3. Research Trends of Student Scientific Literacy Assessment to Support Quality Education.pdf

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RESEARCH TRENDS OF STUDENT SCIENTIFIC LITERACY ASSESSMENT TO SUPPORT QUALITY EDUCATION

Muhammad Novaldy Nur Dwinanda Wahab [1]
Wasis [2]
Binar Kurnia Prahani [3]
Henny Ekawati Haryono [4]
Budi Jatmiko [5]

ABSTRACT

Objective: The objective of this research was to analyze the last ten years student scientific literacy assessment research document growth, document, type, subject area, top contributed authors, sources, and country, language used, top affiliation, and funding sponsor, then review top cited documents, and visualization mapping of research trends.

Background: Scientific literacy has become one of the most discussed topics in science education. It needs some effort to understand the trends and research development to support and focus on these trends. Improvement scientific literacy also can contributed to support SDGs Quality of Education.

Method: This research used bibliometrics analysis. The metadata that used in this research is Scopus database with 591 documents, and mapping applications using VOSviewer.

Research Findings: The result shows that document growth is fluctuative, the most common document type was Article, social sciences was the most subject area. Archilla, P. A. and Rahayu, S. is the top contributed author, Aip Conference Proceedings and Journal of Physics Conference Series is the top contributed sources, while USA is the top contributed country followed by Indonesia. English was the most used language, Universitas Negeri Malang is the top listed affiliation with 19 documents, and National Science Foundation is the top listed funding sponsor. Hu *et al*. (2018) was the top cited documents Mapping of research trends shows these topics was strong connection to teaching and education, but weak connection to climate change and environmental educations

Research Recommendations: Integrating scientific literacy assessment with climate change and environmental education are worth to support SDGs quality of education. It can bring more valuable insight to understanding more complex environmental issues in real world situations.

Research Implications: This research can be used for others researchers to help find new idea to conducting further research in student scientific literacy assessment.

Keywords: assessment, bibliometrics, education, scientific literacy, Sustainable Development Goals (SDGs).

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[1] Universitas Negeri Surabaya, Surabaya, Indonesia.
E-mail: muhammad.novaldy.ndw@gmail.com
[2] Universitas Negeri Surabaya, Surabaya, Indonesia. E-mail: wasis@unesa.ac.id
[3] Universitas Negeri Surabaya, Surabaya, Indonesia. E-mail: binarprahani@unesa.ac.id
[4] Universitas Negeri Surabaya, Surabaya, Indonesia. E-mail: 24030966007@mhs.unesa.ac.id
[5] Universitas Negeri Surabaya, Surabaya, Indonesia. E-mail: budijatmiko@unesa.ac.id

1 INTRODUCTION

The development of technology and information requires each individual to develop further. It is important to develop the abilities that are owned, in order to compete competitively both locally and internationally. One of the abilities that needs to be developed especially for students in high school is scientific literacy. The definition of scientific literacy itself has evolved over time. Paul de Hurd put forward the definition of scientific literacy as cognitive capacity to utilize scientific/technological information in human affairs and for social and economic progress (Hurd, 1998). Miller argues that scientific literacy is defines scientific literacy in the "contemporary situation" (i.e., in today's scientific and technological society) as consisting of three dimensions: (a) understanding of the norms and methods of science (i.e., the nature of science); (b) understanding of key scientific terms and concepts (i.e., science content knowledge); and (c) awareness and understanding of the impact of science and technology on society (Miller, 1983). Meanwhile, Shen put forward three categories of scientific literacy, namely practical scientific literacy, civic literacy, and cultural literacy (Shen, 1975).

Programme International Student Assessment (PISA) generally summarizes that scientific literacy is the ability to engage with science-related issues, and with scientific ideas (*PISA 2018 Science Framework*, 2019). PISA Science Framework has set 3 indicators of students' scientific literacy skills through the PISA Science Framework, namely explaining phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically (*PISA 2018 Science Framework*, 2019). Due to various definitions of scientific literacy, it is not surprising that there's also a various way to measure scientific literacy (R. Laugksch, 2000), commonly referred to as scientific literacy assessment.

PISA conducts a routine global literacy assessment every 3 years. The latest PISA assessment that has been carried out and published was carried out in 2022 (OECD, 2023). Other researchers also try to develop through various research studies to create a scientific literacy test measurement tool. Lippi *et al*. discover 43 documents from 1990-2020 in English, Portuguese, and Spanish

language, who contained the instrument that used to measure scientific literacy (Coppi *et al.*, 2023). After create an analysis using SLR, there's 5 instrument that most frequently used, namely TBSL (R. C. Laugksch & Spargo, 1996; Ozdem Yilmaz *et al.*, 2010), TOSLS (Cartwright *et al.*, 2020; Čipková *et al.*, 2020), SLA (Fives *et al.*, 2014; Rachmatullah *et al.*, 2016), GSLQ (Mun *et al.*, 2015; Pramuda *et al.*, 2019), and ScInqLiT (Innatesari *et al.*, 2019; Wenning, 2007).

Nowadays in literature review, there's a trend that can visualize the trend of research that used bibliometric analysis with the assist of VOSviewer. This type of analysis, assesses research data trends, publication patterns, and citation overview. Bibliometric analysis can be used to find out the top cited authors and sources, as well as collaborate the research across institutions and countries (Perianes-Rodriguez *et al.*, 2016; van Eck & Waltman, 2014). Bibliometrics is commonly used to track the growth of scientific fields, highlight emerging topics, and measure academic impact, and research endeavors (Martins *et al.*, 2024; Yu *et al.*, 2020). Additionally, bibliometrics is used to figure out the keyword pattern that is usually used to find a new novelty idea for research (Misbah *et al.*, 2022; Nordin, 2022). In the terms of scientific literacy, there is a various research bibliometrics in a last couple years. Some examples are bibliometrics analysis about scientific literacy in primary education (Kutlu-Abu *et al.*, 2024a), bibliometrics analysis about studies on scientific literacy in primary education (Kutlu-Abu *et al.*, 2024b), bibliometrics analysis about scientific literacy in science and physics education (Effendi *et al.*, 2021), and bibliometrics analysis about scientific literacy assessment in 2019-2023 (Hadiastriani & Djarot, 2024). However, there still lack of number research that discuss connection of scientific literacy assessment with SDGs component to enhance quality of education in terms bibliometrics analysis.

According to the explanation above, the researcher feels the needs for conduct a research in the topics of scientific literacy assessment, and also bibliometrics analysis with VOSviewer, but with a bit specific topic that focused on student scientific literacy assessment and find the connection to the SDGs. Especially due to condition in researcher's country, where the student scientific literacy skills are still relatively low (Ashari *et al.*, 2023; Nasor *et al.*, 2023; Saraswati *et al.*, 2021; Shohib *et al.*, 2021; Wahab *et al.*, 2023). Hopefully the

more scientific literacy research is conducted, the more beneficial effects it can have on Indonesia's scientific literacy development. However, in this study will conduct a bibliometrics analysis using Scopus database using the assist of VOSviewer to create a mapping of research trends in the term of student scientific literacy assessment in last decade time period (2014-2024). This research aims to identify patterns, research trends, uniqueness, and future education in the student scientific literacy assessment topic. The objectives of this research are as follows:

1) To illustrate the research document growth by year;
2) To identify the document type and subject area;
3) To analyze the top contributed author, sources, and countries;
4) To identify the top language used, author affiliation, and funding sponsor;
5) To analyze the top cited documents;
6) To illustrate the keywords mapping network visualization.

2 THEORETICAL FRAMEWORK

Scientific literacy or science literacy is the ability to engage with science-related issues, and with scientific ideas. Where there are 3 indicators of science literacy competency: 1) explaining phenomena scientifically; 2) evaluating and designing scientific investigations; 3) interpreting scientific data and evidence. PISA explain that scientific literacy influenced by individual content knowledge, procedural knowledge, and epistemic knowledge. PISA divided scientific literacy context into 3 context namely: personal; local or national; and global (OECD, 2019; *PISA 2018 Science Framework*, 2019).

PISA divided scientific literacy abilities into a level, which start from 1b-6. Every single level had their own characteristics. It can be seen on the following explanation where PISA explain each level characteristics (OECD, 2023).

a. Level 1b (score 261-334): Students at Level 1b can identify common or simple phenomena by applying basic scientific knowledge. They can recognize simple patterns in data, comprehend fundamental scientific

terms, and carry out scientific activities by adhering to precise instructions;

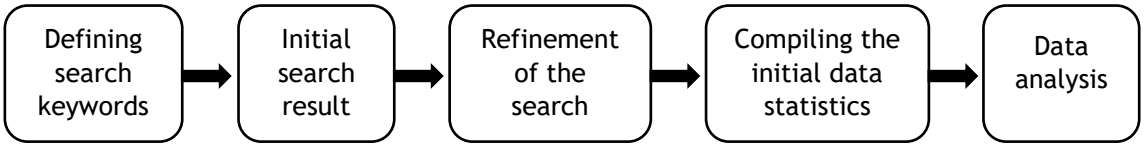
b. Level 1a (score 335-409): Students at Level 1a exhibit the capacity to use fundamental procedural knowledge and content knowledge to find explanations for straightforward scientific phenomena. They can conduct guided scientific studies with a maximum of two variables;
c. Level 2 (score 410-484): At Level 2, students select appropriate scientific explanations, interpret data, and understand the goal of a basic experimental design by applying common knowledge and fundamental procedural skills;
d. Level 3 (score 485-559): At Level 3, students are able to identify or create explanations for well-known phenomena by using their somewhat complicated content knowledge. They can create explanations with pertinent cueing or help in unfamiliar or complex situations;
e. Level 4 (score 560-632): At Level 4, students can create explanations of more complicated or unfamiliar events and processes using more abstract or sophisticated content knowledge that has been either supplied or remembered. They can carry out studies in a limited setting with two or more independent variables;
f. Level 5 (score 633-707): At Level 5, students can describe new and complicated events, processes, and phenomena involving several causal links using abstract scientific ideas or concepts. They can employ theoretical knowledge to analyze data or make predictions, and they can apply more advanced epistemological knowledge to assess different experimental designs and defend their decisions;
g. Level 6 (score 708 and above): At Level 6, students can use content, procedural, and epistemic knowledge to offer explanatory hypotheses of novel scientific phenomena, events, and processes or to make predictions by drawing on a variety of interrelated scientific ideas and concepts from the physical, biological, earth, and space sciences.

3 METHODOLOGY

Bibliometrics analysis is very useful for describing the current research trends because it provides an overview of the existing data literature. By spotting patterns in educational research and guaranteeing that everyone has access to scientific knowledge, bibliometric approaches are especially pertinent in advancing the goals of SDG 4: Quality Education. Because of its ability to comprehensively map the traits and advancements of research findings in particular domains, bibliometric analysis has gained popularity in recent years. In this research, the researcher will analyze and represent the metadata gathered from the Scopus database (www.scopus.com) (Donthu *et al.*, 2021; Mishra *et al.*, 2021; Zhao & Zhou, 2024). The Scopus database was selected because it is the largest academic database, complete with various information data from scientific research articles (Echchakoui, 2020; Zhou, 2024), which makes it useful for visualizing and analyzing publications. There are 5 stages research procedures of this bibliometrics research, it can be seen in the following Figure 1 (Ari Masitoh *et al.*, 2021; Fahimnia *et al.*, 2015; Ilhami *et al.*, 2019; Schmeisser, 2013; Setyaningsih *et al.*, 2018).

Figure 1

Research Procedures



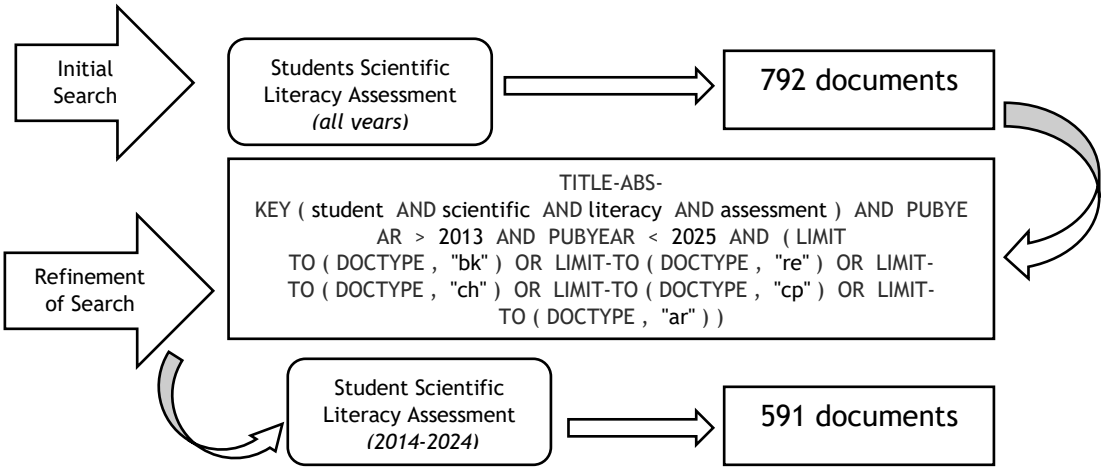
Source: Adapted from (Prahani *et al.*, 2022)

This study is to examine the features of publications and research trends in the area of student scientific literacy assessment over a ten-year period using bibliometric analysis. First step to collect the data from the Scopus database is defining a search keywords, the keywords that used is “TITLE-ABS-KEY (student AND scientific AND literacy AND assessment)”. The initial search result was carried out on November 22nd, 2024 with the result of documents obtained a number of 792 documents. Then, the researcher did a refinement of the search to filtered the documents with a limit year between 2014-2024, and also limited

the document types with “article”, “conference paper”, “book chapter”, “review”, and “book”. It was 591 documents fulfilled the searching criteria from 792 documents of whole years (see Figure 2.). After obtained the statistical data from the Scopus database, all of the data were downloaded to the file format of .ris and .csv and proceed for further analysis using the VOSviewer application to create an mappings of publications, countries, citations, keywords, and authors of research trends in students scientific literacy assessment research (Donthu *et al.*, 2021; Hamidah *et al.*, 2020; van Eck & Waltman, 2014; Zhou, 2024).

Figure 2

Research Flowchart



Source: Adapted from (Suprapto *et al.*, 2021)

4 RESULTS AND DISCUSSIONS

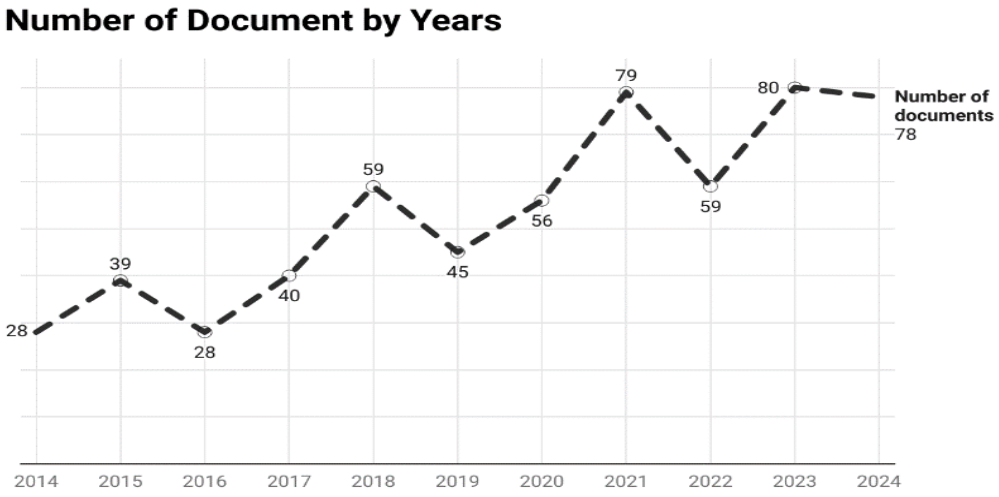
4.1 STUDENT SCIENTIFIC LITERACY ASSESSMENT RESEARCH GROWTH BY YEARS

The number of documents distribution in each year during last decade (2014-2024) can be seen in the following Figure 3. It can be seen, the development of student scientific literacy assessment during 2014-2016 has a fluctuative. There’s a high increase during period of 2016-2018 where the increase number of documents in 2018 is doubled, from 28 documents a year to 59 documents a year. But in the next year (2019) the number of documents is decreased to 45 documents a year, it maybe caused due to a pandemic covid-

19 effect. In the following year, there's another high increase during period 2019-2021 where the number of documents raised from 45, to 56 and 79 documents a year. In 2022, there's a decreased number of documents with 59 documents and after that the highest number of documents a year in student scientific literacy assessment is on 2023 where there's a 80 documents. This year (ongoing) there's already 78 number of documents where there's still a possibility to increased in the end of year on December. Based on this data, it clearly shows further research the researcher needs extra effort to find a new novelty idea in student scientific literacy assessment.

Figure 3

Documents Growth Last Decade in Student Scientific Literacy Assessment Research



Source: Scopus Database

4.2 DOCUMENT TYPE, SUBJECT AREA

Table 1 show the number of documents based on each document type and subject area. In the terms of document type, after analyze the Scopuse databased from 591 documents obtained article is the most common used document type with 394 number of documents. Then, in the second place Conf. Paper is the 2nd most common used document type with 129 number of documents. After that, book chapter, review, and also book is the rest following used document types.

In the terms of subject area, Social Sciences is the top contributed subject in student scientific literacy topic with 42,1% number of documents from 591 documents Scopus database, it happens due to student scientific literacy assessment topics had closed relationship with education, teaching (Suárez-Mesa & Gómez, 2024). The second top contributed subject area is Physics and Astronomy with 9,3%, this subject related to the content knowledge just like PISA stated in their framework (*PISA 2018 Science Framework*, 2019; Rohmatika & Ibrohim, 2024). In the third place, there's Psychology subject area with 6,3%. This subject related with scientific literacy in terms of student self-development (Cao *et al.*, 2024). After that, Computer Science and Engineering is the rest following subject area, that have a relationship with STEM (Singer *et al.*, 2024).

Table 1

Current Number of Document Research Based on Document Type and Subject

Document Type Type	Total	Subject Area Subject	%
Article	394	Social Sciences	42,1
Conf. Paper	129	Physics and Astronomy	9,3
Book Chapter	38	Psychology	6,3
Review	16	Computer Science	5,7
Book	14	Engineering	5,5

Source: Scopus Database

4.3 TOP CONTRIBUTED AUTHORS, SOURCES, COUNTRIES

Table 2, shows the top 10 contributed authors and sources in student scientific literacy assessment research topics. The top contributed authors with six documents are Archila, P.A. and Rahayu, S. Then, Cid; Coppi; Fialho; Lavonen; and Truscoot de Mejia with five documents. The rest of the following top authors with four documents are Le Hebel; Lin; and Montpied. Meanwhile, the top 10 contributed sources were led by Aip Conference Proceedings and the Journal of Physics Conference Series with 40 documents. Then, the rest following top contributed sources are International Journal of Science

Education, Journal of Chemical Education, ASEE Annual Conference and Exposition Conference Proceedings, and etc.

These findings are in line with the previous section where the Article and Conf. Paper are in the top two list. Figure 4 shows the map illustrated top countributed countries around the world from that analyzed from 591 documents Scopus database in this research. As we can seen, USA (181) and Indonesia (108) are the top two list countries based on number of documents. Meanwhile, China; Australia; Germany; Spain, etc. are the next following listed.

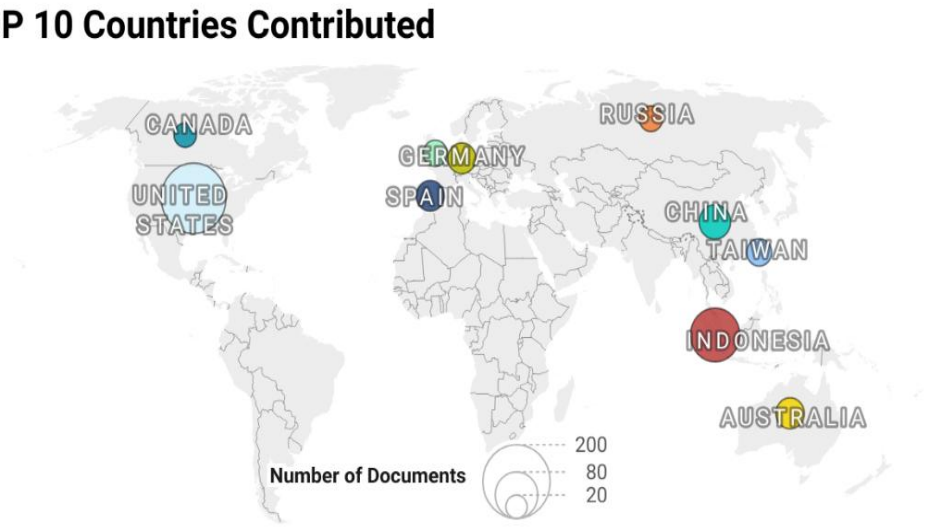
Table 2

Top Contributed Authors and Sources

Top Authors Author	Total	Top Sources Sources Title	Total
Archila, P. A.	6	Aip Conference Proceedings	40
Rahayu, S.	6	Journal of Physics Conference Series	40
Cid, M.	5	International Journal of Science Education	25
Coppi, M.	5	Journal of Chemical Education	16
Fialho, I.	5	ASEE Annual Conference and Exposition Conference Proceedings	13
Lavonen, J.	5	Journal of Microbiology and Biology Education	10
Truscott de Mejia, A. M	5	Education Sciences	9
Le Hebel, F.	4	Obrazovanie I Nauka	9
Lin, H. S.	4	Eurasia Journal of Mathematics Science and Technology Education	8
Montpied, P.	4	Journal of Research in Science	8

Figure 4

Top Contributed Countries



Source: Scopus Database

4.4 TOP LANGUAGE, AUTHORS AFFILIATION, AND FUNDING SPONSOR

In the following Table 3, the researcher identified the top language used, top affiliation, and also top funding sponsor in student scientific literacy assessment research during last decade from 2014-2024. English is the top used language as we can seen there's 548 documents/articles that written in English. It happens due to English as the main language that commonly used in various journal sources, it can be said that English as the main language that used in scientific research. Other language had a significantly fewer contribution such as Russian 17, Spanish 13, and Chinese with 9 documents/articles. Meanwhile the others have minor participants include Portuguese and Czech with 2, then Slovenian, German, French, and Croatian with 1 document/article.

Next, in the top affiliation there's four University that come from Indonesia. Consist of Universitas Negeri Malang as the number one list with 19 documents/articles. Then, Universitas Pendidikan Indonesia in the number three with 14 equals with National Taiwan Normal University. After that, on number four list Universitas Negeri Yogyakarta with 10, and Universitas Negeri Padang at number six with 9 documents/articles. Meanwhile, the rest of others top affiliation are come from USA namely Arizona and Michigan State University, and then from Germany (Leibniz Institute), Portugal (University of Evora), and Finland (Helsingin Yliopisto).

After that, in this section the researcher identified the top funding sponsor. In the number one list there is National Science Foundation from USA with total number of documents/articles 34. On the top two Fundação para a Ciência e a Tecnologia equals with Ministério da Educação e Ciência from Portugal with 7 documents/articles. The following list there is Bundesministerium für Bildung und Forschung Germany equals with Ministry of Science and Technology Taiwan 6 documents/articles. Then the rest of listed, are from USA, China, and Colombia.

Table 3

Top Language Used, Top Affiliation, Top Funding Sponsor

Top Language		Top Affiliation		Top Funding Sponsor	
Language	Total	Affiliation	Total	Funding Sponsor	Total
English	548	Universitas Negeri Malang	19	National Science Foundation	34
Russian	17	National Taiwan Normal University	14	Fundação para a Ciência e a Tecnologia	7
Spanish	13	Universitas Pendidikan Indonesia	14	Ministério da Educação e Ciência	7
Chinese	9	Universitas Negeri Yogyakarta	10	Bundesministerium für Bildung und Forschung	6
Portuguese	2	Leibniz Institute for Science and Mathematics Education	9	Ministry of Science and Technology, Taiwan	6
Czech	2	Universitas Negeri Padang	9	Directorate for Education and Human Resources	5
Slovenian	1	Arizona State University	7	Institute of Education Sciences	5
German	1	University of Evora	7	Ministry of Education of the People's Republic of China	5
French	1	Michigan State University	7	U.S. Department of Education	5
Croatian	1	Helsingin Yliopisto	6	Universidad de los Andes	5

Source: Scopus Database

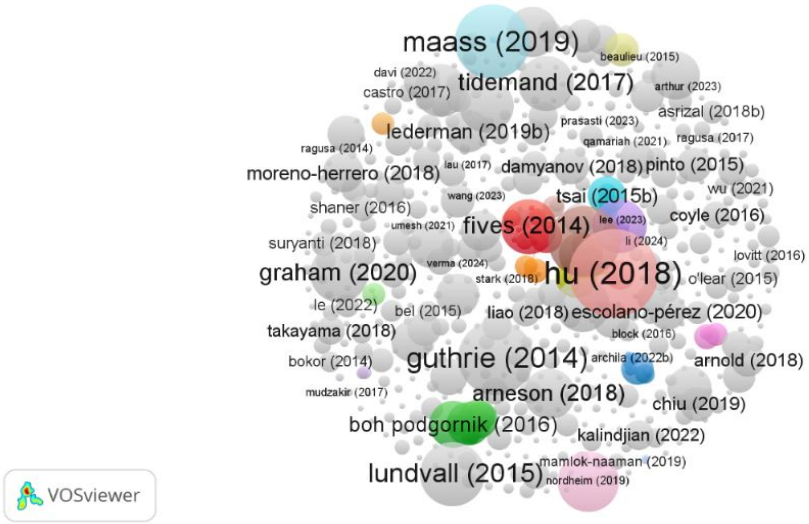
4.5 TOP CITED DOCUMENTS

From the 591 documents obtained, then the researcher conducted and analysis using VOSviewer to mapping network visualization of top cited documents. Figure 6 below show the top cited documents from 591 documents, the bigger size of node means the greather number of citations from the documents (van Eck & Waltman, 2014). *On the top three list, there's Hu et al. with 204 total citations, then Maass et al. with 149 and Guthrie & Klauda with 148 total citations. In the 4th - 6th place Reily et al. with 135 citations, Lundvall with 110 citations, Schwichow et al. 98 citations, and Graham with 88 citations. Then, the rest top cited documents are from Fives et al. 82 citations, Tidemand & Nielsen 81 citations, and Aditomo & Kleime 78 citations. These top cited research are contributing to support the SDGs in improving the quality of education, which crucials for our future. In the following Table 4, the researcher tries to review these top cited documents to find out the*

findings and recommendations that have a link with student scientific literacy topic.

Figure 5

Mapping Network Top Cited Document Visualization



Source: Scopus Database

Table 4

Review from Top Cited Documents/ Articles

Author(s)	Findings and Recomendations
Hu, X.; Gong, Y.; Lai, Chun.; Leung, F.K.K.S	ICT availability in school had a positive influence on students' attitudes and academic outcomes, whereas ICT availability at home had a negative influence on students' academic outcomes. ICT can boost student interest and curiosity, which leads to improved scientific literacy scores. The effectiveness of ICT is tied to the quality of its use, highlighting the need for teacher training and improved pedagogical approaches (Hu *et al.*, 2018)
Maass, K.; Geiger, V.; Ariza, M.R.; Goos, M.	STEM education contributes to preparing students for fostering skills such as critical analysis, ethical reasoning, and evidence-based decision-making. Effective STEM education, which integrates mathematics and science with technology and engineering, enhances scientific literacy. Curriculum development and interdisciplinary training for teachers are still needed to enhance the STEM approach to be more effective (Maass *et al.*, 2019)
Guthrie, J.T.; Klauda, S.L.	Improving scientific literacy requires more than content knowledge; it needs integrated learning that practices scientific literacy with cognitive scaffolding and motivation strategies. Motivation can engage the student's thinking skills which are important for scientific literacy understanding. CORI can be an option to be used for practicing scientific literacy (Guthrie & Klauda, 2014)
Reilly, D.; Neuman, D.L.; Andrews, G.	The underrepresentation of women in STEM fields is partly linked to gender disparities in scientific literacy, which persist but are less pronounced. Encouraging girls' interest and confidence in science should be a key focus in addressing these inequalities, especially in

Author(s)	Findings and Recomendations
	areas where the gaps are more significant. To boost participation in STEM careers, educational systems must actively work to break down gender stereotypes in science and mathematics (Reilly *et al.*, 2015)
Lundvall, S.	Scientific literacy is evolving, one example is physical literacy which has a multidimensional concept with significant implications for education and sports. Its adoption can foster more inclusive and extensive physical education. Further research is necessary to improve the potential and quality of physical education (Lundvall, 2015)
Schwichow, M.; Croker, S.; Zimmerman, C.; Höffler, T.; Härtig, H.	CVS is crucial to scientific research. It builds inquiry, critical thinking, and persuasive argumentation abilities and is a fundamental component of scientific literacy. This method can used as an effective teaching strategy that includes cognitive conflict, and tasks that actively engage students' attitudes (Schwichow *et al.*, 2016)
Graham, S.	The reciprocal relationship between reading and writing is crucial for improving literacy, but the sciences of these two domains are frequently separated in both research and practice. Researchers should prioritize research investigating the combined impacts of reading and writing on literacy development. Policymakers and educators must promote integrated literacy programs (Graham, 2020)
Fives, H.; Huebner, W.; Birnbaum, A.S.; Nicolich, M.	The SLA offers a validated tool for assessing scientific literacy in middle school students by combining demonstrated knowledge with attitudes toward science. It addresses gaps in existing measures by including motivational factors and focusing on overarching scientific processes. Through its continued development and use, the SLA enables teachers and researchers to track the progress of scientific literacy and evaluate the impact of educational interventions (Fives *et al.*, 2014)
Tidemand, S.; Nielsen, J.A	Socioscientific issues may contribute to developing student scientific literacy. There's a challenge in implementing socioscientific issues in teaching biology. Some teachers only focused on teaching the content, and not on engaging the students and facilitating them in scientific debate. Socioscientific issues can improve student argumentation skills and lead them to get meaningful learning (Tidemand & Nielsen, 2017)
Aditomo, A.; Kleime, E.	Guided inquiry can significantly benefit student scientific literacy. Guided inquiry students outperform the students who learn with free inquiry or unguided methods. The Teacher should focus on providing effective guidance during the inquiry activities. The development of assessment still needs to be refined and get the better role of guided inquiry in learning (Aditomo & Klieme, 2020)

4.6 KEYWORDS ANALYSIS MAPPING NETWORK VISUALIZATION

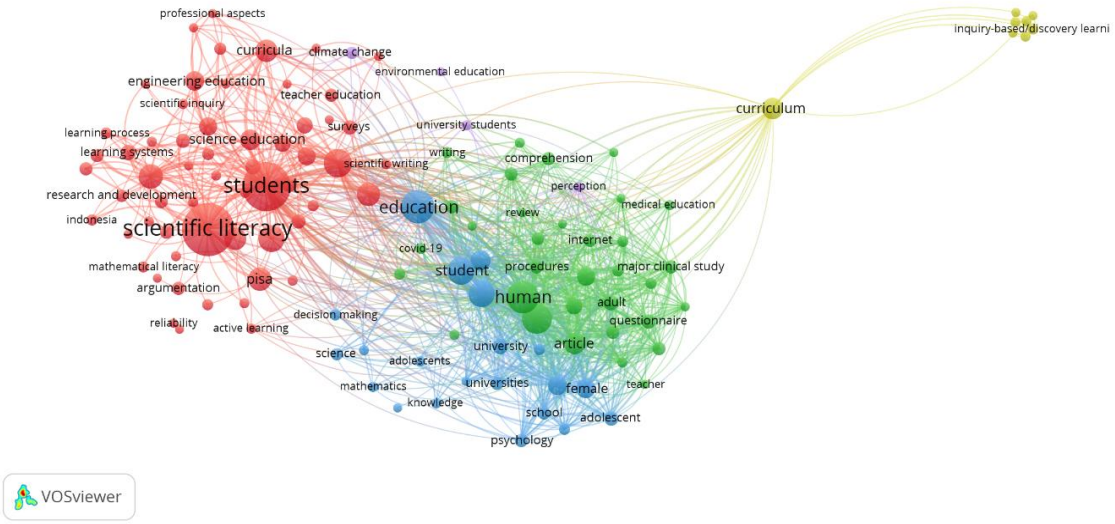
Finally in this section, the researcher tries to illustrate the trend in the last decade research about student scientific literacy assessment using VOSviewer mapping network visualization. According to co-occurrence analysis using bibliographic data from 591 scopus documents, a total of 2682 keywords were obtained. Then, the researchers used default option minimum number of

occurrences with five minimum occurrences. After choosing the threshold, there's 125 keywords that meet the threshold from 2682 all keywords that identified. In the following Figure 6 show the result of co-occurrences analysis using bibliographic data from scopus database. It consisted of 5 clusters, with 4 main clusters are red nodes (n=59), green (n=33), blue (n=21), and yellow (n=8), then the last cluster with purple colour (n=4).

The main nodes in red cluster are scientific literacy, students, and teaching. Then, main nodes in green cluster are humans, article, and health literacy. After that, the main nodes in blue cluster are education, learning, and literacy. The yellow cluster main nodes were curriculum. Meanwhile for the last cluster or puple cluster keywords are climate change, environmental education, and perception. In the following Figure 7, the researcher tries to show some detail link between important keywords such as assessment, teaching, education, and curriculum.

Figure 6

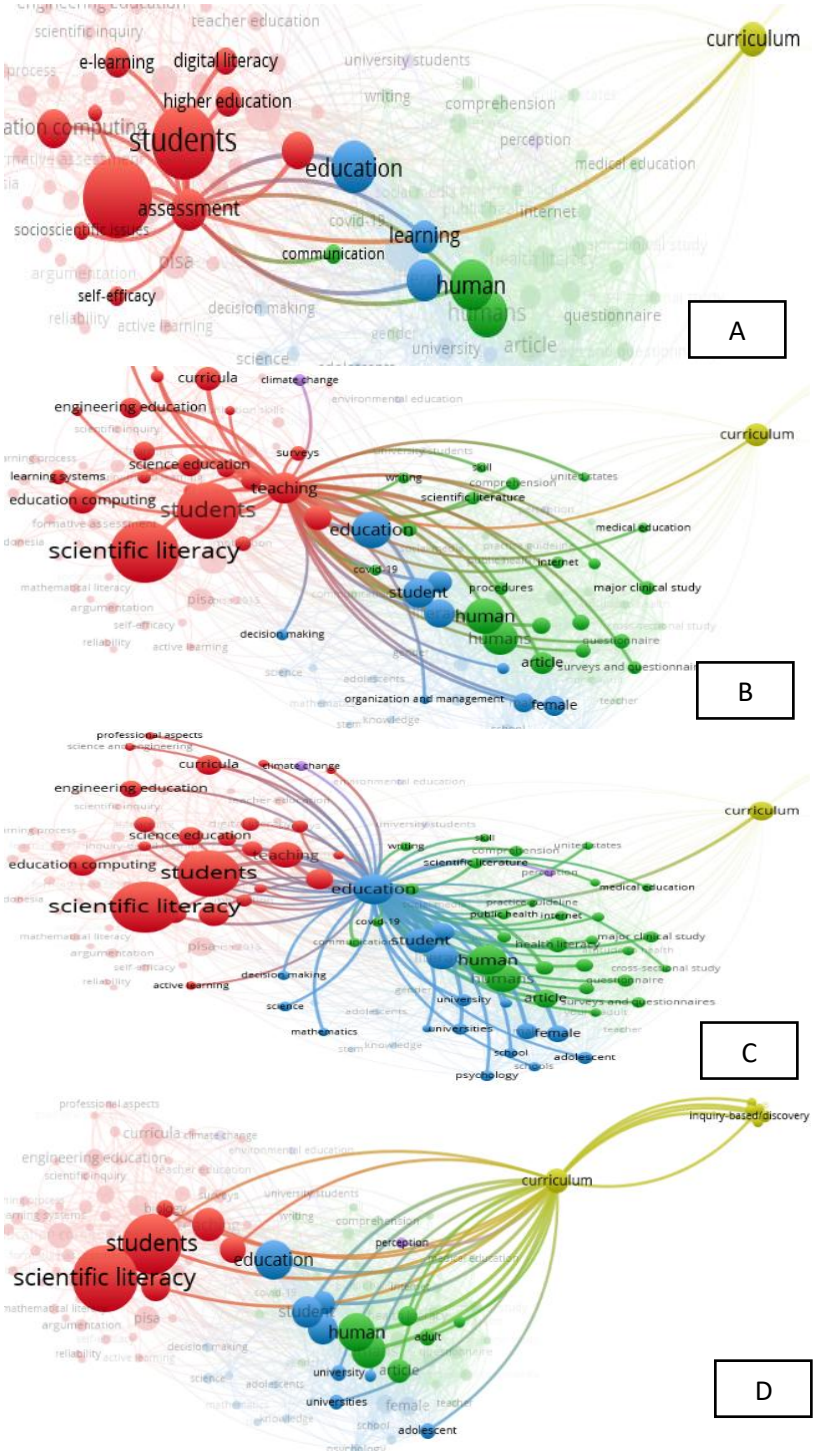
Result of Keyword co-occurences Network Visualization



Source: VOSviewer

Figure 7

Specific Important Keywords Mapping Result of a) assessment, b) teaching, c) education, and d) curriculum



Source: VOSviewer

The size of a nodes indicates the number of publications that use the related phrase in their title or abstract. In visualization, terms that occur together frequently are usually placed next to one another *(van Eck & Waltman,*

2014). Strong network links or bigger size nodes has less good novelty, than the weak links or smaller nodes which mean has a good novelty on that keyword/term (Prahani *et al*., 2022; Suprapto *et al*., 2023). For example, it can be a good idea for further research to connect the link between scientific literacy assessment with climate change, and environmental education. Another idea for further research also maybe can integrates a recently technology like augmented reality in student scientific literacy assessment, which still didn't appear in the mapping network visualization. This findings show the oppurtunities for further research to integrated the scientific literacy assessment with climate change and environmental education, which enables to support SDGs 4 Quality of Education and SDGs 13 Climate Action (United Nations, 2015)

5 CONCLUSION

This research aims to analyze the trends from 2014-2024 of research from Scopus database with focus about student scientific literacy assessment. In this research also review top cited documents/articles to identified its findings and recommendations that related to scientific literacy. Conclusions from this research are: In the last decade, the research about student scientific literacy assessment is fluctuative. Article was the common document type in this trends research with a total 394 number of documents and followed by Conference Paper with 129 number of documents. Meanwhile, in the subject area, social sciences were the top-listed subject area, covering 42,1% of the 591 documents, followed by physics and astronomy with 9,3%. In the top contributed author Archilla, P. A.; and Rahayu, S. is the top contributed with 6 number of documents. Then, in the top contributed sources Aip Conference Proceedings and Journal of Physics Conference Series is the top listed with 40 number of documents. While at the top contributed countries USA is the top listed with 181 number of documents followed by Indonesia with 108 documents. English was the most used language with 548 number of documents. On the top affiliation, Universitas Negeri Malang is the number one listed with 19 number of documents. Then, National Science Foundation is the top listed

funding sponsor with 34 documents. The top cited documents were *Hu et al. with 204 total citations that discuss about impact of ICT to improve their scientific literacy. Student Scientific Literacy Assessment Research trends mapping in the last 10 years shows its focus that leads to strong links to teaching and education. It also has a related into some learning models, and curriculum. But had a weak links to climate change and environmental education which crucial in SDGs.*

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