IJIS Edu : Indonesian J. Integr. Sci. Education, 8 (1) 2026

Volume 8 Issue 1 , Januari 2026
P-ISSN: 2655-2388, E-ISSN: 2655-2450

Development of Learning Media to Enhance Students' Digital Literacy: A Bibliometric

Andik Purwanto[1*], Syukri Hamzah[2], Rendy Wikrama Wardana[3], Fitri April Yanti[4], Reygan A. Butali[5]

[1,2,3,4] *Doctoral Program of Education, University of Bengkulu. Bengkulu, Indonesia*
[5] *College of Arts and Sciences, Mariano Marcos State University, 16-S Quiling Sur, City of Batac 2906, Philippines*
Corresponding E-mail: andik.purwanto@unib.ac.id

Abstract: This research aims to determine the need for the development and application of learning media as an effort to improve students' digital literacy. The research method carried out is the determination of keywords, namely "digital literacy competency education" and "journal' in the Publish or Perish (PoP) software as a research data source database with the Scopus database, resulting in 157 articles from 2014-2024 and obtaining 42 articles as samples in accordance with the keyword criteria. Meta-data analysis was carried out using Mendeley and VOSViewer to visualize a bibliographic network with research variables such as the year of publication of the article, the country of publication of the journal, the name of the author of the article, and the article with the most citations. The results of the analysis show that the development and application of learning media as an effort to improve students' digital literacy is indeed needed in supporting the learning process and can be an interesting alternative method to improve student academic achievement. In addition, the results of mapping analysis using VOSviewer show several themes about the use of comic-based physics learning media such as 'university student', 'application', 'role', 'scientific literacy', and 'effect' which are still rarely researched and become the latest themes in research. So it can be concluded that the development and application of learning media as an effort to improve students' digital literacy needs to be researched again.

Keywords: *Digital Literacy, Learning Media, Bibliometric Analysis, Educational Technology, Student Literacy*

How to cite this article :

Purwanto, A., Hamzah, S., Wardana, R., Yanti, F., & Butali, R. (2026). Development of Learning Media to Enhance Students' Digital Literacy: A Bibliometric Analysis. *IJIS Edu : Indonesian Journal of Integrated Science Education, 8*(1). doi:http://dx.doi.org/10.29300/ijisedu.v8i1.7181

1. Introduction

The rapid development of science and technology in the era of the 5.0 revolution requires every human resource to be able to act quickly, precisely, creatively, and innovatively to create quality human resources (Malina et al., 2021). Digital literacy is one of the skills that must be mastered in facing the challenges of the 5.0 revolution. The 5.0 revolution brings quite rapid changes in every aspect of life, where every activity carried out in daily life will be inseparable from computers, mobile phones, and other technology that can facilitate all communication and work (Ririen & Daryanes, 2021).

Digital literacy can also be interpreted as an important part of the learning development process in higher education. The digital literacy skills that a person possesses will not make him careless in receiving information he obtains from digital media. Thus, digital literacy skills will enable a person to create, collaborate, and communicate effectively and use technology according to conditions (Rini et al., 2022).

The rapid development of technology today also has an impact on the education sector. Where, the learning process, which initially only took place face-to-face, is now combined with online learning so that it requires students to learn independently by utilizing available information and communication technology. Students with good digital literacy skills will find it easier to find, understand, and select the information needed on the internet, making it easier for students to achieve learning success (Dinata, 2021). Research (Saputra & Salim, 2020) explains that universities are the main actors who welcome the digital literacy movement by 56.14%, where most students who enter universities have good skills in accessing social networks.

The generation that grows and develops with freedom of access to the use of digital media sources has a different mindset from the previous generation. This difference in mindset makes students a millennial generation who since birth in this world have become very digital and urban. Qualified digital literacy skills must be accompanied by the ability to navigate information and knowledge for maximum and positive learning and academic performance (Syabaruddin & Imamudin, 2022). Digital literacy in the academic field must begin to be developed through the socialization of the literacy curriculum to improve students' digital literacy skills in the current era of the 5.0 revolution.

Despite the growing body of literature on digital literacy, a significant research gap remains in the form of a systematic, long-term global mapping of student-focused digital literacy trends within a high-impact, peer-reviewed database over the last decade (2014–2024). While existing studies often analyze general information literacy or focus on localized regions, there is a lack of comprehensive bibliometric evidence tracking how student-centric digital skills have evolved in direct response to the human-centric demands of Society 5.0.

The novelty of this research lies in its specific utilization of the Scopus database to synthesize a decade of international scientific progress, specifically identifying the transition from basic functional ICT skills to the sophisticated collaborative and

Online ISSN 2655-2450 | Print ISSN 2655-2388

creative competencies required today. By providing a detailed visualization of keyword evolution and citation impacts, this study offers a unique strategic roadmap that bridges the gap between traditional literacy and the innovative requirements of the 5.0 era.

Based on the description above, this study will discuss more about "Bibliometric Analysis of Improving Student Digital Literacy" with the Scopus database. Scopus was chosen as a database because Scopus is a research database with comprehensive, relevant, and reliable sources of journal articles, making Scopus a database or a place for researchers to find written sources relevant to their research (Effendy et al., 2021). The purpose is to find out the trend of writing articles to increase student digital literacy between 2014-2024, the trend of articles that have the highest number of citations, the classification of journal rankings, the country of origin of the journal publisher, and to conduct mapping in looking for trends in international scientific publications with the Scopus database based on keywords.

2. Method

This research was carried out using a research method in the form of a literature *review* assisted by a bibliometric approach. Ayu (2023) revealed that this research method is used as a medium to identify a theory of research results that only focuses on one specific research topic by using a comprehensive approach to explore the improvement of students' digital literacy.

To identify the trend of increasing students' digital literacy, this study will use the previously selected research variables, which are in accordance with table 1.

Table 1. Research Variables

Variable	Criterion
Year of publication of the article	All research works are considered
Publisher's journal name	All research works are considered
Country	Articles with more than two references on a theme
Writer	Articles with more than two references on a theme
Articles with the most citations	Articles with more than two references

(Rodríguez et al., 2018)

a. Data collection and selection techniques

This research involves collecting articles from existing databases such as Scopus. Data collection was carried out using the *Publish or Perish* (PoP) application on Friday, November 22, 2024.

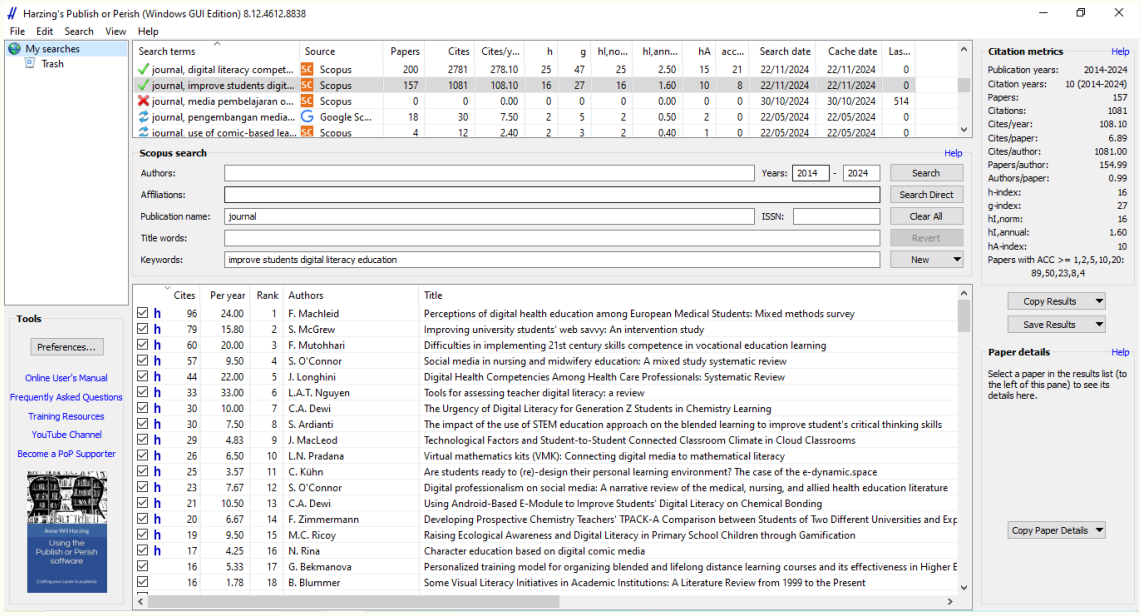

Figure 1. Scopus Database Search in PoP

Figure 1 is the first step in the bibliometric analysis process, namely the collection of the Scopus database using PoP using the keywords "improve", "student", "digital literacy", and "education", the maximum number of publications is 200 articles in the period from 2014 to 2024. From the Scopus database and the keywords, 42 articles were obtained that will be sampled in the research to be carried out because they are in accordance with the criteria that have been determined, namely about digital literacy and the articles are published in the form of journals.

Table 2. Top 10 Most Cited Articles From 2014-2024

Author	Title	Year	Citation
S. McGrew	*Improving University Students' Web Savvy: An Intervention Study*	2019	79
F. Mutohhari	*Difficulties In Implementing 21st Century Skills Competence In Vocational Education Learning*	2021	60
L.A.T. Nguyen	*Tools For Assessing Teacher Digital Literacy: A Review*	2024	33
C.A. Dewi	*The Urgency Og Digital Literacy For Generation Z Students In Chemistry Learning*	2021	30
J. MacLeod	*Technological Factors And Student-To-Student Connected Classroom Climate In Cloud Classroom*	2018	29
C.A. Dewi	*Using Android-Based E-Module To Improve Students' Digital Literacy On Chemical Bonding*	2022	21

Online ISSN 2655-2450 | Print ISSN 2655-2388

Author	Title	Year	Citation
I.F. Adi Badiozaman	*Embracing Educational Disruption: A Case Study In Making The Shift To A Remote Learning Environment*	2022	15
Asrial	*Effectiveness Of Integrated Science Instructional Material On Pressure In Daily Life Theme To Improve Digital Age Literacy Of Students*	2018	15
B. Umut Zan	*A Study On Digital Literacy Skills Of Factualty Of Letters Students: Use Of University Library*	2020	14
M. Rizal	*Development Of A Problem-Based Learning Management System-Supported Smartphone (PBLMS3) Application Using The ADDIE Model To Improve Digital Literacy*	2021	9

b. The process of compiling statistics on the initial data

The filtering process according to (Karuniawan & Risdianto, 2023) is the process of compiling initial data on articles found in the initial search and then saved in the Mendeley application and exported in RIS format to store important information in the article.

Table 3. Article Filtering Results

Article Filtering Process	Number of Articles
Not Relevant to the topic	41
Similar Articles	0
Not an educational theme	55
Unidentified (contains only the quote)	19
The topic of improving students' digital literacy	42
Total	157

Table 3 shows the results of filtering articles from the initial search. An initial search on the PoP application found 157 articles about improving students' digital literacy, which was then filtered to leave 42 articles in accordance with the research theme. Of the 157 articles, there were 41 articles that were not relevant to the research theme, there were 55 articles with the subject of a sample of research data sources outside education, and there were 19 articles that were not identified (containing only citations).

c. Final Data Analysis

Data analysis was carried out using bibliometric analysis using the keyword "improving student digital literacy" from the Scopus database search assisted by the PoP application (Rahmawati et al., 2022). The data in table 4 was obtained after the article database of the PoP application in the initial search was filtered based on the previous process.

Table 4. Data Metric Results

Publicacion years	: 2015-2024
Citation years	: 9(2015-2024)
Paper	: 42
Citations	: 446
Cites/year	: 51.78
Cites/ paper	: 11.10
Cites/author	: 466.00
Papers/author	: 42.00
Author/paper	: 1.00
h-index	: 10
g-index	: 19
hl,norm	: 10
hl,annual	: 1.11
hA-index	: 7
Paper whith ACC	: 1,2,5,10,20: 34,22,11,5,2

3. Result and Discussion

Bibliometric analysis has shed light on the landscape of improving students' digital literacy. Bibliometric analysis according to (Supinah & Soebagyo, 2022) was carried out using two categories, namely performance analysis and science mapping. Performance analysis is carried out by looking at the number of publications each year, the articles with the most citations, the journals with the highest number of articles, and the countries with the most journal publishers. The second analysis was carried out by scientific mapping, namely by *Circles Network Visualization, Frames Overlay Visualization*, and *Density Visualization*.

a. Year of Article Publication

The year of publication of the article is seen based on the year when the article was published with the criteria, namely all articles with the topic of improving student digital literacy published in the range of 2014-2024. Based on the search for Scopus indexed articles assisted by PoP, the results of the search data on the increase in student digital literacy in the period from 2015 to 2024 have changed as shown in the figure below.

Online ISSN 2655-2450 | Print ISSN 2655-2388

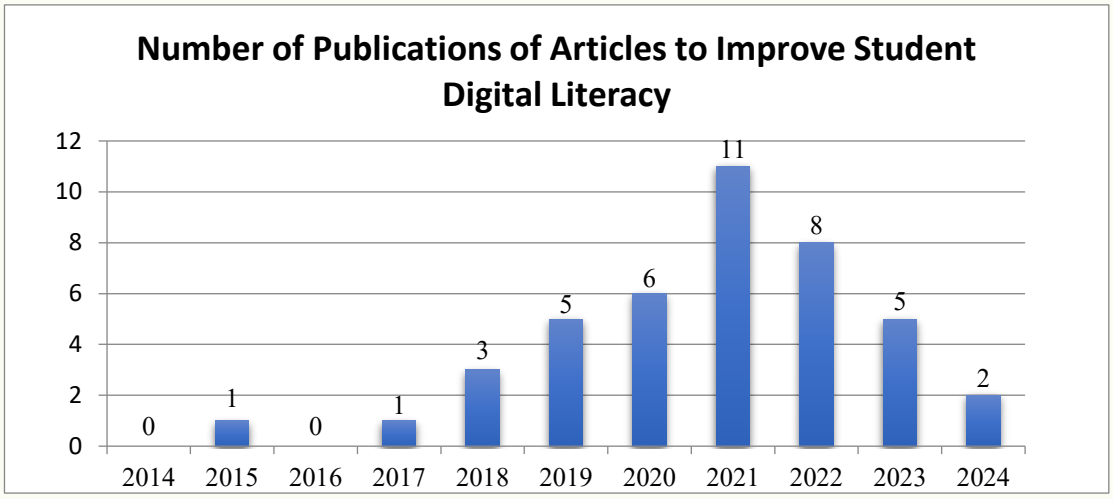

Figure 2. Number of Publications of Articles to Improve Student Digital Literacy

The data shown in figure 2, gives an idea that from 2014 there was no publication of articles on improving student digital literacy, until in 2015 there was one published article, while in 2016 there was no published article. Then in 2017 there was one published article and there was a significant increase in the number of article publications in the following years, where in 2018 there were 3 published articles, in 2019 there were 5 published articles, in 2020 there were 6 published articles, and in 2021 was the year with the highest number of publications, namely 11 articles. The number of publications in 2022 to 2024 has experienced a significant decrease in the number of article publications from the previous year. Where in 2022 there are 8 published articles, in 2013 there are 5 published articles, and for 2024 there are 2 published articles.

b. Publisher Journal Name

Scopus-indexed articles on improving students' digital literacy written in international journals. The data on the name of the publisher journal was obtained based on the data of journal search results through PoP software which can be seen in the publisher section. The following is a table of international journals published with the number of published articles.

Table 5. International Journal Publishers With Number of Published Articles

No.	Publisher's Journal	Number of Articles
1.	*Journal Of Physics: Conference Series*	7
2.	*Turkish Online Journal Of Educational Technology*	2
3.	*International Journal Of Scientific And Technology Research*	1
4.	*Scottish Medical Journal*	2
5.	*Journal Of Curriculum And Teaching*	1
6.	*International Journal Of Media And Information Literacy*	2
7.	*International Journal Of Engineering Pedagogy*	1

8.	*Italian Journal Of Sociology Of Education*	1
9.	*International Journal Of Emerging Technologies In Learning*	4
10.	*International Journal Of Information And Learning Technology*	2
11.	*European Journal Of Educational Research*	1
12.	*Journal Of Information Technology Education: Innovations In Practice*	1
13.	*Universal Journal Of Educational Research*	4
14.	*European Journal Of Contemporary Education*	1
15.	*International Journal Of Interactive Mobile Technologies*	2
16.	*Journal Of Educational Computing Research*	1
17.	*Journal Of Applied Research In Higher Education*	1
18.	*Journal Of Computers In Education*	2
19.	*International Journal Of Evaluation And Research In Education*	2
20.	*British Journal Of Educational Psychology*	3

Table 5 shows the name of the publishing journal and the number of articles published indexed by Scopus about improving students' digital literacy. "*Journal Of Physics: Conference Series*" was recorded as the publisher of the most articles on improving students' digital literacy, amounting to 7 articles.

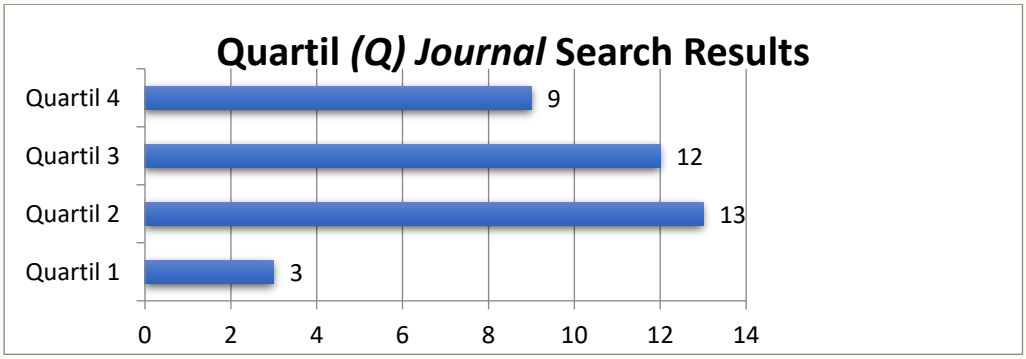

Figure 3. Quartil *(Q) Journal* Search Results

Based on figure 3 about the results of the *Quartil* (Q) search in Scopus-indexed journals conducted through the https://www.scimagojr.com website on the *Journal Ranking* menu, the publisher journal contained in table 3 is indicated as a journal with Q1, Q2, and Q3 rankings. '*Journal of Educational Computing Research*' and '*British Journal of Educational Psychology*' are indexed by Scopus Q1 with a number of published articles as many as three, while '*Scottish Medical Journal*', '*International Journal Of Engineering Pedagogy*', '*International Journal Of Information And Learning Technology*', '*Journal Of Information Technology Education: Innovations In Practice*', '*European Journal Of Contemporary Education*', and '*Journal Of Applied Research In Higher Education*' are indexed by Scopus Q2 with a total of 13 articles, then there are

Online ISSN 2655-2450 | Print ISSN 2655-2388

five Scopus Q3 reputable journals, namely '*Journal Of Physics: Conference Series*', '*Italian Journal Of Sociology Of Education*', '*European Journal Of Contemporary Education*', '*International Journal Of Interactive Mobile Technologies*', and '*International Journal Of Evaluation And Research In Education*' with a total of 12 publications. There are also reputable journals of Scopus Q4, namely, '*Turkish Online Journal Of Educational Technology*', '*International Journal Of Media And Information Literacy*', and '*Journal Of Curriculum And Teaching*' with a total of 9 published articles.

c. Journal Publisher Country

The Journal Ranking *menu* also presents data on the country of origin of the journals presented in figure 4. The figure below presents data from the journal publisher country about the use of comic-based learning media in physics learning.

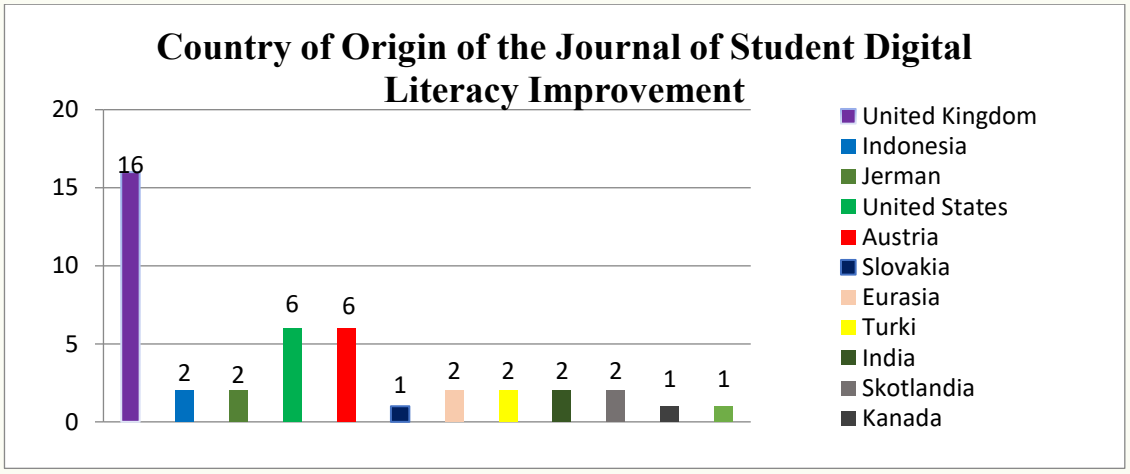

Figure 4. Country of Origin of the Journal of Student Digital Literacy Improvement

The data presented in figure 4 shows that United Kingdom is the country that publishes the most articles on improving students' digital literacy, namely 16 articles published in the period 2014-2024 in the '*Journal Of Physics: Conference Series*'. Then followed by the United States and Austria as the second place with the number of published journals each being 6 articles. Then there are Indonesia, Germany, Eurasia, Turkey, India, and Scotland with the number of published articles is 2 articles each. As well as Slovakia, Canada, and Italy with the number of published journals each being 1. This result is in line with research (Mutohhari et al., 2021), where the United Kingdom, Australia and the United States are countries that emphasize digital skills as a basic skill that must be acquired by every citizen. Based on this data, it is known that Asian countries, especially in Indonesia, still have relatively few journal publications with the theme of digital literacy skills published internationally because in the year span between 2014-2024 there is only one published article, so that the theme can be an opportunity for research to be carried out and published internationally.

d. Author

Every published article certainly has author data in each article. To find out the relationship between authors contained in the existing PoP reference database, visualization was carried out for 42 articles that had passed the filtering using *the VOSviewer* application. For more details, you can see the picture below.

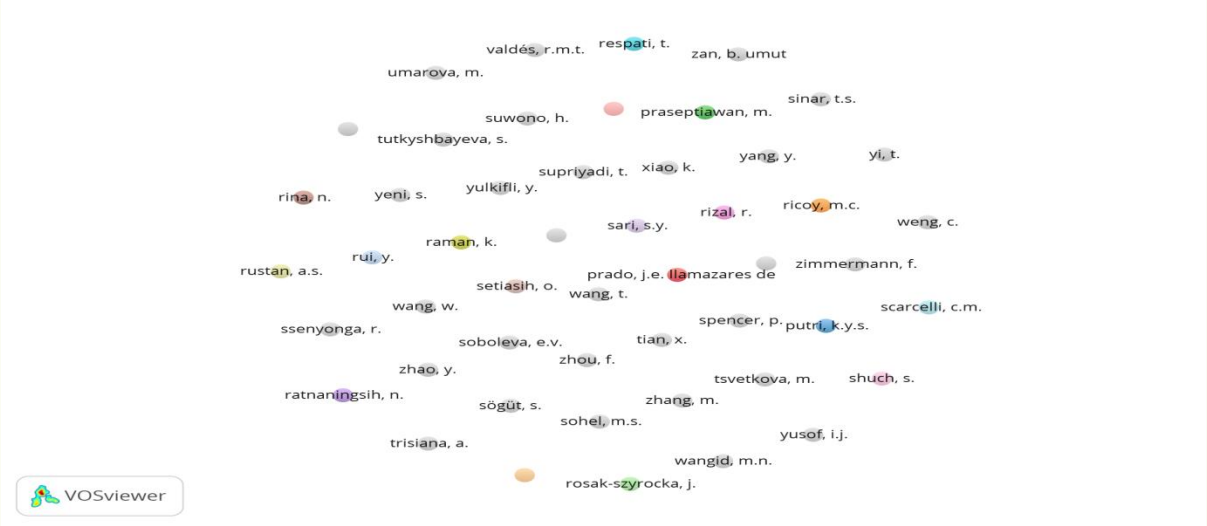

Figure 5. Popular Author of 42 Articles

The data obtained from the visualization presented in figure 5 shows that no two authors are the same in the 42 articles. There are several researchers such as Supriyadi, Sari, Rahmadi, Ratnaningsih and others are authors from Indonesia, this identifies that the opportunity to conduct more in-depth research on improving students' digital literacy in Indonesia is very high. However, it is very unfortunate because even though there are several researchers from Indonesia, the publication of the journal is not carried out in Indonesia, there are only two articles that have been detected internationally from the journal '*International Journal Of Evaluation And Research In Education*'.

e. Analysis of Frequently Occurring Words

The data obtained from the PoP application is then stored in RIS format which will then be analyzed bibliometrically using *the VOSviewer* application for further bibliometric analysis. The data image from the bibliometric analysis using *the VOSviewer* application is shown in figure 6.

Online ISSN 2655-2450 | Print ISSN 2655-2388

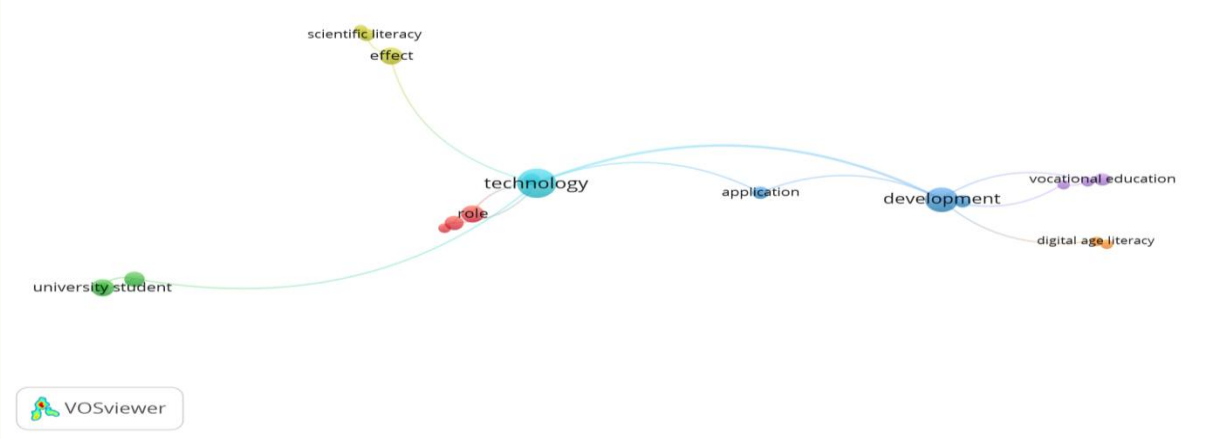

Figure 6. *Circles Network Visualization*

The size of the circle in each term that appears will be different according to how often the term appears or not, the more often the term appears in the title or abstract, the larger the size of the circle and vice versa. The results of the accumulation of PoP applications and *Vosviewer* show clusters with various themes that are connected to the network in a coherent manner.

The results of data analysis based on figure 6 show that there are 7 clusters consisting of 19 themes related to improving students' digital literacy, namely, cluster 1, which is a cluster characterized by red color consisting of 3 themes, namely, *competency, digital skill, role*. Cluster 2 is a cluster characterized by green color consisting of 3 themes, namely, *cross sectional study, relationship, university student*. Cluster 3 is a cluster characterized by blue consisting of 3 themes, namely, *application, development, mobile technology*. Cluster 4 is a cluster characterized by yellow color consisting of 3 themes, namely, *e module, effect, scientific literacy*. Cluster 5 is a cluster characterized by purple consisting of 3 themes, namely, *physics, STEM, vocational education.* Cluster 6 is a cluster characterized by light blue color consisting of 2 themes, namely, *case study, technology.* Cluster 7 is a cluster characterized by orange color consisting of 2 themes, namely, *digital age, literacy, effectiveness.*

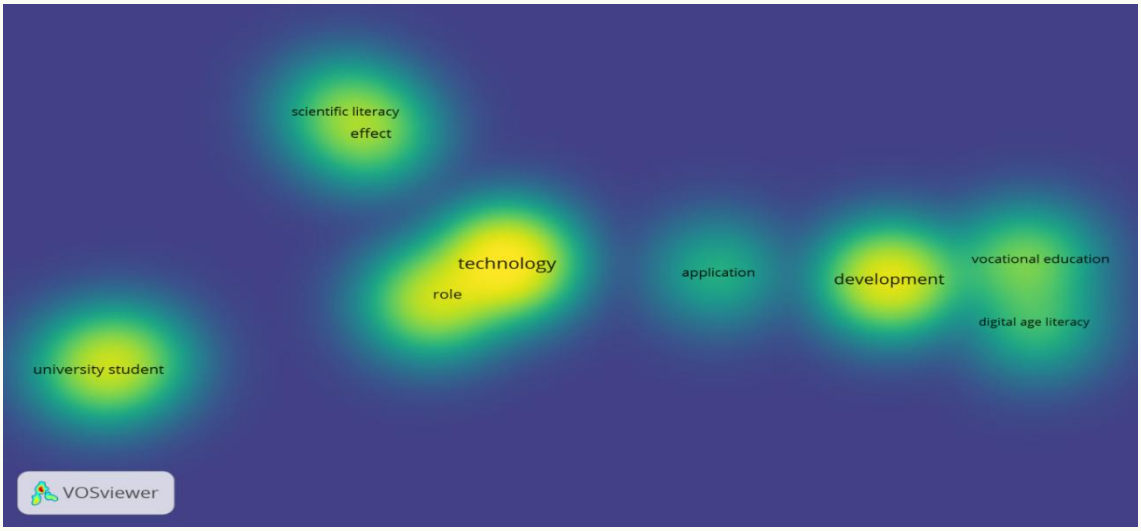

Figure 7. *Density Visualization*

The results of density visualization using *the VOSviewer* application in figure 7 show that the semi-bright yellow color and the larger the circle of a term, the term means that it often appears in a quote (Sudarnono et al., 2024). Research that uses the terms '*technology*' and '*development*' has the highest number of studies based on the results of density visualization that has been carried out. Meanwhile, *'university student'*, *'application'*, *'role'*, *'scientific literacy'*, and *'effect'* have a dimmer color than other terms which shows that these terms are still rarely researched and have the opportunity to become the latest theme in development research.

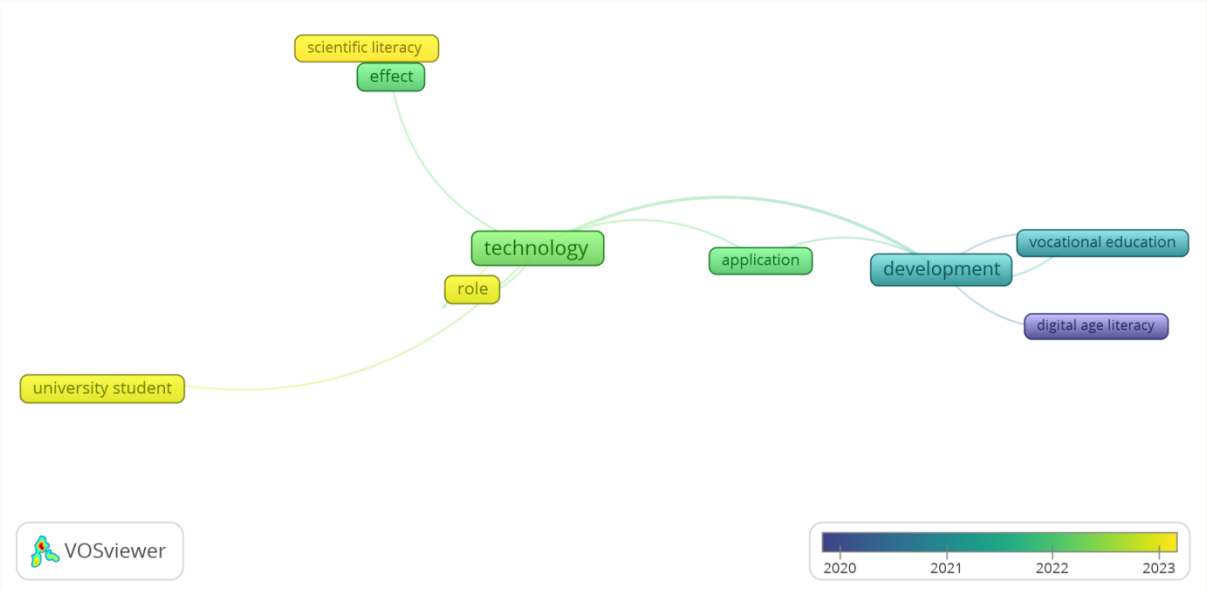

Figure 8. *Frames Overlay Visualization*

Online ISSN 2655-2450 | Print ISSN 2655-2388

Figure 8 shows the results of *Frames Overlay Visualization* on the research theme in Scopus-indexed journals seen from the year of publication. Based on the image, it can be seen that the purple tissue shows the oldest publication year and the yellow tissue shows the most recent publication year. So from the data, it can be interpreted that the theme of *'effect', 'technology',* and *'application'* is a light green theme. Meanwhile, *'scientific literacy', 'role',* and *'university student'* are the latest themes related to improving students' digital literacy.

The results of the analysis that have been carried out based on *Frames Overlay Visualization* and *Density Visualization* have terms such as *'scientific literacy', 'application', 'effect', 'role',* and *'university student'* which shows that these terms or themes are still rarely researched. So that these themes can be a novelty and reference material in conducting further development research.

Based on the results of bibliometric analysis conducted from 2014 to 2024, it can be concluded that the increase in student digital literacy from year to year continues to increase in the field of education. The development and use of technology that is increasingly widespread among the community not only affects the way of interacting with others, but also affects all existing sectors, including the education sector. This development is inseparable from the demands of 21st century skills in the form of communication skills, digital literacy, problem-solving skills, creative and critical thinking skills (Kateryna et al., 2020).

The development of ICT that is increasingly developing today has resulted in a new revolution in various sectors of life. The education sector is one of the sectors that has undergone a significant evolution of changes in the education system. The development of ICT has many positive impacts on the education sector, such as increasing digital literacy for students and educators (Reddy et al., 2020). Increasing the digital literacy of students and educators can occur with the support of available facilities and infrastructure. Therefore, to improve students' digital literacy, teachers must play an active role in the application of communication technology in learning activities (Umut Zan et al., 2020). The application of technology in learning activities can be done by using electronic devices that can support it, such as the use of electronic books, technology-based learning media, online simulations (PheT Simulation), interactive games, and so on (Buchholz et al., 2020).

Digital literacy is a necessary ability to communicate, collaborate, and manage information through practical communication information systems (Bekmanova et al., 2021). The transformation of the current educational environment requires educators to be able to provide initial learning about digital literacy as the formation of competencies needed by students (Zabolotska et al., 2021). Therefore, the learning process must be juxtaposed with digital understanding to hone students' ability to think creatively and critically to achieve the expected results (Rizal et al., 2021). The

use of technology in the learning process is expected to make learning activities more meaningful and allow a wider communication process to occur (Susanto et al., 2020).

The development of digital literacy has great potential in improving experience, understanding, and skills in the field of technology today. Previous research has shown that the development of digital literacy in the learning process can enrich students' learning experience, making learning materials more interesting and easy to understand (Dewi et al., 2022). In addition, the trend of increasing the publication of articles on improving digital literacy shows an increasing interest in research in exploring the potential of effective learning media. By continuing to develop digital literacy-based learning media, it is hoped that it can become an alternative in the learning process, and can improve students' overall abilities.

Therefore, improving students' digital literacy is something that must be analyzed and researched in more depth based on a review of existing literature studies and research that will be carried out so that we can find out the improvement of students' digital literacy in the international arena. The use of digital technology as a learning medium can also overcome the problem of space and time limitations in learning activities because this technology-based learning media can be accessed anytime and anywhere by students.

4. Conclusion

This research was conducted to analyze the improvement of students' digital literacy bibliometrically using the Scopus database through the PoP application and then processed using *the VOSviewer* application. The results of literature search on the PoP application were obtained from 42 research articles published in the range of 2014 to 2024. Based on the results of the analysis that has been carried out, it shows that the increase in student digital literacy in Scopus-indexed journals in the period from 2014 to 2024 is not too volatile, a significant increase occurred from 2020 to 2021 and at the same time became the peak of the most publications. Meanwhile, from 2021 to 2024, the number of article publications has decreased. The journal that contains the most articles about improving students' digital literacy is *the Journal Of Physics: Conference Series*. The country that publishes the most journals about the trend of increasing students' digital literacy is the United Kingdom. An article on the trend of increasing students' digital literacy shows the increasing research interest in exploring the potential of effective learning media. By continuing to develop technology-based learning media, it is hoped that it can become an alternative in the learning process, and can increase students' interest and learning outcomes. The results of the analysis that have been carried out using *VOSviewer* show several

Online ISSN 2655-2450 | Print ISSN 2655-2388

themes about the use of comic-based physics learning media such as *'university student', 'application', 'role', 'scientific literacy',* and *'effect'* which are still rarely researched and are the latest themes in research. So that a conclusion can be drawn that the improvement of students' digital literacy still needs to be researched again so that there is a great opportunity to become a novelty and reference in conducting further development research.

References

Ayu, F. B., & Risdianto, E. (2023). Bibliometric Analysis: Application of Blended Learning in the Development of Digital Skills in the Era of Digital Education. *JENTIK : Jurnal Pendidikan Teknologi Informasi dan Komunikasi*, 2(2), 43–47. https://doi.org/10.58723/jentik.v2i2.226

Bekmanova, G., Ongarbayev, Y., Somzhurek, B., & Mukatayev, N. (2021). Personalized training model for organizing blended and lifelong distance learning courses and its effectiveness in Higher Education. *Journal of Computing in Higher Education*, *33*(3), 668–683. https://doi.org/10.1007/s12528-021-09282-2

Buchholz, B. A., DeHart, J., & Moorman, G. (2020). Digital Citizenship During a Global Pandemic: Moving Beyond Digital Literacy. *Journal of Adolescent and Adult Literacy*, *64*(1), 11–17. https://doi.org/10.1002/jaal.1076

Dewi, C. A., Awaliyah, N., Fitriana, N., Darmayani, S., Nasrullah, Setiawan, J., & Irwanto, I. (2022). Using Android-Based E-Module to Improve Students' Digital Literacy on Chemical Bonding. *International Journal of Interactive Mobile Technologies*, *16*(22), 191–208. https://doi.org/10.3991/ijim.v16i22.34151

Dinata, K. B. (2021). Analysis of Students' Digital Literacy Ability. *Edukasi: Journal of Education*, *19*(1), 105–119. https://doi.org/10.31571/edukasi.v19i1.

Effendy, F., Gaffar, V., Hurriyati, R., & Hendrayati, H. (2021). Bibliometric Analysis of the Development of Research on the Use of Mobile Payments with Vosviewer. *Journal of Interkom: Journal of Scientific Publications in the Field of Information and Communication Technology*, *16*(1), 10–17. https://doi.org/10.35969/interkom.v16i1.83

Karuniawan, A., & Risdianto, E. (2023). Bibliometric Analysis of Online Learning in the Era of Technological Progress. *LARVA : Journal of Information and Communication Technology Education*, 2(2), 48–53. https://doi.org/10.58723/jentik.v2i2.227

Kateryna, A., Oleksandr, R., Mariia, T., Iryna, S., Evgen, K., & Anastasiia, L. (2020). Digital literacy development trends in the professional environment. *International Journal of Learning, Teaching and Educational Research*, *19*(7), 55–79. https://doi.org/10.26803/ijlter.19.7.4

Malina, I., Yuliani, H., & Syar, N. I. (2021). Analysis of the Needs of Physics E-Module as PBL-Based Teaching Materials at MA Muslimat NU. *Syllabus Journal of Physical Science Education*, *3*(1), 70–80. https://doi.org/10.31540/sjpif.v3i1.1240

Mutohhari, F., Sutiman, S., Nurtanto, M., Kholifah, N., & Samsudin, A. (2021). Difficulties in implementing 21st century skills competence in vocational education learning. *International Journal of Evaluation and Research in Education*, *10*(4), 1229–1236. https://doi.org/10.11591/ijere.v10i4.22028

Rahmawati, S., Rachmani, N., & Nino, D. (2022). Literature study: students' mathematical connection ability in hybrid learning is reviewed from gender with a ICT-assisted preprospec learning model. *Prisma, Proceedings of the National Seminar on Mathematics*, *5*, 423–430. https://doi.org/https://journal.unnes.ac.id/sju/index.php/prisma/

Reddy, P., Sharma, B., & Chaudhary, K. (2020). Digital literacy: A review of literature. *International Journal of Technoethics*, *11*(2), 65–94. https://doi.org/10.4018/IJT.20200701.01

Rini, R., Suryadinata, N., & Efendi, U. (2022). Literasi digital mahasiswa dan faktor-faktor yang berpengaruh. *Jurnal Akuntabilitas Manajemen Pendidikan*, *10*(2), 171–179. https://doi.org/10.21831/jamp.v10i2.48774

Ririen, D., & Daryanes, F. (2021). Analisis Kemampuan Literasi Digital Mahasiswa. *Edukasi: Jurnal Pendidikan*, *19*(1), 105. https://doi.org/10.31571/edukasi.v19i1.2499

Rizal, R., Rusdiana, D., Setiawan, W., & Siahaan, P. (2021). Development of a problem-based learning management system-supported smartphone (PBLMS3) application using the ADDIE model to improve digital literacy. *International Journal of Learning, Teaching and Educational Research*, *20*(11), 1Rini, R., Suryadinata, N., & Efendi, U. (2022). Student digital literacy and influencing factors. *Journal of Educational Management Accountability*, *10*(2), 171–179. https://doi.org/10.21831/jamp.v10i2.48774

Ririen, D., & Daryanes, F. (2021). Analysis of Students' Digital Literacy Skills. *Education: Journal of Education*, *19*(1), 105. https://doi.org/10.31571/edukasi.v19i1.2499

Rizal, R., Rusdiana, D., Setiawan, W., & Siahaan, P. (2021). Development of a problem-

Online ISSN 2655-2450 | Print ISSN 2655-2388

based learning management system-supported smartphone (PBLMS3) application using the ADDIE model to improve digital literacy. *International Journal of Learning, Teaching and Educational Research*, *20*(11), 115–131. https://doi.org/10.26803/ijlter.20.11.7

15–131. https://doi.org/10.26803/ijlter.20.11.7

Rodríguez, A., Cáceres Reche, M., & Alonso Garcia, S. (2018). The digital competence of the future teacher: bibliometric analysis of scientific productivity indexed in Scopus. *IJERI: International journal of Educational Research and Innovation*, *0*(10), 317–333. https://doi.org/https://doi.org/10.33407/itlt.v91i5.5048

Saputra, H. N., & Salim, S. (2020). Portrait of Student Attitudes in the Use of Digital Literacy. *Journal of Educational Communication*, 4(2),94. https://doi.org/10.32585/jkp.v4i2.667

Sudarnono, Ida, M., & Burhanuddin. (2024). Development of Mobile Learning Based on Local Wisdom: Bibliometric Analysis. *PenKoMi Journal: Education and Economic Studies*, *7*(1), 66–77. https://doi.org/https://doi.org/10.33627/pk.v7i1.1672

Supinah, R., & Soebagyo, J. (2022). Bibliometric Analysis of ICT Usage Trends in Mathematics Learning. *JNPM (National Journal of Mathematics Education)*, *6*(2), 276. https://doi.org/10.33603/jnpm.v6i2.6153

Susanto, R., Rachmadtullah, R., & Rachbini, W. (2020). Technological and pedagogical models: Analysis of factors and measurement of learning outcomes in education. *Journal of Ethnic and Cultural Studies*, *7*(2), 1–14. https://doi.org/10.29333/ejecs/311

Syabaruddin, A., & Imamudin, I. (2022). Implementasi Literasi Digital Di Kalangan Mahasiswa. *Jurnal Eduscience*, 9(3), 942–950. https://doi.org/10.36987/jes.v9i3.3447

Umut Zan, B., Çolaklar, H., Altay, A., & Taşkın, N. (2020). A Study on Digital Literacy Skills of Faculty of Letters Students: Use of University Library. *International Journal of Emerging Technologies in Learning*, *16*(1), 152–171. https://doi.org/10.3991/IJET.V16I01.16567

Zabolotska, O., Zhyliak, N., Hevchuk, N., Petrenko, N., & Alieko, O. (2021). Digital competencies of teachers in the transformation of the educational environment. *Journal of Optimization in Industrial Engineering*, *14*(1), 43–50. https://doi.org/10.22094/JOIE.2020.677813