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A Local Wisdom in Science Education Using Bibliometric Mapping and VOSviewer

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Abstract.

This study aimed to explore the growing trend of research direction in the field of science education based on local wisdom. This study used Scopus search analysis and VOS viewer software. Based on 343 articles (319 selected documents) selected from Scopus-indexed journals, co-authorship, co-citation, co-occurrence, and cluster and content analysis were carried out. The method used in this research is a bibliometric study using the Zupic and Cater standards by applying five standard workflows consisting of, (a) study design; (b) data collection; (c) data analysis; (d) visualization; and (e) interpretation. The results of the quantitative analysis showed that the most important publications on science education based on local wisdom are instruments and products. Literature on local wisdom-based science education has explored the results of this study revealing that 15 topics that have become the latest research trends and are related to this study include studies on, local wisdom, science, ecosystem, science learning, education, development, social science, local knowledge, scientific knowledge, research method, society, assessment, sustainability development, tradition, and culture. The bibliometric study that was conducted illustrates science education researchers that studies related to the development of science teaching materials based on local wisdom to achieve sustainable development goals in the field of education quality (ESD) and life on land (ecosystems). Future research is expected to strengthen the national identity and character of students by applying local wisdom-based science learning to achieve sustainable development goals.

Keywords: local wisdom, science education, bibliometric mapping, VOSviewer

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1. INTRODUCTION

There are some various cultures that belong to the Indonesian nation are spread from Sabang to Merauke. Culture could not be separated from Indonesian society. Education is an element of culture. Culture is developed and passed on through education, and the characteristics and implementation of education are determined by culture [1]. Culture emerges from enduring values, attitudes, and traditions. In its journey, it stems from the strong relationship between human habits in observing natural phenomena and their signs. Habits that continuously give birth to views, knowledge, beliefs, and customs that affect the daily activities of residents are called local wisdom [2].

Local wisdom certainly does not appear by itself, but requires a process that is quite long, through social selection that must be passed so that it is finally proven that it contains elements of goodness for people's lives. Its proven effectiveness in this case makes local wisdom a tradition that is firmly attached to people's lives. However, from time to time these noble values begin to fade, fade, and lose their substantive meaning. Then what is left is only the surface skin, becoming a meaningless symbol. Even recently, the culture of society as a whole has experienced a reduction, showing itself as a display full of formalities. Its presence is nothing more to commercialize and make a profit [3].

Zuria and Sunaryo stated that "education should be cultured and become an inseparable part. Therefore, the curriculum must connect and even recommend that students interact and work together with the surrounding environment [4]. The same thing was stated by Jumriani "local wisdom is local knowledge that is used by the community to survive in an environment that is integrated with belief systems, norms, culture expressed in traditions that have been adhered to for a long time. The learning process that occurs in Indonesia is based on a curriculum that has been set by the government, currently the curriculum that is set is "Free Learning - Independent Campus" which is basically explained by [5] focusing on developing an industrial mindset in students in the world of higher education. The mindset that is built into the MBKM curriculum must be integrated with the local wisdom values of each region [6].

The various descriptions of local wisdom stated above, of course, will not be much different from the integration of local wisdom with science education implemented at the university level. The research trend in integrating local potential is mainly implemented in various fields. Mapping the trend of this research can be done by conducting a literature review. However, in reality, systematic literature review research that integrates local wisdom in new education focuses on biology, mathematics, astrophysics, and education in general, but not on science education [7]. Discussion of natural science material

related to local wisdom has been carried out by several previous studies including: Integrated Science material based on the 5E learning cycle [8]; Integrated Science Material [9]; Pressure Material [10]; Volcano Material [11]; Vibration and wave material [12]; Ethno science Material [13, 14]; Science material is related to environmental literacy [15]; Biology Material [16]; Material on Biodiversity [17]; Material Change of Objects [18]; Ecology material in environmental knowledge [19] and Environmental & Sanitation Preservation Materials [20]. Based on research that has been conducted in the field of education, it attracts researchers to visualize research trends involving local wisdom in science education. Visualization of research trend mapping is carried out using a bibliometric study.

2. RESEARCH METHOD

Bibliometric analysis is a research that is urgently needed in the current era of technological growth [21–23]. Widyatwati suggests that bibliometric analysis has several functions, namely: a) finding the desired contribution in the field; b) obtain new ideas for investigations; c) identify knowledge gaps; d) one-stop browsing [24].

This study used a bibliometric study using the Zupic and Cater standards by implementing five standard workflows consisting of study design, data collection, data analysis, visualization, and interpretation [25]. Figure 1 shows a summary of the overall research steps carried out. The bibliometric analysis method is used to describe a mapping of knowledge, concepts or topics as a whole, showing a research trend and the process of evolution of a field of knowledge. The bibliometric approach used in this study uses modern technology in information engineering, database management and statistics by combining VOS Viewer software.

The description from each steps of research could be explained as followed:

First step: study design. This step is carried out through a descriptive analysis of relevant information from various local wisdom-based science education studies, so that researchers can obtain an overview of evolutionary metrics from this study [26].

Second step: data collection. This step is carried out by compiling bibliometric data to identify data sets and determine research sources from the Scopus database [27]. Scopus was chosen based on the consideration that the Scopus database is the best known and widely used for analyzing reputable scientific articles. [28]. Scopus is an abstracts and citation database for peer-reviewed literature and is also part of SciVerse provided by Elsevier as described in the previous section and is also based on the same database as Science Direct [29, 30]

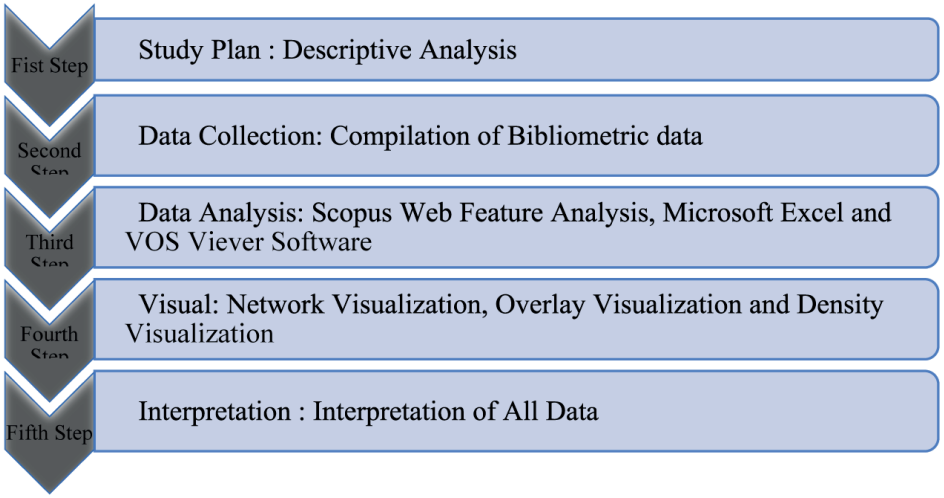

Figure 1: There are five steps of operational standards [25].

A literature search was carried out in February 2023, a search strategy using the Scopus web with the keywords "TITLE-ABS-KEY(local AND wisdom) AND TITLE-ABS-KEY(science)" the results obtained were 343 data, then after using the year range specifications 2002 to 2022, the existing database is 319 documents. These documents were compiled from the Scopus database using the Research Information Systems (RIS) format, the RIS format includes some important information from documents such as citation information (document title, author, year, document type, source title and number of citations), bibliographic information (affiliation, publisher and serial identifier), abstract and keywords (abstract, index keywords and author keywords) [31].

Third step: Data analysis. This step is carried out by analyzing performance and IPA mapping to analyze data using a variety of different applications, including direct analysis using features on the Scopus web and VOS viewer software version 1.6.15.0. [32, 33].

Fourth step: Visualization. This step is carried out with the visualization provided by the VOS viewer software, namely network visualization, overlay visualization and density visualization. This step is used to facilitate understanding and interpretation of research conducted on science education based on local wisdom. [34].

Fifth step: Interpretation. This step is carried out by interpreting all the data obtained in this bibliometric study. The purpose of this step is to obtain a summary and conclusion of the various findings in this study [35].

3. RESULT AND DISCUSSION

3.1. Progress Analysis

3.1.1. Descriptive Analysis

As previously mentioned, the database that has been sorted in this study totals 319 documents from all countries in the world that publish their research on Scopus. Research trends in science education based on local wisdom from 2002 to 2022 based on documents published annually on the Scopus dataset can be seen in Figure 2. Figure 2 shows that the research trend in science education based on local wisdom reached a publication peak in 2021 where the number of publications was the highest and reaching 46 documents, of the 46 documents obtained the most research from Indonesia was 28 documents (60%) and the lowest was in 2005 with 2 documents from the United States and India, in other words that local wisdom research has been recorded in Scopus since 1983 but has become a trend again in 2021, especially in Indonesia since the government issued an MBKM curriculum policy integrated with local wisdom values in each region and was welcomed by researchers by focusing their research studies on local wisdom considering that Indonesia is an island country which has more than 360 tribes. This makes Indonesia rich in cultural diversity, local wisdom and traditions [36].

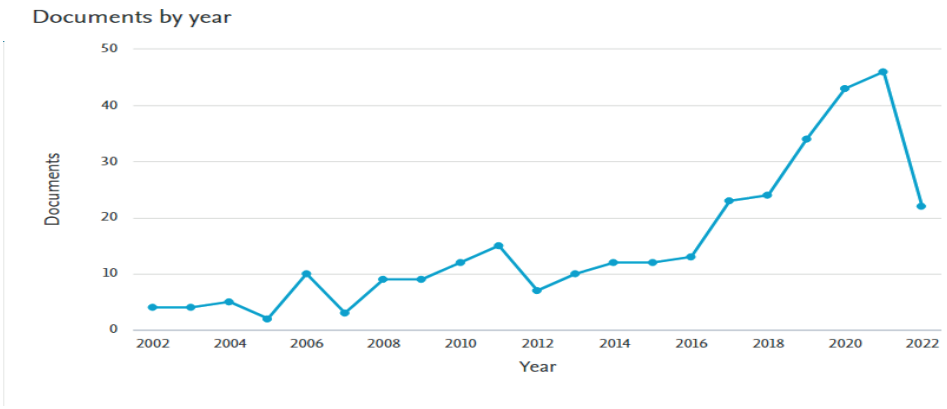

Figure 2: Scopus database for science education based on local wisdom 2002-2022.

Based on the type of documents obtained, it can be seen based on direct analysis from the Scopus web that most types of publications are articles totaling 168 documents (52.7%), conference papers 86 (27%). besides that the contribution of other types of documents consists of book chapters, reviews, conference reviews, books, letters and notes, for more details can be seen in Figure 3.

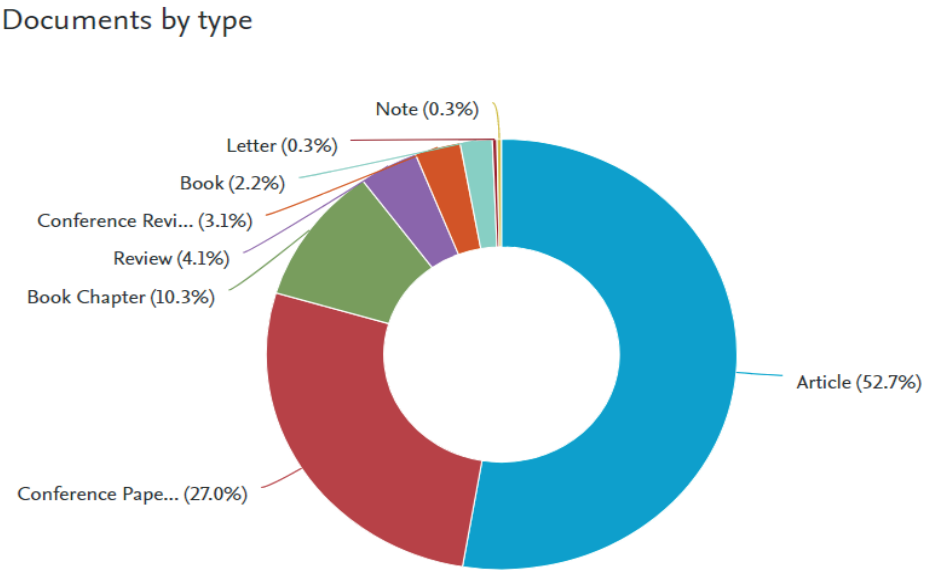

Figure 3: *Scopus database* for science education based on local wisdom based on document type.

3.1.2. Country and ASEAN Analysis

The most productive country in publishing publications related to this research is Indonesia with a total of 119 publications and the least number of which has only conducted one research, namely: Belgium, Bolivia, Chile, Ecuador, Finland, Iran, Ireland, Macao, Nepal, Poland, Russian Federation, Saudi Arabia, Singapore, Spain, Switzerland, Vietnam and Zambia. Who produced the publication, for more details the data is presented in Figure 4.

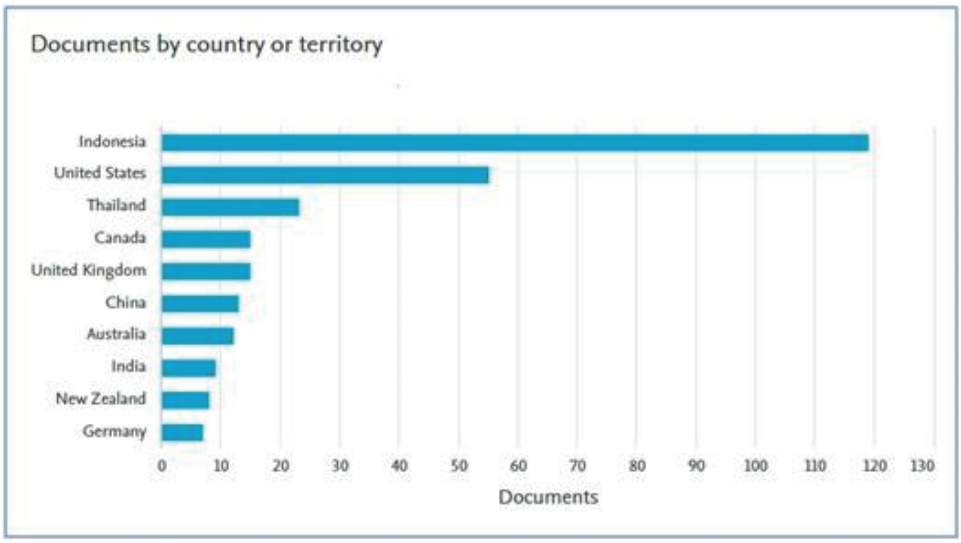

Figure 4: Ten Countries with the most publication contributions.

Figure 4 showed the 10 countries that have contributed the most to the publication of local wisdom-based science education research based on the Scopus dataset. This shows that the topic of local wisdom is an interesting topic considering that Indonesia's territory is so large and consists of various islands and ethnic groups that this topic can still be an interesting research opportunity to be discussed further [37].

This research is also a trend in the Asean region, based on the results of data analysis from Scopus it was found that the top 10 Asean countries contributed to conducting local wisdom-based science education research, namely: Indonesia, Thailand, China, India, Malaysia, Japan, North Korea, Hong Kong, Taiwan and Turkey which have different research focuses, the data in table 1 presents more detailed research trends in 3 Asean countries namely Indonesia, Thailand and China which are in the top 3 which have the highest number of publications related to local wisdom.

Table 1: Research trends in the 3 Asean countries with the most publication contributions.

No	Name of Countries	Topics That Become Research Trends
1.	Indonesia	*Local wisdom, science, study, knowledge, environment, system, community, element, process, resource, sustainability, farmer, disaster, application, education, assessment, school, tradition, local culture and book*
2.	Thailand	*Local wisdom, science, education, knowledge and community*
3.	China	*Wisdom, study and government*

Based on Table 1 data, it can be seen that the most local wisdom topics in Indonesia are broader and deeper in scope than Thailand and China, such as topics related to Resource, Tradition, Local Culture, and Sustainability only in Indonesia. This illustrates that local resources, traditions and culture are very closely related to the conditions in Indonesia which are culturally diverse. When compared to the other two countries, the diversity in Indonesia which consists of ethnicities and cultures is more diverse compared to other countries. This opens up more opportunities to develop research related to science education based on local wisdom in Indonesia to achieve sustainable development.

3.1.3. Authors and Citation Analysis

Based on the analysis of the search results the top 10 authors can be illustrated based on Table 2. This data shows that among the authors mentioned in Table 1 in research on local wisdom-based science education it is possible that there are authors who have

fewer publications but have more citations, as well should. In addition, the large number of publications indicates regularity of contributions on the topic in the period 2002 to 2022.

Local wisdom-based science education publications based on institutional affiliations that most often conduct research related to this topic are: Yogyakarta State University with 13 documents, Indonesian University of Education with 9 documents, Khon Kaen University, Jember University, Semarang State University, Surabaya State University, State University Padang and Ganesha University of Education with 5 documents, Mahasarakham University and University of Toronto produced 4 documents.

The use of the VOS viewer for bibliometric studies is carried out using various approaches and analyzes including bibliographic coupling analysis and co-citation. This analysis combines the similarity of sources cited by two documents, whereas co-citation is used to measure the similarity of citations cited by two documents [38]. These two analyzed can complement each other [39]. Coupling analysis is selected based on document sources, as well as co-citation. The results of the clutch and co-citation analysis in this study can be illustrated in Figure 5.

Table 2: Top ten authors with publications on local wisdom-based science education.

No	Authors' name	Publication	
		Total of Publication	Total of Citation
1	Prasetyo, Z.K.	4	39
2	Sudarmin	4	23
3	Wilujeng, I	4	38
4	El Islami, R.A.Z.	3	35
5	Nuangchalerm, P.	3	35
6	Parmin	3	71
7	Usmeldi	3	6
8	Amin, M.	2	11
9	Ariyani, F.	2	0
10	Arnyana, L.B.P	2	17

Publisher and Journal Analysis

On Figure 5 interpreted that the journal of physics: conference is the largest source of publication compared to other conferences or journals in this study. Apart from that, there are other sources of publication that are the biggest contributors, namely Indonesian science education journals, AIP conference proceedings and the IOP conference series: material. This result is in line with the type of document obtained the most, namely conference paper. In addition, publication sources can also be seen by co-citation analysis as shown in Figure 6. The results of this analysis describe that this

analysis complements the results of the previous analysis. Based on Figure 6, it can be seen that the largest publication source is the journal of computer and education, next is the journal of computers in human behavior. The results of this analysis can be an illustration for researchers regarding local wisdom-based science education to publish, both on popular publication sources such as the results of the analysis and looking for other gaps in publication sources that are still minimal on local wisdom-based science education research.

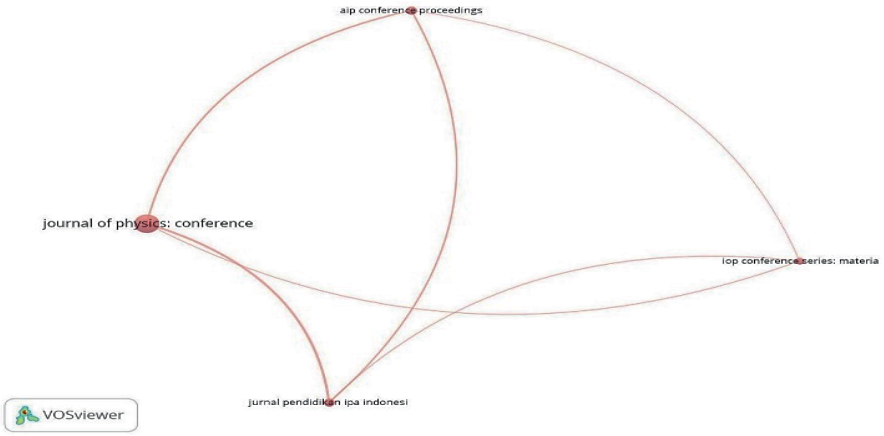

Figure 5: Results of bibliometric analysis with publication source coupling analysis.

3.1.4. The Science of Mapping and Network Analysis

1. Co-Occurrence Analysis

To find out the conceptual structure of science education research based on local wisdom, a co-word analysis was carried out which was mapped and grouped into co-occurrence as shown in Figure 6. In Figure 6 it can be seen that each node shows one keyword. So, the larger the node size indicates the greater the frequency of these keywords. Then, we can also see that each node in Figure 6 [40]. The wider the link, the greater the linkage between the two keywords, the image only contains a maximum of 300 nodes with the highest degree of representing keywords [40].

Figure 7 illustrated that the biggest note in this study is local wisdom. This indicates that local wisdom is the most popular keyword. Apart from that, other big nodes namely science, study and development are other popular keywords after local wisdom. Figure 6 also showed that the widest link is with Science learning and sustainability development which shows its relation to local wisdom. However, it can also be seen that content and

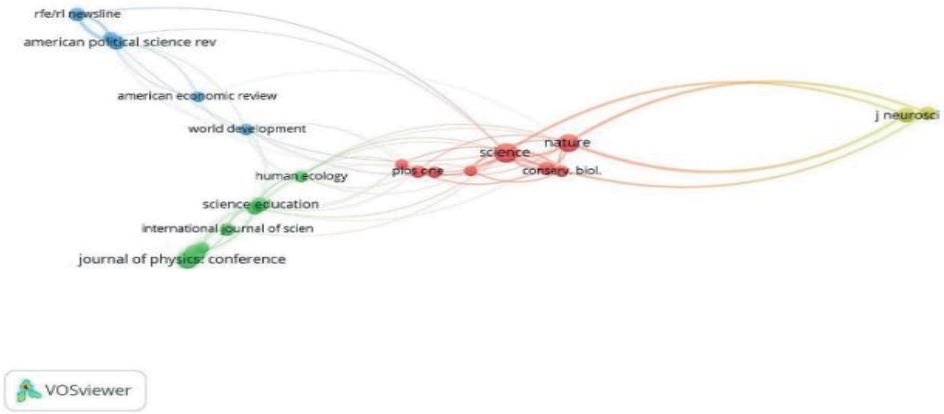

Figure 6: Results of bibliometric analysis with co-citation analysis of publication sources.

assessment have a big relationship with local wisdom. So that research on both of them can be studied in more depth for further research.

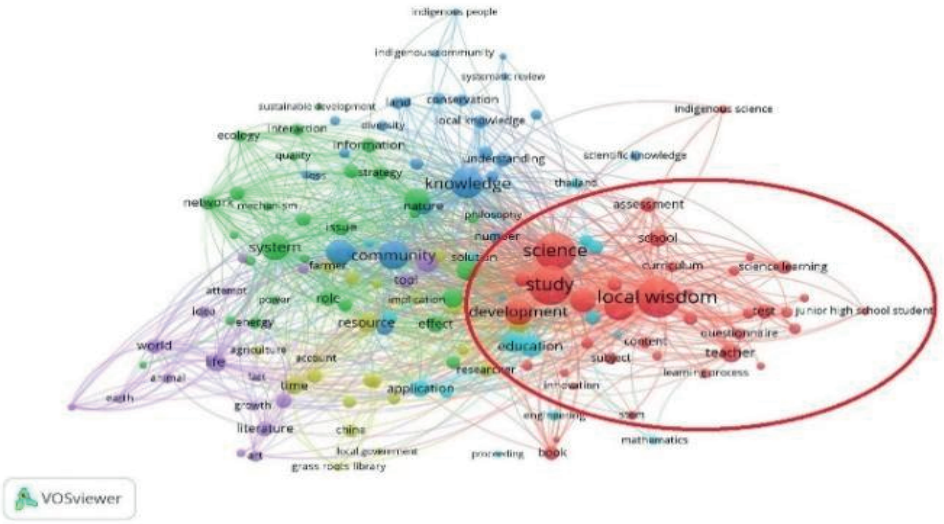

Figure 7: Visualization of the conceptual structure of science learning research based on local wisdom.

There are 6 clusters identified in the results of the analysis using the VOS viewer, but in this study the 3 largest clusters are limited, consisting of cluster 1 in red (the most popular) consisting of 69 keywords. The keywords that appear most frequently are wisdom and management. Green cluster 2 consists of 38 keywords. The top keywords in the sequence are local wisdom and science learning. Furthermore, Cluster 3 has 7 items, with the terms teaching and indigenous knowledge being the top keywords. The keywords in these various clusters show the research relationship between one term and another related to research on science education based on local wisdom. For example, cluster 2 which connects various studies that have been conducted regarding

the use of local wisdom in science education, its relation to skills, counts and scientific knowledge.

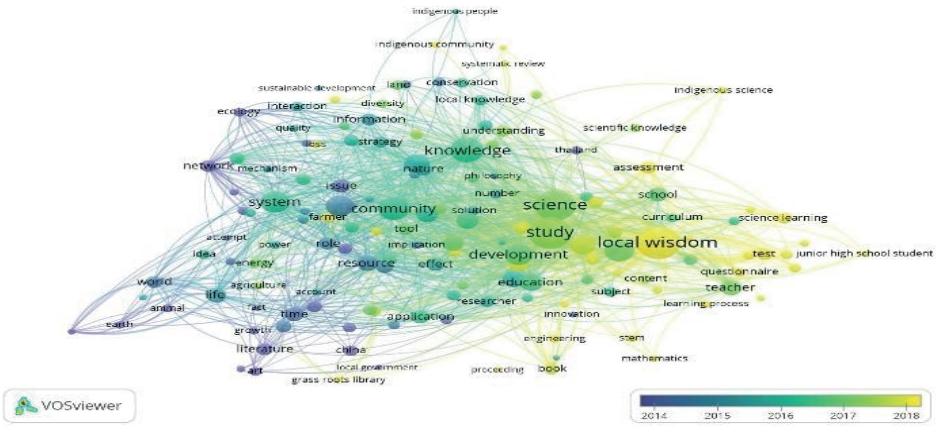

Figure 8: Overlay visualization of science education based on local wisdom (2002-2022).

Based on the results of the overlay visualization in Figure 8 which shows the latest research with light green to yellow indications (the average year range before 2016 and after 2018), the density visualization in Figure 9 and Table 3 regarding terms related to science education based on local wisdom can show that several terms are clearly new and have become research trends related to this study including: local wisdom-based science education, it can be shown that several terms are clearly new and have become research trends related to this study, including: *local wisdom*, *science, ecosystem, science learning, education, development, social science, local knowledge, scientific knowledge, research method, society, assessment, sustainability development, tradition* and *culture*.

So it can be concluded that science education based on local wisdom is still very relevant to do because it is included in a new research trend even though it has been carried out from 2002 to 2022 such as Scopus data and the results of analysis of studies that have been obtained. Science education based on local wisdom shows an increase in 11 positive characters of students, the most significant positive characters are honest, disciplined, conscientious, diligent, careful, responsible, care for the environment and improve thinking skills. This is in line with Yunus' research, the development of character education in tertiary institutions is in line with the values of plurality which are the hallmark of this nation. Local wisdom can make tertiary institutions more characterful and at the forefront of promoting cultural values for progress and development at the national and international levels [41].

2. Analysis Occurrences Content Natural of Science

Table 3: Terms related to science education based on local wisdom.

No	Term	Occurrences	Relevance
1.	*Local wisdom*	140	1.71
2.	Science	187	0.08
3.	Ecosystem	18	0.92
4.	Science learning	17	4.77
5.	Education	49	0.28
6.	Development	90	0.20
7.	Social science	19	0.28
8.	Local knowledge	22	0.54
9.	Scientific knowledge	12	0.80
10.	Research method	15	1.61
11.	Society	53	0.16
12.	Assessment	23	2.10
13.	Sustainability development	25	0.36
14.	Tradition	32	0.49
15	Culture	59	0.16

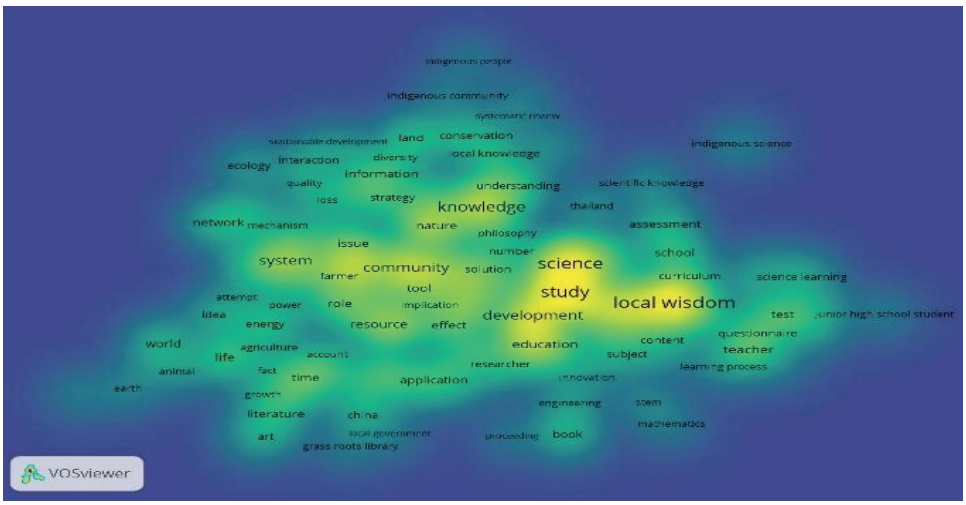

Figure 9: Density visualization .

Figure 10 presented the data related to natural science occurrence content that often appears in science education based on local wisdom which is presented as follows: science, environment, technology, life, earth, biology, physics, chemical concept, home industry, science education, biology education, ethno science, local wisdom value, conservation, species, flora, human life, tree, environmental sustainability, earthquake, species, farming, science center, mathematics, and information system. Based on the results obtained, there are 25 science content that are interrelated with science education research based on local wisdom, this explains that there are still research opportunities related to science and the environment, especially for content that is small in

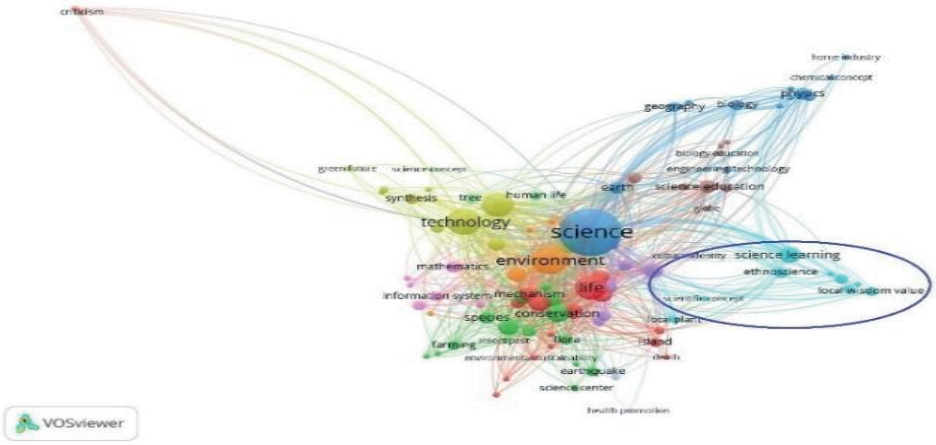

Figure 10: *Occurrences content natural of science*.

size which indicates that there are still open opportunities for new research related to science learning and local wisdom values.

4. CONCLUSION

This study conducted a bibliometric analysis of 319 selected papers from the Scopus web related to local wisdom-based science education using Zupic and Cater standard work and the VOS viewer application. The results of this study reveal that 15 topics are the latest research trends and are related to this study including studies on *local wisdom*, *science, ecosystem, science learning, education, development, social science, local knowledge, scientific knowledge, research method, society, assessment, sustainability development, tradition* and *culture*.

A review of research trends in science education based on local wisdom using bibliometric analysis provides information that the number of publications on many studies on local wisdom-based learning has increased in the period 2012–2021 and Indonesia ranks first in producing publications related to science education based on local wisdom. The research trend of “local wisdom-based learning” is the development of teaching materials based on local wisdom in science learning in Indonesia which shows that science learning based on local wisdom to achieve sustainable goals in the field of education quality (ESD) and life on land (ecosystems) is a new research topic. Future research is expected to strengthen the national identity and character of students by applying local wisdom-based science learning to achieve sustainable development goals.

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