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Submission date: 24-Apr-2024 08:40AM (UTC+0700)
Submission ID: 2359905282
File name: ARTIKEL_INT_BIBBLIO_IMAS-MISBAH_-_Imas_Ratna_Ermawati-2.pdf (790.46K)
Word count: 2465
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RESEARCH ARTICLE | APRIL 05 2024

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AIP Conf. Proc. 3058, 040011 (2024)
https://doi.org/10.1063/5.0200951

A Bibliometric Analysis of Digital Literacy on Science Education

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Abstract. Today using of ICT in the field of massive education is implemented. The research was conducted not only in the field of ICT learning but also science learning. This study aims for mapping digital literacy research in science learning. The goal is not only to map the research that has been done but to provide an overview for conducting research in the field of digital literacy in the future. The method used is bibliometric analysis assisted by VOSviewer program. The analyzed documents were collected from the Scopus database with the keywords "Digital Literacy", "Science Learning" and "Science Education". The data obtained were 60 documents which were then limited by document type journals and conference proceedings and used English. The results of the limitation were collected as many as 40 documents which were then analyzed. The findings obtained are that digital literacy is related to preparation in learning and competency achievement in the 21st century. In addition, teachers as teachers must have good digital literacy skills. The findings show that research in the field of digital literacy will continue to grow over time.

INTRODUCTION

The 21st century is the age of knowledge, where information is widespread and technology is developing very rapidly. The context of the use of technology and communication in education is evidenced by the fusion of space and time factors which are the determinants of the speed and success of science[1–4]. The use of the internet that occurs today provides more space for anyone and at any time to access various information without knowing the boundaries of space and time. Based on data by APJII, it shows that internet users use the internet to communicate via messages (24.7%), social media (18.9%), looking for information (11.5%), and reading news (5.5%). This data illustrates that the use of the internet in the field of education is still not optimal [5]. In fact, when viewed from a broader perspective, digital media has become an important literacy tool to improve educational goals [6].

Digital literacy is the knowledge and skills to use digital media, communication tools, or networks in finding, evaluating, using, creating information, and utilizing it in a healthy, wise, intelligent, careful, precise, and law-abiding manner in order to foster communication and interaction in daily life [7,8]. This digital literacy will bring a breath of refreshment to the implementation of ongoing learning. Science has a nature that is based on the process underlying the development of thinking skills through discovery activities of science objects. In addition, in the process digital literacy becomes a tool to explain phenomena that occur on a scientific basis. This perspective illustrates that digital literacy in science learning is very necessary [9].

The 2nd Young Scholar Symposium on Science and Mathematics Education, and Environment
AIP Conf. Proc. 3058, 040011-1–040011-5; https://doi.org/10.1063/5.0200951
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Digital literacy has an important role to determine the success of students and teachers in the learning process. Research shows that digital literacy has a positive effect on academic performance. Digital literacy can contribute to more efficient task completion through the help of software and computer programs [7,10,11]. Not only for learning needs but to prepare students to be ready to face the times.

Research in the field of digital literacy in science learning has recently been actively carried out to measure digital literacy skills, develop technology-based learning, or discuss science learning policies in the field of digital literacy [12–15]. Therefore, this study was conducted to analyze research with the topic of digital literacy in science learning. This research will be described using a bibliometric study. Some of the research questions in this study are: 1) how much research about digital literacy on science education is done every year? 2) how is the network visualization about digital literacy on science education based on co-occurence?

RESEARCH METHOD

In this study, the research used was bibliometric literature analysis. Bibliometric analysis is the quantitative study of bibliographic material. It provides an overview of the research area which can be classified by papers, authors and journals. Literature and metadata searches were carried out using the Scopus database with the keywords "digital literacy", "science learning", and "science education" obtained 60 documents. The obtained documents are then reduced based on the document type in the form of articles and conference papers and in English. The results of the documents were then analyzed using VOSviewer software to analyze co-occurrence. The results of the network visualization are then described qualitatively.

RESULT AND DISCUSSION

Digital Literacy in Science Education

This study is an analysis of the database of articles obtained from Scopus using the keywords "digital literacy", "science learning", and "science education". The documents obtained are limited by the source type originating from journals and conference proceedings, as well as the type of language used, namely English language. This is to make it easier to analyze the article. The next step is to analyze the document with the help of VOSviewer with bibliometrics analysis. The results of the analysis are presented in Figure 1.

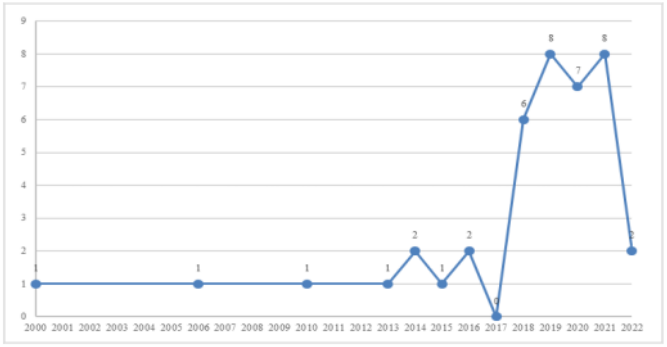

FIGURE 1. Graphics document publication by years

Figure 1. shows that publications on digital literacy in journals and conference proceedings began in 2000. The highest number of studies were carried out in 2021 and 2019, namely 8 documents. However, the graph shows that research continues to increase in the field of digital literacy every year. It is hoped that in 2020 research in this field will continue to be carried out so that the field of digital literacy can be explored more broadly.

Trend Research of Digital Literacy in Science Education

The implementation of research in the field of digital literacy which continues to increase from year to year can provide an overview of the types of research in the field of digital literacy. The results of the analysis carried out are presented in Figure 2.

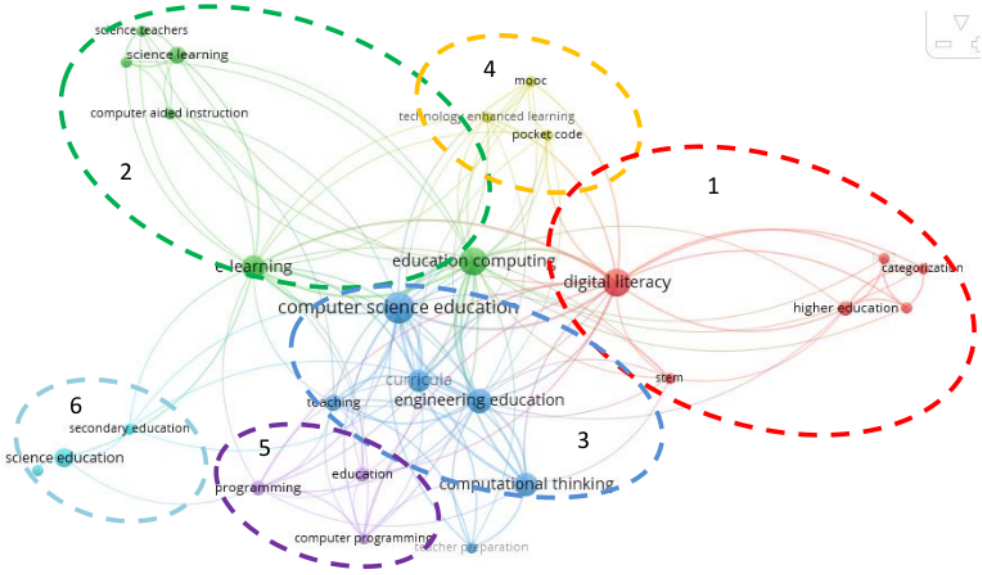

FIGURE 2. Network visualization in VOSviewer about digital literacy

Figure 2 illustrates the results of the analysis using VOSviewer. Network visualization from digital literacy is divided into six clusters, each of which is marked with red (Cluster 1), green (Cluster 2), dark blue (Cluster 3), yellow (Cluster 4), and purple (Cluster 5), and light blue (Cluster 6). This network visualization means that research in the field of digital literacy is carried out in several fields, especially education and learning. Research in the field of digital literacy in the field of science education is directly related to the process of implementing learning and the results of the competencies achieved. The results of network visualization from digital literacy are presented in Figure 3.

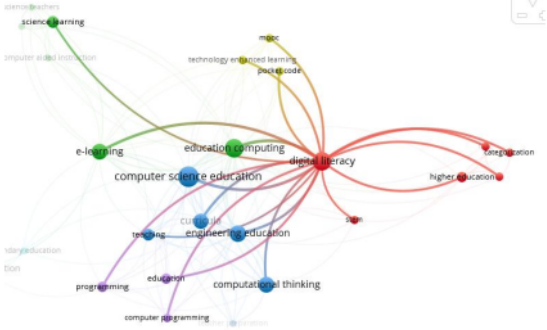

FIGURE 3. Network visualization of digital literacy

Figure 3 illustrates that digital literacy can be achieved by applying technology-based learning, namely e-learning. E-learning takes place at the basic, secondary and higher education levels [16]. During the COVID-19 pandemic, e-learning-based learning was carried out, one of which was in the form of MOOC (Massive Open Online Course).

MOOC (Massive Open Online Course) is an online course aimed at unlimited participation and open access via the Web [17–21]. MOOC can be prepared for learning with various desired topics. In addition, another way is to develop teaching materials in electronic form such as e-modules, e-worksheets or e-books [6,22,23]. In addition, the use of learning models will be very influential in the achievement of learning competencies. To achieve STEM digital literacy skills, it is shown that it can support technology-based learning. So that it can help develop students' digital literacy skills [24].

Digital literacy in learning is also related to 21st century competencies, one of which is computational thinking [25,26]. The application of digital literacy can help improve computational thinking skills, especially for teachers. Teachers as educators need to have this ability, this is because education in schools is expected to maintain the digital literacy of students. This maintenance is intended so that students can apply digital literacy skills in everyday life. However, little is known about how teachers apply technology as part of a learning strategy. Several studies have shown that the use of information technology in education and developing students' understanding of the digital world is very important [8,13,27]. However, in the curriculum the use of technology is not officially mentioned. Teachers as subjects who play a role in introducing digital to students must first be digitally literate or have digital literacy skills. The results of the mapping on the VOSviewer are shown in Figure 4.

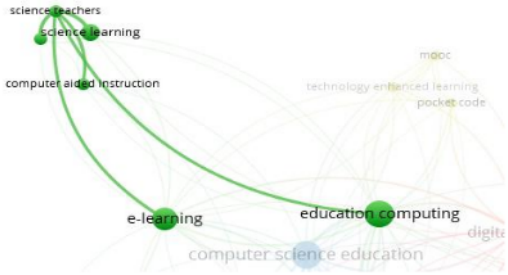

FIGURE 4. Science teacher network visualization

Figure 4 means that science teachers play an important role in learning. During the COVID-19 pandemic, teachers were forced to be ready to use technology-assisted distance learning. E-learning is prepared as much as possible so that knowledge transfer occurs. The results of the analysis in several studies of teachers having digital literacy skills with indicators of information, communication, content creation, safety, and problem solving are in a fairly good category [28]. In the content creation indicator, a high category is obtained, this is because the teacher is prepared to create technology-based learning to the fullest. However, a study conducted to analyze the readiness of science teachers in the future shows that science teachers, especially in Indonesia, are not quite ready in the field of digital literacy [29]. This finding indicates that in the future the competence of teachers must be improved through training programs. This research is still limited to the analysis of science teachers, research on the readiness of prospective science teachers in the field of digital literacy for teacher preparation in the future can be done.

Bibliometric analysis can provide an overview of the number of studies by year. the results of the overlay visualization show that STEM is a trending research topic in 2020. Research in the STEM field is related to 21st century competencies, namely computational thinking and is carried out in higher education. The overlay results are presented in Figure 5.

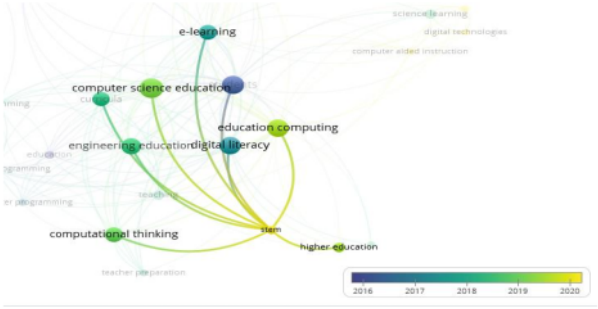

FIGURE 5. Result overlay visualization

The various findings obtained indicate that research in the field of digital literacy needs to be explored more deeply. Further research can be conducted to analyze the relationship between digital literacy and the ability to think in the 21st century, digital literacy in science learning, the development of STEM-based instructional learning to improve digital literacy or to analyze digital literacy skills at the primary, secondary and higher education levels or to science teachers alone.

CONCLUSION

Overall, the findings in this study explain that digital literacy in science education is very important. The findings obtained are that digital literacy is related to preparation in learning and competency achievement in the 21st century. In addition, teachers as teachers must have good digital literacy skills. The findings show that research in the field of digital literacy will continue to grow over time.

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