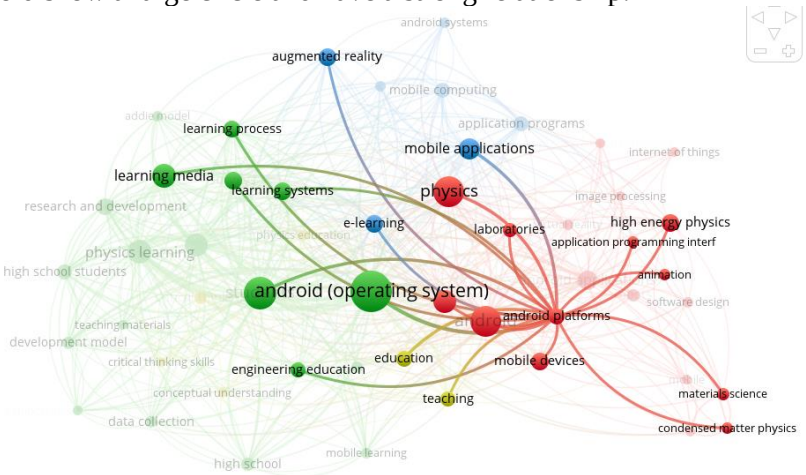

Figure 7. Linkage Android Platform

Figure 7 shows that the Android platform and Android learning have a close relationship in supporting learning as a physics learning medium, making 98.73% of students say physics learning conducted by teachers is more interesting, fun, innovative, creative, and varied. The use of media in the teaching and learning process can generate new desires and interests, generate motivation, and stimulate learning activities as well as psychological influences on students [18].

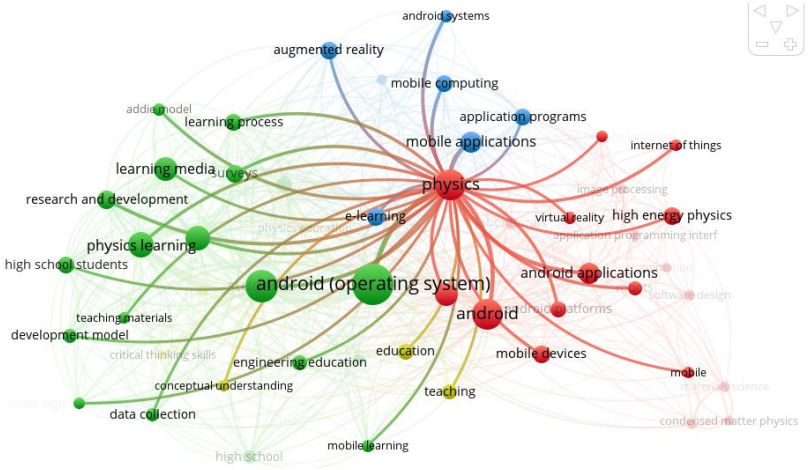

Figure 8. The Relationship Between Physics and Android Devices

Figure 8 shows the relationship between Physics and Android devices. From the picture, it can be seen that learning physics is closely related to Android and several learning media. It can be seen that Android and several learning media such as augmented reality, virtual reality, and several other media display a large circle and show a strong relationship. states that teachers experience difficulties when giving material that contains a lot of physics equations. This can be overcome by utilizing Android technology with one of its features, namely the virtual lab so that the material can be easily understood by students.

Table 1. Countries with articles on Physics and Android

Country	Documents	Citations
Indonesia	121	494
United States	22	86
India	11	77
Brazil	10	20
Poland	9	0
China	8	6
Spain	7	1
Germany	6	176
Malaysia	5	21

In Table 1, Indonesia is the country that produces the most articles on Physics and Android with a total of 121 documents with 494 citations. The United States ranks second with 22 documents and 86 citations, followed by several others, namely Brazil, Poland, China, Spain, Germany, and Malaysia. Therefore, it can be seen that Indonesia has many innovations in the form of articles on physics and Android.

Figure 9. Visualization of the Author Collaboration Network with the Most Connections

In Figure 9, all authors have a relationship with each other. If examined further, it can be seen that the relationship between authors is divided into two clusters, namely green and red. The author's relationship comes from two institutions dominated by the Yogyakarta state university. From these results, it can be said that the strongest collaborative relationship related to the keyword Online learning with video was carried out by the writer from Yogyakarta State University.

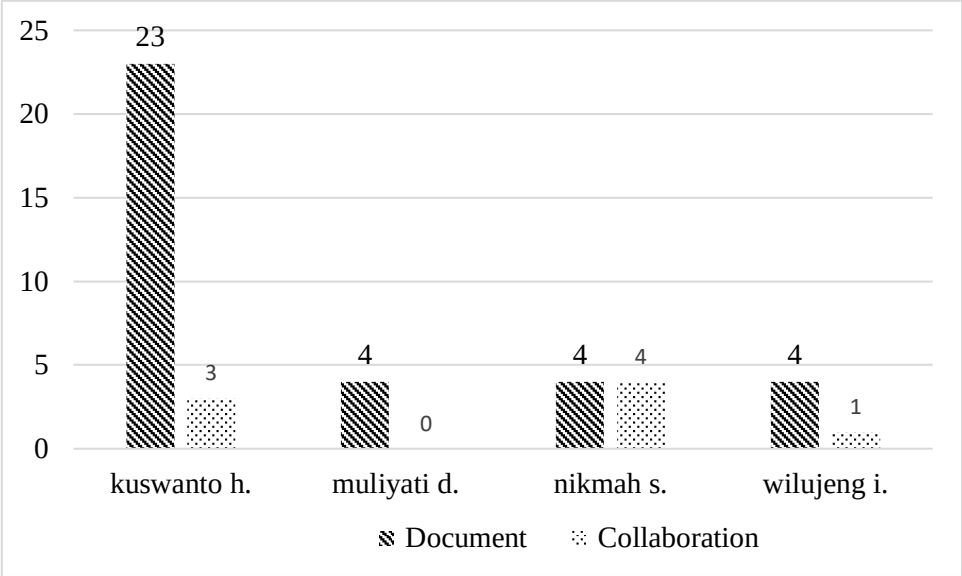

Figure 10. Top Authors of Android-based Learning Articles Published from 2016 to 2020

Based on Figure 10, the most published article was written by Kuswanto h.. with 23 documents and 3 collaborations. Followed by Nikmah S. with 4 documents and 1 collaboration, then Wilujeng i. with 4 documents and 1 collaboration. Collaboration allows researchers to have the opportunity to publish their research results in international journals and motivates researchers to produce research together. From the results of VOSviewer mapping using co-authorship analysis, the highest collaborative relationship between article authors is Kuswanto h. which has 23 documents and 3 collaborations. VOSViewer is used to build and visualize correlations in article or publication excerpts [19].

Tabel 2. Author of the Most Cited Article on the Effectiveness of E-Learning in Indonesia

Journal	**Total of citied**
Conference proceedings	45
International journal of instruction`	145

International journal of interactive mobile technologies	50
IOP conference series: materials science and engineering	40
Journal of physics: conference series	202
Lecture notes in computer science (including subseries lecture notes in artificial Intelligence and lecture notes in bioinformatics)	5
Physics education	140
Proceedings of spie - the international society for optical engineering	0

Based on Table 2, the author's performance can be seen from his achievement of the highest number of article citations throughout the year. The Journal of physics: conference series has the highest number of citations to mobile technologies and learning articles with 202 citations, followed by the international journal of instruction citations 145 times and physics education with 140 citations. These three articles are more widely cited than any other because they have topics that are relevant today.Based on the results and discussion conducted on the topic of Android-Based Physics Learning, it can be concluded that learning with Android media in the last five years has increased, which means that this research is still ongoing and has the potential to be carried out.

4. Conclusions

The author's keywords that are most used in this research topic are "Android, Physics, and Android Platform". This can be seen in the large circle that has a strong relationship. In this study it was found that Kuswantu h. is the author who has contributed the most to research on Android-based physics learning and is the most cited article in Indonesia. Opportunities for future research with the topic of Android-based Physics learning in physics learning have potential opportunities where this research increases every year and is still relevant for research. From the results of this study, it is hoped that teachers can consider the application of Android-based physics learning media to improve students' understanding of concepts.

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