The effectiveness of virtual class-based e-learning with video-assisted google classroom as a physics learning media (2016-2020)

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Abstract: This study aims to analyze research trends in online learning based on virtual class with video-assisted google classroom, the contribution of Indonesian researchers, and future research opportunities on the topic of online learning. This research method uses literature study through bibliometric analysis. In searching the articles, Publish or Perish (PoP) and Vosviewer softwares were utilized on the Scopus database. The search results consist of 264 documents selected from 2016 to 2020. The analysis results show that the publication of online learning articles with videos in the last five years has increased, which means that the research is still potential to be conducted. The most widely used author keywords in this research topic are "Video, Group, and Platform". Future research opportunities with the topic of online learning with videos in physics learning have potential opportunities where this study has increased every year and is still relevant for research.

Keywords: Google Classroom, Online learning, bibliometrics, virtual class

Introduction

The world is currently facing a global crisis due to the Covid-19 outbreak (Dash et al., 2021) which has hampered various sectors around the world. One of the countries affected by the Covid-19 virus is Indonesia (Rejeki et al., 2021). The Indonesian government has issued various policies to reduce the spread of the corona virus by imposing social distancing and physical distancing to implementing PSBB (Khoirunurrofik et al., 2022). The policy of limiting the spread of Covid-19 has an impact on life throughout the world, especially education sector in Indonesia (Putri et al., 2020).

Several local governments have taken policies to close the schools in anticipation of the spread of Covid-19. The Minister of Education and Culture (2020) in Bahasoan et al. (2020) said that regarding the prevention of Covid-19 in education units, all universities in Indonesia have taken firm steps to conduct learning activities at home according to the government's advice. The Governor of West Java Province, Ridwan Kamil, said that the concept was not a holiday, but schooling at home with remote directions using an online system. In fact, this makes teachers and students confused because they have to change habits that were previously carried out in classroom learning since the learning activities must be carried out from home using online learning methods (Suyadi & Selvi, 2022). Recently, learning at home is still ongoing, along with the decline in Covid-19 cases in Indonesia.

One of the learning media used by teachers during the Covid-19 pandemic is the e-learning using the Google Classroom application (Aisyah et al., 2021). According to Kumalawati et al. (2021),

e-learning is a process of utilizing technology in the learning process. E-learning is an information and communication technology used in the teaching and learning process (Sayekti, 2018). The use of e-learning can improve scientific literacy and analytical thinking skills (Risniawati et al., 2020; Setiaji & Jumadi, 2018), and increase student motivation (Wardono et al., 2016). Nowadays, Google Classroom is a very effective learning media innovation. It is an alternative that can be used to maximize the learning activities (A'yun et al., 2021) and can be used by all fields of education to facilitate teachers and students. Utilization of Google Classroom can make it easier for teachers and students to connect with each other so that it is easier to group and distribute assignments (Maman et al., 2021). It is hoped that the application of Google Classroom media in learning using video can increase learning effectiveness and learning motivation, especially in physics material.

Based on the research by Munawaroh et al. (2021), learning often leaves conceptual errors because it is unable to connect the conventional concept with the new one. Therefore, it takes innovation of learning media for students. Distance learning with Google Classroom provides learning materials that are designed in such a way that it is easier for students to understand them (Gupta & Pathania, 2021; Rahmad et al., 2019). In addition, the material provided can be in the form of videos that can be played back when there is material that is not understood to improve student learning outcomes (Sarwa et al., 2021; Taufik & Yustina, 2020). Learning using video can increase interest in learning because it has its own charm for students and can explain something abstract to seem real (Handayani & Alperi, 2021), especially in physics subjects which are often considered difficult and less enjoyed by students (Lestari et al., 2020).

This is in line with research by Suryandari and Singgih (2021) which says that the possible solution in carrying out online learning is to use video as a medium for delivering information, compared to video conferencing or with modules. Video can convey material better than the module and reduce the quantity of internet quota usage compared to video conferences. Research conducted by (Marisda & Ma'Ruf, 2021) shows that learning physics during the Covid-19 pandemic is not favorable. There are problems that arise when teaching explicit physics material which has many formulas and mathematical calculations so that students have difficulty in understanding physics material during online learning. This can be overcome by creating learning videos containing teachers explaining physics equations by delivering competency material that is better understood by students. That way, the conventional learning can be replaced by video-based learning that is carried out online (Suryandari & Singgih, 2021).

During the last five years (2016-2020), e-learning has been carried out on several physics' materials. However, virtual class-based e-learning with Google Classroom is still lacked to be applied (Sudarsana et al., 2019). To find out how much and how far the development of e-learning using Google Classroom with a video model, an analysis of the results of previous studies was carried out using the literature review method using bibliometric analysis. Research on the topic of online learning with videos is still rare. This is the novelty of this research, so this study aims to map the research trends, authors, and journals that most contribute to research on the effectiveness of online learning based on virtual classes with video-assisted google classroom so that they can be used as references in following up on future research opportunities.

Methods

This study uses a bibliometric analysis method carried out by looking at the distribution of publiccations to evaluate the contribution of articles to the development of knowledge of various literatures using statistical methods including quantitative analysis (Suprapto et al., 2021a, 2021b). Bibliometric analysis can provide a broader understanding of the entire discipline. The research data collection technique uses secondary data in the form of metadata.

Searching the Keywords

Data collection and processing was carried out started from April 7, 2021 with the flow of activities as shown in Figure 1. This study uses filters to search for titles, abstracts and keywords as follows:

AND learning AND physics AND video AND google AND classroom AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016).

Getting Initial Search Results

The data source was taken from Scopus in the last 5 years (2016 – 2020) and obtained 264 documents that met the search criteria. The search results are downloaded in Excel and Research Information Systems (RIS) format.
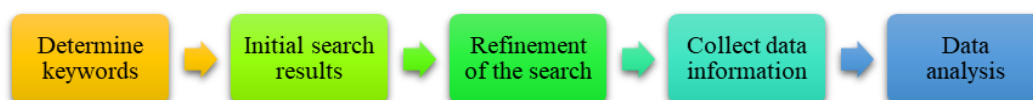

Figure 1. Five Steps in Performing a Bibliometric Analysis (Haryandi et al., 2021; Setyaningsih et al., 2018; Suprapto et al., 2021a)

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 revealed the research topic statistically, with the provision that the relationship between keyword author and Co-Authorship analysis revealed the relationship of articles based on the number of collaborations of the same author. From this analysis, it is identified that some information was obtained, such as the contributions of authors and journals, and the materials used according to the selected articles to get an explanation according to the purpose.

Results and Discussion

The research data obtained were analyzed using PoP, Mendeley Desktop, and VOSviewer applications to determine frequently used search keywords. It was obtained 264 documents discussing online learning research with videos in physics learning from the Scopus database between 2016 and 2020 with the keyword "Learning AND Physics AND Video AND Google AND Classroom". From the results obtained by PoP, articles were systematically sorted by the most relevant to the keywords until the one with the highest relevance appears, as shown in Table 1. Table 1 shows the top 10 articles with the highest relevance by PoP that are most relevant to the keyword "Learning AND Physics AND Video AND Google AND Classroom". Number 1 has the highest level of relevance.

Based on the results of the study in Figure 2, the number of articles has increased every year. From 2016 to 2017 there was an increase in research interest, but in 2018 it was decreased. From 2018 to 2020, interest in video-assisted online learning research is getting higher and growing. This shows that the effectiveness of online learning still has the potential to be researched.

Furthermore, the test was carried out using VOSviewer Software on a map based on text data and using the RIS file type. The calculation method used the binary counting. The minimum number that appeared in terms was 10 and resulted in 141 meeting the threshold out of a total of 6572 terms. For each of the 141 terms, a relevance score was calculated. Based on this score, the most relevant terms were selected. With the default selection is 60% of the most relevant terms, about 85 terms were selected. The resulting data mapping is shown in Figure 3.

Based on Figure 3, there are 4 clusters with different colors, namely red, green, blue, and yellow. Each color indicates the division of the cluster and the number of keywords related to each other. The red has the most correlation, which is 32 items, followed by green with 22 items, blue with 19 items, and 12 yellow items.

Based on Figure 4, the keywords that meet the research objectives are online learning using video. This image shows the use of video in online learning with the Google Classroom platform to increase learning effectiveness. Video is considered better than the module for delivering material and reducing the use of video conferencing quota. Learning videos are believed to be able to help educators and students because they can listen repeatedly and contain audio and visual content so

that they are expected to help the learning process at home become concrete like learning at school. Learning videos can provide memory stimulation for material information, even in material that is difficult for students (Suryandari & Singgih, 2021).

Table 1. 10 Top 10 Articles of Highest Relevance by PoP

No.	Publication Year	Author	Title	Publisher	Citation
1.	2020	W. Wagiran, D. Rahdiyanta, A.E. Wibowo, O.L. Sati, M.R. Badu	Online learning of mechanical engineering subject in the Covid-19 era: Strategy, platform and media	IOP Publishing Ltd	0
2.	2020	N. Kholifah, I. Irwanto, S.D. Ramdani, M. Nurtanto	Vocational skills learning model strategies during covid-19	IOP Publishing Ltd	0
3.	2020	M. Dobricki, A. Evi-Colombo, A. Cattaneo	Situating vocational learning and teaching using digital technologies - A mapping review of current research literature	European Research Network Vocational Education and Training	1
4.	2020	K.F. Hew, C. Jia, D.E. Gonda, S. Bai	Transitioning to the "new normal" of learning in unpredictable times: pedagogical practices and learning performance in fully online flipped classrooms	Springer Science and Business Media Deutschland GmbH	0
5.	2020	E. Marshman, S. Devore, C. Singh	Holistic framework to help students learn effectively from research-validated self-paced learning tools	American Physical Society	1
6.	2020	A. Koenig	The Algorithms Know Me and I Know Them: Using Student Journals to Uncover Algorithmic Literacy Awareness	Elsevier Ltd	1
7.	2020	C.D. Porter, J.R.H. Smith, E.M. Stagar, A. Simmons, M. Nieberding, C.M. Orban, J. Brown, A. Ayers	Using virtual reality in electrostatics instruction: The impact of training	American Physical Society	0
8.	2020	S.S. Oyelere, N. Bouali, R. Kaliisa, G. Obaido, A.A. Yunusa, E.R. Jimoh	Exploring the trends of educational virtual reality games: a systematic review of empirical studies	Springer	0
9.	2020	A. Fidai, M.M. Capraro, R.M. Capraro	"Scratch"-ing computational thinking with Arduino: A meta-analysis	Elsevier Ltd	1
10.	2020	H. Taufik, Yustina	Motivation and Skills of Science Teachers' Online Teaching through Online Learning Training in the Covid-19 Period in Pekanbaru Indonesia	IOP Publishing Ltd	0
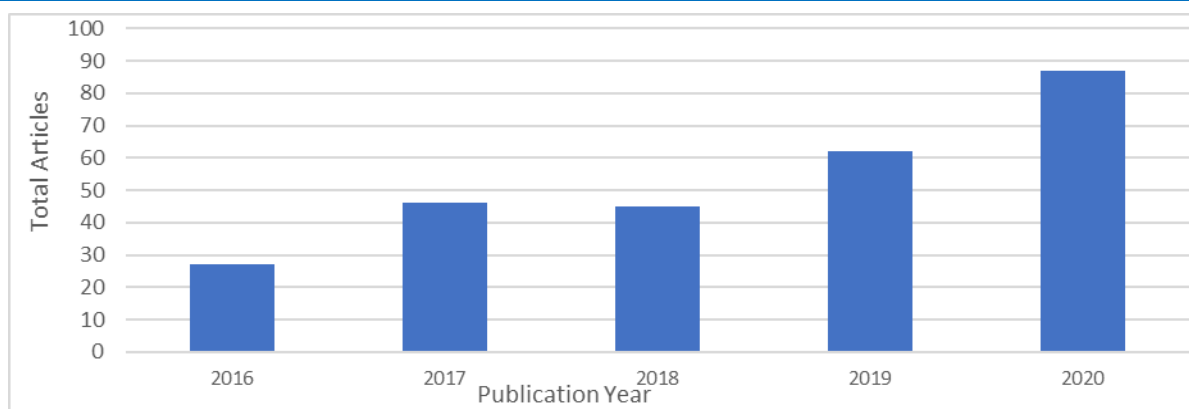
Figure 2. Number of Published Articles of Video-Assisted Online Learning from 2016 to 2020
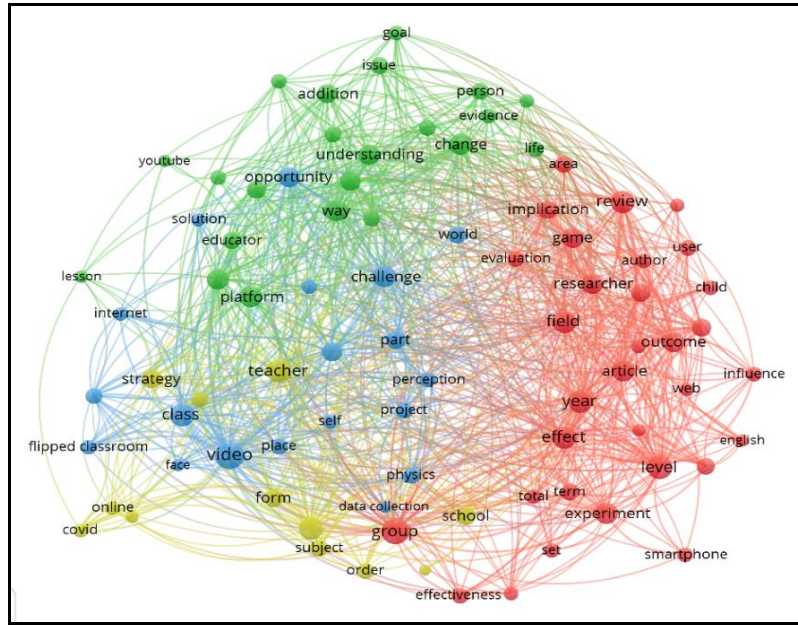
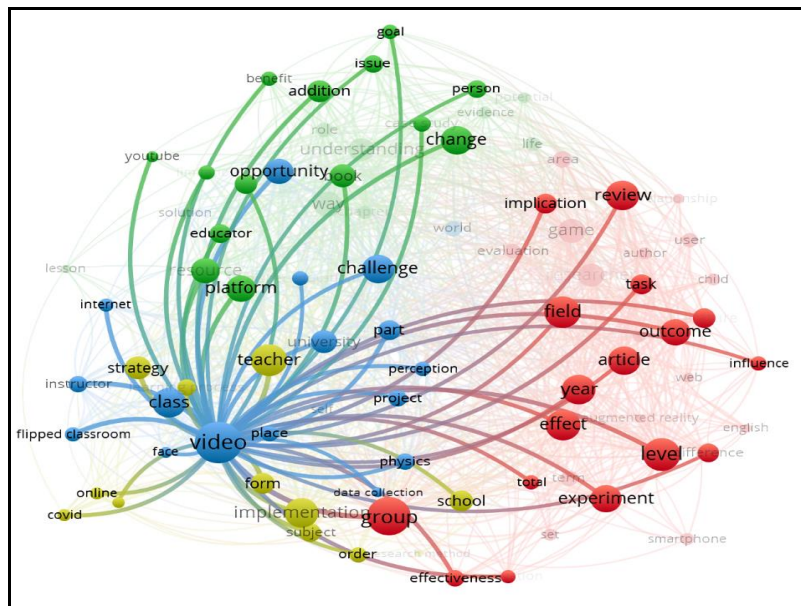**Figure 3**. Visualization of Co-Occurrence on a map based on text data for Video Assisted Online Learning

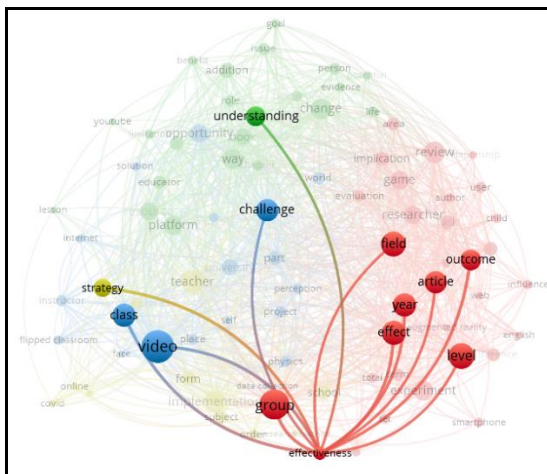**Figure 4**. Map network visualization of the keyword "Video"

Figure 5. Linkage of Effectiveness of Video-assisted Online Learning
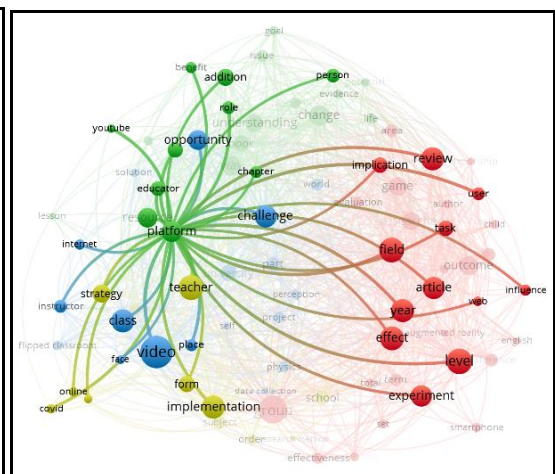
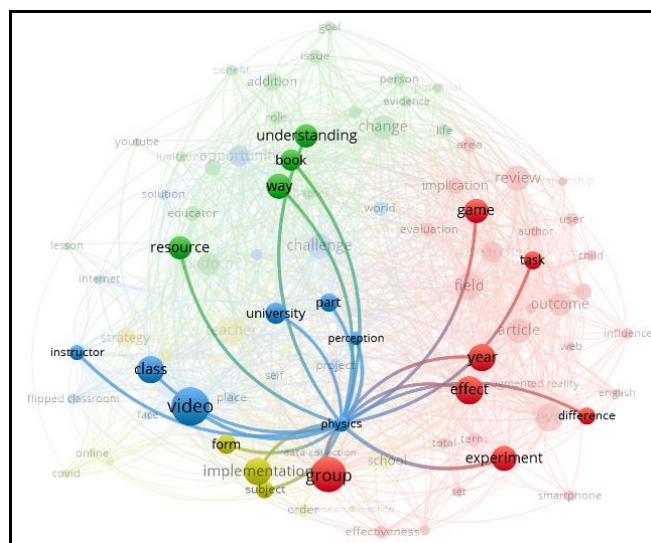**Figure 6**. Linkage of the platform to Video-assisted online learning

Figure 7. Linkage of Physics to Video-assisted online learning

Figure 5 shows that the effectiveness of online learning with the help of videos is closely related. In addition, the group also has a close relationship. This can be seen in the picture where the group and video show a large circle and have a strong relationship. Figure 6 shows that video-assisted online learning platforms have a close relationship with videos and teachers. According to (Nurfalah, 2019), the use of virtual class-based E-Learning learning media using google classroom can provide convenience and facilitate users to get material. This is in line with research of Murtikusuma et al. (2019); and Ramadhani et al. (2019) on the implementation of E-Learning using Google Classroom assisted by Video which is more effective in learning. Figure 7 shows the relationship between Physics and video-assisted online learning. From the picture, learning physics itself has a close relationship with videos and groups. This can be seen in groups and videos that show large circles and have a strong relationship. Lestari et al. (2020); Marisda and Ma'Ruf (2021) stated that teachers had difficulties when providing material that contained many physical equations. This can be overcome by making learning videos containing the teacher explaining physics equations, so that the material can be easily understood by students.
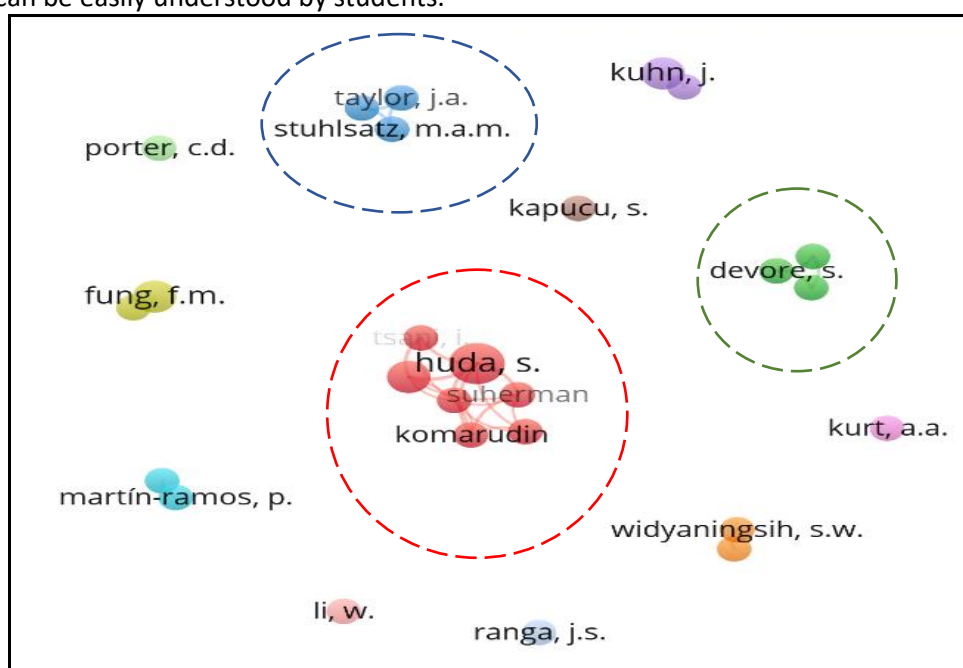

Figure 8. Network Visualization on Author Documents, Author Relationships, and Collaboration Among Authors

Figure 8 shows the co-author relationships and collaboration patterns between authors. It is seen that there are 12 groups identified by various colors. There are authors who have no relationship with other authors and do not collaborate. The strongest collaborative relationship is the red cluster. The collaboration of writers who have a relationship with each other is shown in Figure 9.
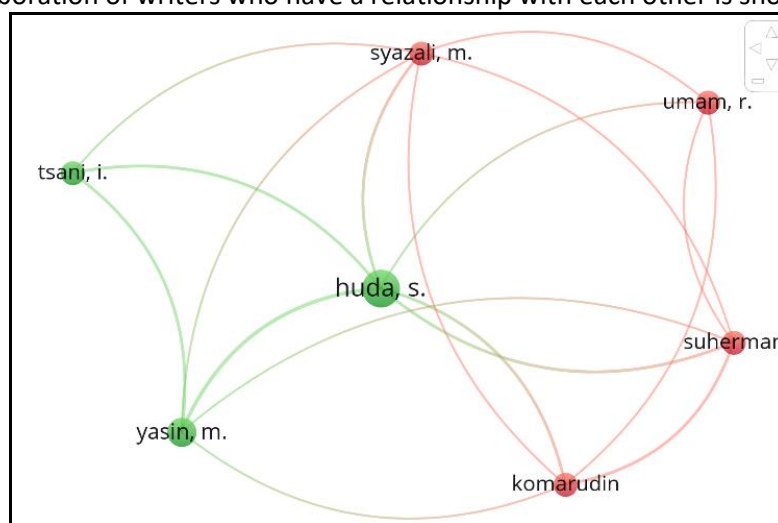

Figure 9. Visualization of Author's Network Collaboration with the Most Connections

In figure 9, all authors have a relationship with each other. If explored further, it is seen that the relationship among the authors is divided into two clusters, namely green and red. The relationship between the authors comes from two institutions, namely the green cluster comes from Institut Agama Islam Negeri Kediri and the red cluster comes from Universitas Negeri Raden Intan Lampung. From these results, it can be said that the strongest collaborative relationship related to the keyword Online learning with video was carried out by authors from Institut Agama Islam Negeri Kediri and Universitas Negeri Raden Intan Lampung.
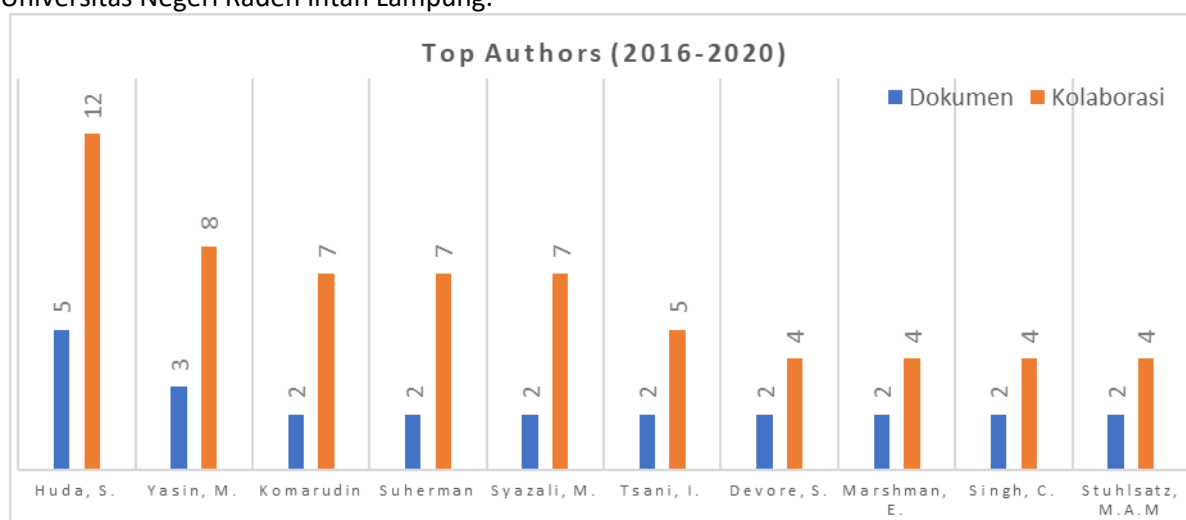

Figure 10. Top Author of Video-Assisted Online Learning Published Articles from 2016 to 2020

Based on Figure 10, the most published articles were written by Huda, S. with 5 documents and 12 collaborations. Followed by Yasin, M. with 3 documents and 8 collaborations, then by Komarudin and Stunhlsatz with 2 documents and 7 collaborations. Collaboration allows researchers to have the opportunity to publish their research results in international journals and motivates researchers to produce joint research. From the results of VOSviewer mapping using Co-authorship analysis, the one with the highest collaboration relationship between article authors is Huda, S., which has 5 documents and 12 collaborations. VOSViewer is used to build and visualize correlations in citations of articles or publications (Shen & Wang, 2020).

Table 2. Most cited authors of articles on the effectiveness of E-Learning in Indonesia

Author/Year	Journal	Total Citation
Febrianto P.T/2020	International Journal of Learning, Teaching and Educational Research	2
Yasin M/2020	Journal of Physics: Conference Series	2
Tsani I/2020	Journal of Physics: Conference Series	2
Yusuf I/2020	International Journal of Emerging Technologies in Learning	5
Purnama S/2019	Journal for the Education of Gifted Young Scientists	5
Permana A.H/2019	Journal of Physics: Conference Series	9
Sumarni S/2019	International Journal of Innovation, Creativity and Change	9
Amir M.F/2018	International Journal of Engineering and Technology (UAE)	11
Wiana W/2018	Journal of Physics: Conference Series	4
Yusuf E/2016	Pertanika Journal of Science and Technology	2

Based on Table 2, the author's performance can be seen in his achievements from the highest number of article citations throughout the year. The highest number of citations to articles on the effectiveness of E-Learning learning in Indonesia is owned by Amir et al. (2018) with 11 citations, followed by Sumarni et al. (2019) and Permana et al. (2019) with citations of as many as 9 times. These three articles are quoted more than other articles because they have current relevant topics.

The novelty of this research is the successful discovery of online learning research with video-assisted Google Classroom in physics education on the Scopus database in the last 5 years. In addition, the pattern of collaborative relationships between researchers from Indonesia who studied online learning with video in the field of education was also found in the last five years, where previously there was no research that revealed the pattern of this collaborative relationship. Based on data collected from the Scopus database, no research has been found that examines bibliometric analysis of online learning with videos in education in Indonesia in the last 5 years. Therefore, this research is the latest research in the last 5 years that analyzes the effectiveness of e-learning learning with video-assisted Google Classroom using bibliometric analysis. The number of citations in the keywords used have contributed so that they can be used as references in following up on future research opportunities.

Conclusion

Based on the results and discussions carried out on the topic of research on the effectiveness of online learning based on virtual classes with videos, it can be concluded that online learning with videos in the last five years has increased, which means that the research is still potential to conduct. The most widely used author keywords in this research topic are "Video, Group, and Platform". This can be seen in the large circle which has a strong relationship. In this study, it was found that Amir M.F was the author who contributed the most to online learning research with videos and was the most cited article in Indonesia. Future research opportunities with the topic of online learning with videos in physics learning have potential opportunities where this research is increasing every year and is still relevant for research. From the results of this study, it is hoped that teachers can consider implementing E-Learning with video-assisted Google Classroom to create more effective learning.

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