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Mobile learning uses in vocational high school: A bibliometric analysis

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Abstract

Mobile learning enables organizations to meet the educational demands of digital native learners in the digital era. Education at the vocational high school level also makes use of it, as this level of education has unique characteristics in terms of the type of learning that occurs, notably the emphasis of practice-based learning. There has not been a study on the usage of mobile learning at the vocational high school level that has used the bibliometric method to provide a baseline for future research. The objective of this paper is to conduct a thorough bibliometric analysis of the literature on mobile learning in vocational high schools. Articles were obtained from the Scopus database, as many as 121 articles were studied in this study, out of 132 articles discovered between 2015 - 2020. After managing the database, the researcher used VOSviewer software to classify and visualize co-authorship, co-accuracy, and citation. Overall, the information presented in this review can be used as a starting point for future research on the topic of m - learning in educational process of vocational high school.

Keywords: bibliometric analysis, mobile learning, mobile learning application, E-learning, vocational high school

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1. Introduction

Background

Currently, there is no level of education that has not been affected by digitalization, even vocational high school. Instead of only presenting theoretical information, this level emphasizes the importance of practical learning experience (Suharno et al., 2020). Additionally, the expected learning output will be geared toward creating graduates who are prepared to enter the workforce (Basuki et al., 2021). This has consequences for the maturing of the notion of digitization of education, which is being implemented in a number of ways, one of which is through the usage of mobile learning (Filianti et al., 2020). A teacher's choice of learning media in a vocational high school environment must be able to fit students' learning demands while also meeting the output objectives (Marpanaji et al., 2018).

Mobile learning adoption relating educational in public schools has been studied (Khan & Gupta, 2021), as well as in the higher education environment (Crompton & Burke, 2018). Where mobile learning utilization in education process in public schools become widely reviewed in terms of concepts, applications, framework designs for learning models and emerging technologies (Khan & Gupta, 2021). When it comes to higher education, the majority of the research has highlighted the impact of m - learning on student accomplishment, with language acquisition courses being the most frequently offered course (Crompton & Burke, 2018).

Conceptual or Theoretical Framework

E-Learning emerged and developed rapidly after computers and the internet existed at the end of the 20th century, although there are some experts who note that distance learning similar to E-Learning has started since the 19th century (Gogos, 2013). The presence of computers that could access the internet in the 1980's made it easy for someone to study about certain subjects and acquire specific skills. Online learning system began to actually take shape in the following decade, as people had access to an unprecedented amount of online knowledge and E-Learning alternatives. Online learning is more widely known than it has ever been, among other persons understanding the potential it can give, along with introduction of mobile learning in the 1970s, and as a result, it has become more widely available (Gogos, 2013).

A computer scientist named Alan Kay initially conceived of mobile learning (M-Learning) in 1968, when phones were anything but digital. This was a watershed moment in the development of the technology. In his mind, a "Dynabook" is a portable computer that would enable pupils to learn from any location. Ideally, the Dynabook should be portable or mobile, and it should be capable of being utilized for both learning and teaching purposes, as said by Alan Kay. Yet, even though it was never achieved, it laid the groundwork for the current state of mobile learning (Crompton, 2013).

As a result of the introduction of the smartphone application, mobile learning has become more ubiquitous. Since then, almost all Learning Management Systems (LMSes) have been able to make their information accessible on mobile platforms, even though that has not resulted in all organizations immediately adopting mobile learning. So far, according to latest study by Brandon Hall, over than 75% of the workforce in 2021 will be utilizing mobile learning (O'Connell, 2021).

The usage of mobile learning in the education process will make it even easier for instructors to deliver practical and theoretical material to pupils. Mobile learning used by students also makes an interesting impression so that they are enthusiastic in participating in the learning process. According to Uther (2019) in this era of technological development, mobile learning provides new opportunities in learning. Since the rise in the number of students who use smartphones in their daily activities,

technology-based learning methods have received considerable attention. It is possible to carry out learning activities at various times and locations thanks to mobile learning (Pereira & Rodrigues, 2013).

Implementation of mobile learning in educational activity has expanded considerably as a result of the advancement of equipment in the field of education, specifically the Society 5.0 movement (Churiyah et al., 2021). It is critical to incorporate mobile learning into vocational high school learning because global competition is becoming more difficult to compete against, and because pupils who are deemed more prepared to employ mobile learning in the learning process are becoming more prevalent (Ozdamar Keskin & Kuzu, 2015). By introducing mobile learning in vocational high schools, it is hoped that student engagement in the learning experience will be increased, as well as a more appropriate reaction to the development of the qualities of today's students.

Mobile learning can be defined in a variety of ways by various individuals. Mobile learning, according to several researchers, is a cross-context learning model that involves interaction with personal electronic devices (Danish & Hmelo-Silver, 2020), which in this particular instance refers to the utilization of smart phones, tablet devices, and laptop computers for educational purposes (Sung et al., 2019). Because mobile devices have network connections, they can be used for mobile learning, which is a type of education system that can be done over the internet (Pereira & Rodrigues, 2013).

Through mobile learning practices, smartphone ownership can be used to promote the involvement of vocational high school students and serve as a cognitive tool to concretize knowledge, consolidate learning, and demonstrate learning activities (Hsieh & Tsai, 2017). Mobile learning can help students be more active in their process of discovery, be more mobile in the educational process, and have more timely and faster interactions, all of which help them be more motivated and learn more (Sung et al., 2019).

Related Research

The field of research focusing on the adoption of m-learning at the vocational high school level continues to see major advancements. In the last five years, its use is still integrated with the concept of e-learning (Triyono & Köhler, 2015) and only in general or non-practical learning areas (Hromin & agran, 2015). While the last few years have begun to focus on using it to aid remote learning during the outbreak crisis of Covid-19 (Khollifah et al., 2020; Wagiran et al., 2020). This has had an indirect impact on vocational education, where mobile learning has been used (Tucek et al., 2020), although the concept is still seems not ready yet (Churiyah et al., 2021).

In the current age, digital-based learning media play a critical function in assisting vocational high school students' learning output (Teräs et al., 2020). Furthermore, it is expected that they will be able to show certified competencies after graduation, allowing them to be prepared to operate in the industrial sector (Suharno et al., 2020). Therfore, the widespread adoption of m - learning in high school vocational education must be thoroughly reevaluated (Brantes et al., 2013). For a better knowledge of its use in learning, research that focuses on efforts to describe the application of mobile learning in vocational school learning must be carried (Khan & Gupta, 2021).

Purpose of the Study

By utilizing bibliometric analytic methodologies, this study seeks to provide a comprehensive picture of the topic of mobile learning in vocational high schools from 2015 to 2020. However, the specific objective of this study is to establish the following Research Questions (RQ) about the utilization of mobile learning in vocational high schools:

1. RQ1. What is the topic's significance and contribution?

2. RQ2. When it comes to this research topic, what are the most common terms, and how have they altered or expanded throughout the last five years?
3. RQ3. Which researcher has published the most scientific articles on the topic? What affiliation and country are they from?
4. RQ4. Which top publications contributed to this research topic?

The findings of this study are significant for academics, researchers, and education professionals, particularly at the vocational high school level. This is intended so that they can make the right decision of mobile learning utilization for education process in a vocational school environment. On the other hand, researchers can use these discoveries as a guide for future investigation. To accomplish the research objectives, bibliometric analytic methodologies in tandem with the VOSviewer software are employed to visualize the findings of data analysis from the articles discovered during the literature search process (van Eck & Waltman, 2010).

2. Methods and Materials

Research Model

This study is the literature study method named bibliometric analysis of literature. Study of bibliometric literature using systematic and detailed method (Garza-Reyes, 2015), at the same time is a method that uses thinking that focuses on the boundaries of knowledge (Tranfield et al., 2003).

Participants

All data required for this study was obtained from a source on the internet, so no participants were recruited from among students or any other group.

Data Collection Tools

Data was gathered from online sources on the internet in the form of publications and journals that discussed or researched the usage of "mobile learning" at the "vocational school" level, which were used in this study.

Data Collection Process

As depicted in the following figure, a five-stage technique was utilized in this investigation, which was adapted from the findings of Setyaningsih et al. (2018) and Tranfield et al. (2003).

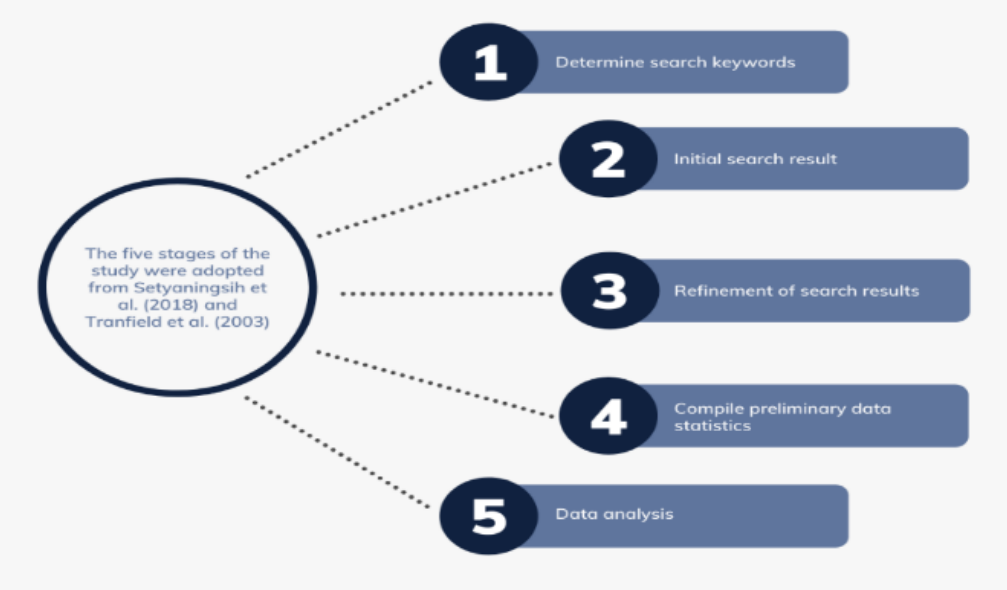

Figure 1. Five Stages of Bibliometric Literature Study Method

The keywords that the researcher used in compiling the articles were "mobile learning" OR "e-learning" OR "mobile learning application" OR "electronic learning" OR "digital learning" AND "vocational high school" OR "vocational school". The search was carried out in December 2021 on the Scopus database which is a credible and high-quality reference source in this research topic area (Baas et al., 2020).

The search for articles that the researcher did specifically for "journal" and "proceedings", only "title words" and the year "2015-2020". A total of 132 articles were found in the initial search. All the important information about each article is put together in a CSV file that includes the title, author, institution, abstract, keyword phrases and bibliography.

The appropriate articles indexed in the Scopus database are filtered, in order to select articles only from “journals” and “proceedings”. Furthermore, to make appropriate improvements, each article metadata is further processed in an excel file which is then returned to save as in a CSV file to be used for further data analysis.

The data collected is saved in CSV format. The initial stage includes examining the elements of journal articles and complete proceedings (year of publication, volume, number, pages, etc.) and adding incomplete information if necessary. Then the data is analyzed to classify articles by the year, publication source, and publisher.

VOSviewer is used for data analysis. VOSviewer is a software application that assists in the construction and visualization of bibliometric networks. These networks can be created around journals, researchers, or individual articles and can be based on citation, bibliographic coupling, co-citation, or co-authorship relationships.

Data Analysis

Bibliometric Analysis of literature in this study is using VOSviewer. VOSviewer used to analyze and visualize the bibliometric network in this study. VOSviewer is used for its ability to work efficiently with large data sets and provides a variety of interesting visuals, analysis, and investigations (van Eck &

Waltman, 2010). In addition, VOSviewer may generate publication maps, author maps, journal maps, or keyword maps based on network-shared citations (Hudha et al., 2020).

3. Results

This study aims to analyze literature sources related to the keywords "mobile learning" OR "e-learning" OR "mobile learning application" OR "electronic learning" OR "digital learning" AND "vocational high school" OR "vocational school". Literature sources were obtained from journal publications and proceedings indexed by Scopus during the 2015 – 2020 period in English. There are three aspects analyzed, namely: co-authorship, co-accurence, and citation. Through bibliometric analysis of literature studies that have been carried out using the VOSviewer software, the results are obtained as described in the points below. For each presentation of co-authorship, co-accurence, and citation meta data, the researcher uses a minimum occurrence of 1, due to the lack of literature sources obtained in the research area of the use of mobile learning in vocational high schools. The use of VOSviewer software assistance is intended to classify and visualize the data that the researchers have done (Hudha et al., 2020; van Eck & Waltman, 2010).

Co-Authorship

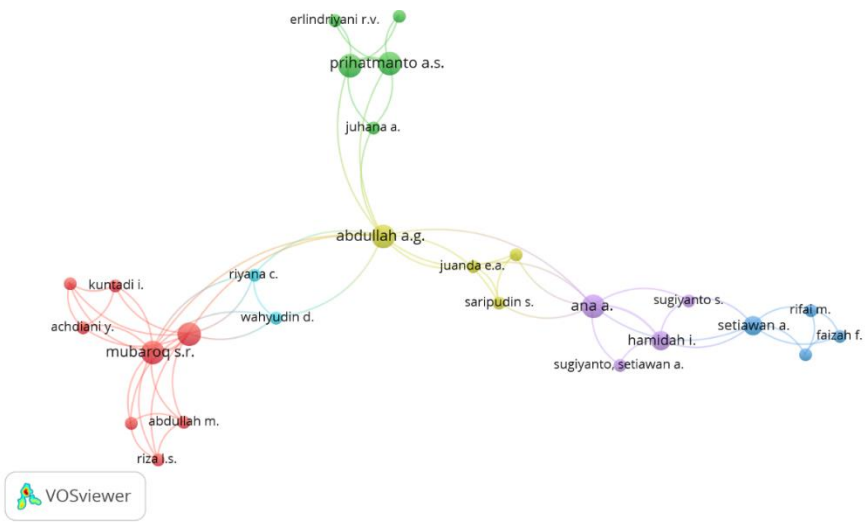

Figure 2. Network Visualization of Co-Authorship Metadata (Author Name)

Figure 2 depicts the six distinct groups of authors found in the various fields of study. Each author has a connected network, which means that each author has a relationship with one another in conducting research on the topic of using mobile learning at the vocational high school level.

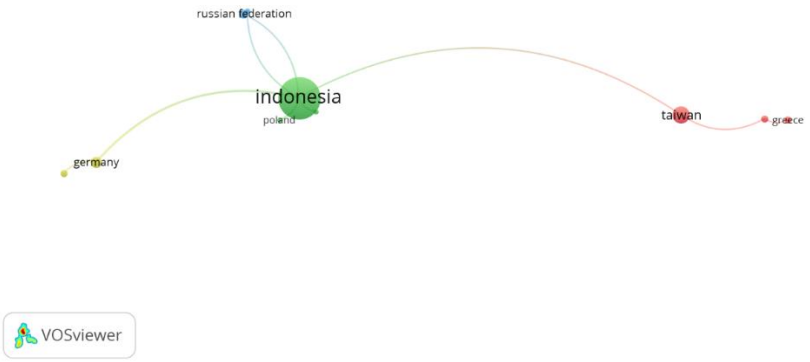

Figure 3. Network Visualization of Co-Authorship Metadata (Author Country)

If we take a look at figure 3 and refer to figure 2 (Judging from the name that identifies Indonesian), we can see that most of the authors who have looked into mobile learning usage in vocational high schools are from Indonesia, followed by Taiwan and Germany. This is aligned to the rising educational level in these countries, where the government has begun to place a greater emphasis on human resource development through vocational education (Said et al., 2017; Wiriadidjaja et al., 2019). Germany's success in shaping the quality of human resources through vocational education has begun to be adopted by many developing countries, one of which is Indonesia (Zimmermann, 2013). The usage of mobile learning is facilitating the learning process in Taiwan, where vocational education is becoming increasingly popular and contributing to the reduction of unemployment (Wang et al., 2020).

Co-Accurence

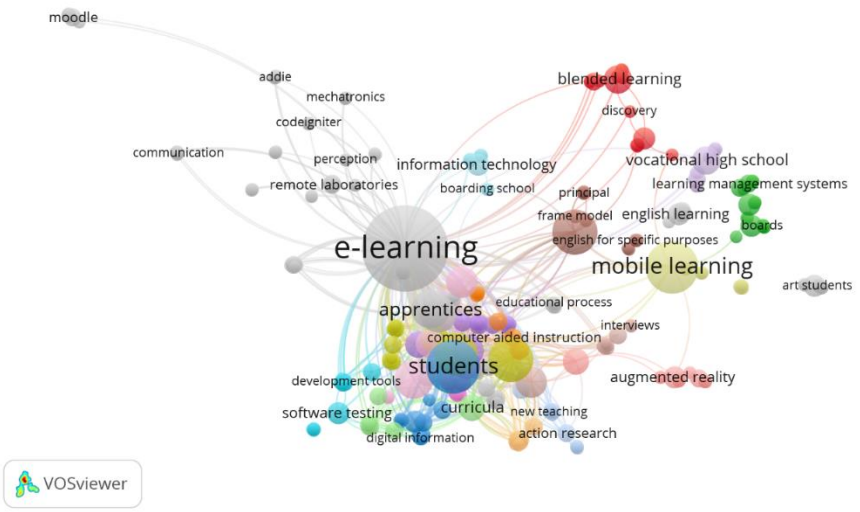

Figure 4. Network Visualization of Co-Accurance Metadata (Keywords)

The keywords associated with research on mobile learning in vocational high schools are extremely varied. It is consistent with a mobile learning in a broad sense, which means the utilization of technological instruments for educational purposes that are simple to use anywhere and at any time (Filianti et al., 2020). In this analysis, there are also many clusters that can be seen and are very possible

to be developed, which means future researchers can relate the use of mobile learning to vocational high schools in more detail.

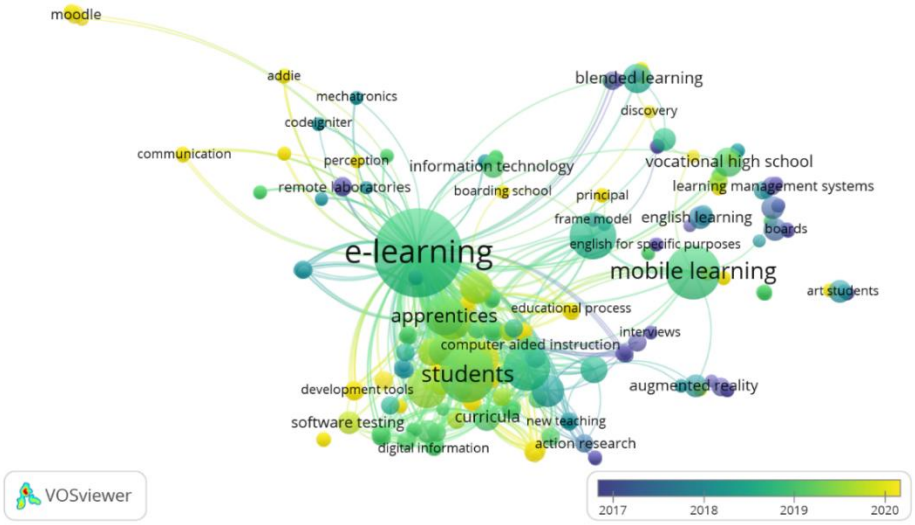

Figure 5. Overlay Visualization Against Co-Accurance Metadata (Keywords)

As illustrated in Figure 5, there is a year-over-year development of keywords, where the yellower the keyword cluster, the more recent the research is carried out. Similarly, the bluer the keyword cluster, the longer the research has been carried out. It is also possible that the existence of the covid-19 outbreak led to the formation of this keyword since it forced instructors in vocational high schools to be innovative in their use of learning systems to facilitate remote learning (Kholifah et al., 2020; Saripudin et al., 2020). Given the significance of these findings, academic research in the subject of mobile learning usage in vocational high schools can be directed in a more forward-looking way in order to keep up with emerging trends and demands in the sector.

Citation

The purpose of analyzing the publications that have received the most citations in the research topic of mobile learning in vocational high schools is to determine which articles have had the most influence on the growth of knowledge in this sector. As can be observed from the preceding analysis, the majority of authors were from Indonesia; in fact, only a few contributed to the top ten most cited papers. This can serve as a guide for Indonesian scholars interested in writing articles that will help in the development of scientific repertoire in the field of mobile learning in vocational high schools. Detailed information about the top ten published references is included in Table 1.

Table 1. List of Top 10 Articles Cited

No.	Year of Publication	Author	Title	Journal	Cites	Publisher
1	2018	Bulaeva M.N., Vaganova O.I., Koldina M.I., Lapshova A.V., Khizhnyi A.V.	Preparation of bachelors of professional training using MOODLE	Advances in Intelligent Systems and Computing	58	Springer Verlag
2	2015	Cattaneo A.A.P., Motta E., Gurtner J.-L.	Evaluating a mobile and online system for apprentices' learning documentation in vocational education: Usability, effectiveness and satisfaction	International Journal of Mobile and Blended Learning	19	IGI Global
3	2017	Tsai C.-H., Cheng C.-H., Yeh D.-Y., Lin S.-Y.	Can learning motivation predict learning achievement? A case study of a mobile game-based English learning approach	Education and Information Technologies	18	Springer New York LLC
4	2016	Ernst S.-J., Janson A., Söllner M., Leimeister J.M.	It's about understanding each other's culture - Improving the outcomes of mobile learning by avoiding culture conflicts	International Conference on Information Systems, ICIS 2016	11	Association for Information Systems
5	2018	Alptekin M., Temmen K.	Design concept and prototype for an augmented reality based virtual preparation laboratory training in electrical engineering	IEEE Global Engineering Education Conference, EDUCON	9	IEEE Computer Society
6	2015	Dai C.-Y., Huang D.-H.	Causal complexities to evaluate the effectiveness of remedial instruction	Journal of Business Research	9	Elsevier Inc.
7	2019	Fronza I., Pahl C.	Teaching software engineering principles in non-vocational schools	CSEDU 2019 - Proceedings of the 11th International Conference on Computer Supported Education	8	SciTePress
8	2017	Chen M., Yu S.Q., Chiang F.K.	A dynamic ubiquitous learning resource model with context and its effects on ubiquitous learning	Interactive Learning Environments	8	Routledge
9	2019	Imelda, Cahyono B.Y., Astuti U.P.	Effect of process writing approach combined with video-based mobile learning on Indonesian EFL learners' writing skill across creativity levels	International Journal of Instruction	6	Eskisehir Osmangazi University
10	2018	Darmawan D., Kartawinata H., Astorina W.	Development of web-based Electronic Learning System (WELS) in improving the effectiveness of the study at vocational high school "Dharma Nusantara"	Journal of Computer Science	6	Science Publications

As shown by Table 1, the top ten most cited publications are Bulaeva et al. (2018) from Minin University in Russia. As of January 2022, 58 papers had been cited in favour of the use of Moodle to facilitate online learning in vocational and general education courses. His research demonstrates how to establish an online learning environment that is capable of producing learning results that are not only related to theoretical comprehension, but also to practical outputs.

Furthermore, the second most citations are articles written by Cattaneo et al. (2015) from the Department of Education, University of Fribourg, Switzerland. This article, as of January 2022 has been cited as many as 29 times, this paper investigates mobile learning utilization to support the vocational learning process for youth in Switzerland, since 99% of teenagers in Switzerland have smartphones, hence must be used for educational purposes. The findings are able to bring together trainers (teachers) and students (trainees) in the context of vocational education to learn a certain skill.

As for the third most citations are articles written by Tsai et al. (2017) from the Sport and Promotion of Health Department, University of Transworld, Taiwan. The article, which as of January 2022 has been cited 18 times, this paper discusses predictions of learner motivation for the achievement of vocational high school students in mobile game-based English subjects. In his research it was revealed that mobile games which are part of mobile learning are able to improve student achievement during learning at the vocational high school level.

These three findings have received a significant number of citations, making them by far the most influential findings in the field. Even the paper by Tsai et al. (2017) also the most cited in the network of articles in the literature sources that researchers collect. The other seven articles also contributed through the many citations obtained. As a consequence, these findings can be used as a basis for finding reference sources and making reference to the topic of utilizing mobile learning in vocational schools

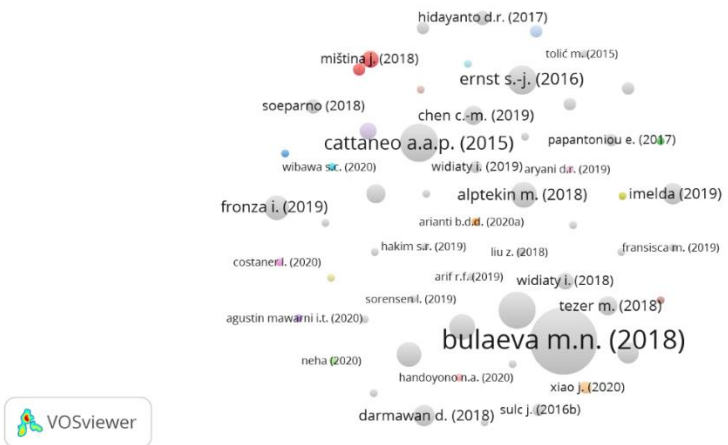

Figure 6. Network Visualization Against Metadata Citation

In Figure 6 it can be seen that the name with the largest cluster is Bulaeva et al. (2018) which was then followed by other names. They are researchers who have a high interest in conducting studies in the field of using mobile learning in vocational high schools. As an outcome, the consequences of this finding might be utilized as a reference while giving public lectures or other presentations on related topics as an expert.

4. Discussion

Still, there might not be a lot of research done on mobile learning at vocational schools in Europe or America. According to the conclusions of this survey, the majority of authors are from Asia, specifically Indonesia and Taiwan. Due to the trend of mobile learning growing rapidly which is due to advances in digital technology (Danish & Hmelo-Silver, 2020), the emergence of covid-19 pandemic (Churiyah et al., 2021), and the development of students (Kirschner & De Bruyckere, 2017), hence it is critical for conducting a research which specifically discusses the mobile learning utilization at the vocational education level. The characteristic of vocational high school education that focuses on the output of students' skills and their relevance to the needs of the industrial market is increasingly important because learning in the digital era is required to be able to accommodate full-practice-based learning (Cattaneo et al., 2015; Erzsebet et al., 2017).

It is necessary for academics from different countries to collaborate in order to do study on the adoption of mobile learning in vocational school level. This collaboration has so far only taken place between colleges in one country. Geographical barriers must be fused in order to generate significant empirical data for the human resource development process in many countries. In this instance, Germany's ability to begin existing collaborations as a leader in vocational education is necessary (Wiriadidjaja et al., 2019).

According to the results of this bibliometric analysis, keywords relating to research on the utilization of mobile learning in vocational high schools are becoming more prevalent each year. It is expected that by utilizing these discoveries, researchers will be able to correlate keywords in greater detail with one another, resulting in empirically significant conclusions (Khan & Gupta, 2021). In some countries, there is a demographic advantage that must be capitalized on, one of which is the government's commitment in designing vocational education (Eicker et al., 2017). Hence, the investigations on mobile learning usage in vocational high schools is becoming increasingly relevant.

Researchers and academics can utilize the publications with the most citations, which are the most significant contributors to this research, as a key reference source while studying and producing new discoveries in the subject of employing mobile learning in vocational high schools. Following the discovery of these research, authors who have a great interest in the relevant area of study may find themselves in the position of becoming specialists in public speaking or other forms of presentation as a result of their conclusions.

5. Conclusion

It is possible to conclude from the findings of the bibliometric study, as well as from the discussion in the previous section, that most of the authors of research articles on "mobile learning" and its relationship to "vocational high school" come from Asia, especially from Indonesia and Taiwan. In addition, the level of collaboration between writers across countries is relatively low where there is almost no collaboration between writers from different countries. Also, the results of the analysis for the number of citations in this topic, can be a future reference for this kind of research.

This study has limitations in that the analysis is limited to the last five years (2015 – 2020). Whereas in 2021, when the COVID-19 pandemic arose, a considerable amount of research was conducted on the subject of mobile learning. It is mostly used to facilitate online learning, notably at the vocational high school level. Aside from that, additional resources including such Web of Science

and others might be utilized to support study findings on this important topic. Collaboration amongst authors from diverse backgrounds is also critical for producing more meaningful empirical findings.

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