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Research Trends in Local Wisdom Integrated Scaffolding Inquiry Learning Model to Improve Students' Science Literacy: Bibliometric Analysis 2014-2024

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Abstract— This study aims to provide a bibliometric review of research trends on local wisdom-integrated scaffolding inquiry models to improve students' scientific literacy during the period 2014-2024. Data were obtained through Google Scholar using analysis tools such as Publish or Perish and Dimension.ai, resulting in 1,000 documents selected based on PRISMA guidelines. The analysis was carried out using bibliometric and content analysis methods, supported by VOSviewer software to visualize keyword trends and research patterns. The results showed that the publication trend peaked in 2021, reflecting significant interest in this topic. The dominant publication types were chapters and edited books, indicating that this topic is often discussed in comprehensive academic references. Keywords such as local wisdom, scientific literacy, and scientific inquiry indicate the focus of research on the integration of local cultural values with a scientific-based approach. Network visualization and research density underscore the importance of evaluating the effectiveness of local wisdom-based learning in improving students' scientific literacy, problem-solving skills, and scientific understanding. So it can be concluded that the research trend of the local wisdom integrated scaffolding inquiry model has become the main focus in the development of science education that is relevant and contextual to the needs of the 21st century.

Keywords— Scaffolding Inquiry, Local Wisdom, Science Literacy, Bibliometric Analysis.
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Introduction

Scientific literacy is one of the essential skills that students must have in the 21st century [1], [2]. This ability includes understanding scientific concepts, critical thinking skills, and the ability to make decisions based on scientific facts that are relevant to everyday life [3], [4]. However, the reality on the ground shows that the scientific literacy of students in Indonesia is still at a concerning level. Based on the evaluation results of the Programme for International Student Assessment (PISA) from 2009 to 2018, Indonesian students have never been out of the top ten bottom rankings [5], [6], [7]. Worse still, Indonesian students are ranked 74th out of 79 participating countries with a score of 396 in the last PISA assessment [8]. Indonesia's score is considered very low because it is far from the average score of PISA participants, which is 489. This indicates that Indonesian students' science literacy scores are still below the international average, and indicates a gap between the ideal conditions expected and the reality in the field [9].

This gap is caused by various factors, one of which is the suboptimal use of learning models that support the development of holistic scientific literacy [10]. Most of the learning processes in schools are still oriented towards memorization and information transfer, without providing enough space for students to explore, analyze, and apply scientific concepts in real-life contexts [11]. In addition, the lack of integration of local contexts in learning makes students feel that the material being taught is not relevant to their environment and daily lives. As a result, learning motivation decreases, and students' ability in science learning to solve real problems is limited [12], [13].

To overcome these problems, the scaffolding inquiry learning model is a promising approach. This model provides gradual support to students throughout the learning process, allowing students with varying levels of ability to actively participate in inquiry-based learning activities [14], [15]. This support can be in the form of guidance, prompting questions, or supporting materials tailored to students' needs, so that they can develop critical thinking and problem-solving skills independently [16], [17]. Furthermore, the integration of local wisdom in the scaffolding inquiry model can provide a more relevant and meaningful learning context for students [18], [19]. Local wisdom, which includes traditions, culture, and local resource potential, can be used as a context in science learning to explain scientific concepts (Arifin et al., 2024; Kasi [4], [20]. In this way, students not only understand science theoretically but are also able to relate it to their environment and culture [21], [22]. This is expected to improve scientific literacy while instilling awareness of local culture and values [23].

Previous studies have shown that the inquiry learning model is effective in improving students' scientific literacy [24]. On the

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other hand, several studies have also revealed that learning based on local wisdom can increase the relevance of learning and motivate students [25]. However, studies that combine the scaffolding inquiry approach integrated with local wisdom are still very limited, especially in the context of science education in Indonesia. Therefore, an in-depth analysis is needed to identify related research trends, in order to determine the extent to which this innovation has been implemented and what its potential for future development is [26], [27]. Through a bibliometric analysis approach, this study aims to map research trends related to the local wisdom integrated scaffolding inquiry model to improve students' scientific literacy [28]. The analysis includes identifying patterns, keyword trends, and research gaps that have not been touched. Thus, this study is expected to be a basis for further development, both in theoretical and applied scopes [29].

The significance of this research lies in its contribution to the development of educational science, especially in developing adaptive and contextual learning models. In addition, this research also has practical implications for teachers and educational policy makers. Teachers can use these findings to design learning that is more relevant to students' needs, while policy makers can use it as a reference in developing a locally-based curriculum that supports the strengthening of scientific literacy. With the application of this model, students are expected to not only excel in scientific literacy but also have strong cultural insights. Therefore, this research is important to be carried out as an effort to realize education that not only produces an academically intelligent generation but is also strongly rooted in local values in facing global challenges.

Research Methods

This research is descriptive and analytical, which aims to understand and describe research trends related to the scaffolding inquiry learning model integrated with local wisdom to improve students' science literacy. The data used in this study were obtained from information sources indexed by Google Scholar, with the help of analysis tools such as Publish or Perish and Dimension.ai. The search on Google Scholar was carried out using keywords relevant to the research theme, such as the scaffolding inquiry model, local wisdom, science literacy.

This study analyzed 1000 documents indexed by Google Scholar in the period 2014 to 2024. Google Scholar was chosen as the main database because it has the advantage of providing broad access to scientific publications, conference articles, and other reference materials, especially in the field of education. This database is also known to be consistent in its document selection and is able to display more documents compared to other databases, as stated by several previous studies [30], [31], [32].

To ensure data quality and relevance, this study used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in the data filtering process. This stage includes the process of identifying, selecting, and evaluating documents. In the selection stage, documents that are irrelevant, duplicate, or do not meet quality criteria are removed. Evaluation of document quality is based on the number of citations and the relevance of the content to the research topic.

After the data was filtered, analysis was carried out using bibliometric and content analysis methods. Bibliometric methods were used to identify research trends, main themes, and patterns that developed in studies related to the local wisdom integrated scaffolding inquiry learning model. This analysis was carried out with the help of software such as VOSviewer to visualize the relationship between keywords, authors, institutions, and research areas. This visualization helps reveal key trends and potential research areas that have not been explored. In addition to bibliometric analysis, content analysis was used to explore the relevant document content in more depth. This analysis aims to explore details about the innovations that have been implemented, the challenges faced, and the contribution of research to the development of students' scientific literacy through a scaffolding inquiry approach based on local wisdom.

Results and Discussion

This study aims to describe the research trends related to the scaffolding inquiry learning model integrated with local wisdom to improve students' scientific literacy conducted from 2014 to 2024. Research documents on the trend are taken from scientific publications indexed by Dimensions.ai. Figure 1 below shows the publication trend of the scaffolding inquiry learning model integrated with local wisdom to improve students' scientific literacy from 2014-2024.

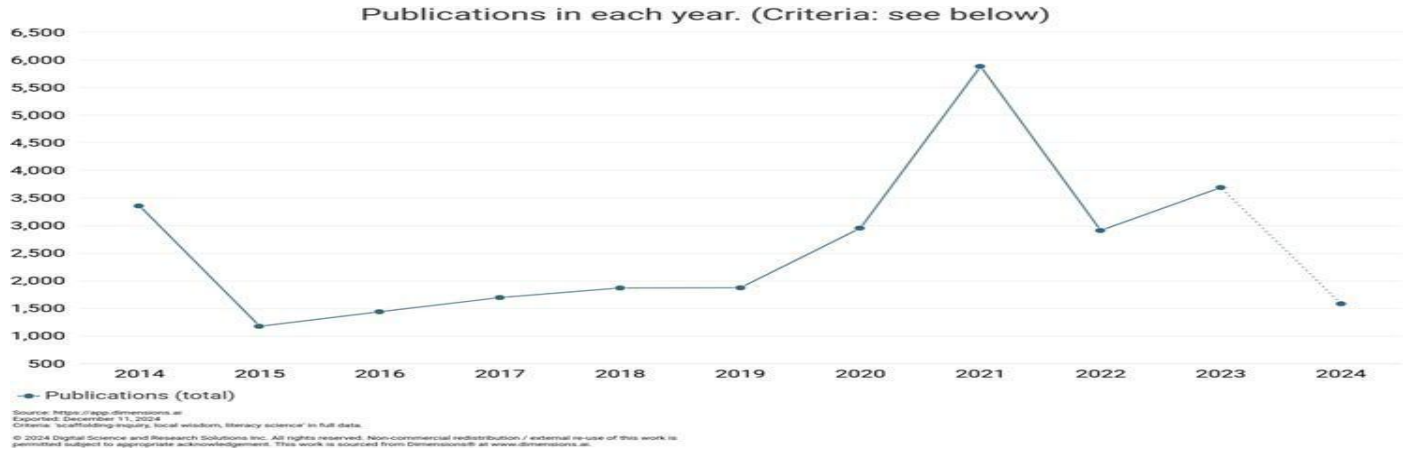


Fig. 1. Research trends on scaffolding inquiry learning models integrated with local wisdom to improve students' scientific literacy in 2014-2024.

Figure 1 shows that the research trend on scaffolding inquiry learning models integrated with local wisdom to improve students' scientific literacy from 2014 to 2024 experienced significant fluctuations. In 2014, the number of publications reached more than 3,500. However, there was a sharp decline in 2015 with publications below 1,000.

From 2016 to 2019, the number of publications showed a steady upward trend, reflecting increasing attention to learning approaches that integrate local wisdom in improving students' scientific literacy. The peak occurred in 2020 with more than 6,000 publications, indicating the peak of academic interest in this topic. However, this trend experienced a drastic decline in 2021 before increasing again in 2022 and 2023. In 2024, projections show a decline again with the number of publications estimated to be less than 1,500.

The increasing research trend until 2020 reflects the relevance of this approach in science education, especially in building 21st-century skills through local culture-based learning contexts. The decline after 2020 may be due to a shift in research focus, resource constraints, or implementation challenges. However, overall, the trend shows that the scaffolding inquiry learning model integrated with local wisdom remains a significant topic in efforts to improve students' science literacy. Table 1 is also presented below, which displays research on the scaffolding inquiry learning model integrated with local wisdom to improve science literacy based on publication type.

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Table 1. Research trends on scaffolding inquiry learning models integrated with local wisdom to improve science literacy based on publication type.

Publication Type	Publications
Chapter	19.782
Edited Book	10.128
Monograph	7.127
Article	2.161
Proceeding	155
Preprint	63

Based on Table 1, it is known that research on the scaffolding inquiry learning model integrated with local wisdom to improve students' scientific literacy is found in several types of publications. The most common type of publication found is chapters, with a total of 19,782 publications, followed by edited books with 10,128 publications, monographs with 7,127 publications, articles with 2,161 publications, proceedings with 155 publications, and preprints with 63 publications. The trend of research on the scaffolding inquiry learning model integrated with local wisdom shows that publications in the form of chapters dominate, reflecting that many studies are published as chapters in books or as part of larger collections. This shows an interest in sharing research findings in a format that can be used as a comprehensive reference in various academic books.

Meanwhile, publications in the form of edited books also show a significant number, namely 10,128 publications. The edited book plays an important role in documenting a wide range of research in one volume, allowing multiple perspectives related to scaffolding inquiry learning integrated with local wisdom for science literacy to be brought together and presented to readers from various disciplines. Articles are also a relevant publication type with 2,161 publications, indicating that scientific articles are an important means of disseminating more specific and in-depth research results on this topic. Articles allow researchers to present research results in a structured and in-depth manner, and can be published in scientific journals both online and in print, reaching a wider audience.

The least common publication type is preprints with 63 publications, which usually function as early drafts that have not gone through the peer-review process. Although small in number, preprints provide researchers with the opportunity to quickly share research findings with the scientific community before being formally published. In general, these data indicate that research on the scaffolding inquiry learning model integrated with local wisdom to improve students' scientific literacy has received significant attention in various types of publications, dominated by chapters and edited books. The dominance of these publications reflects that this topic is widely discussed in a larger context, where research is collected together to provide a comprehensive picture of the topic. Also presented below is Table 2 which displays the ten (10) main sources of research trends on integrated local wisdom scaffolding inquiry learning models to improve students' scientific literacy which are often cited by other researchers in relation to this.

Table 2. Top 10 main sources of research trends on local wisdom integrated scaffolding inquiry learning models to improve students' science literacy in 2014-2024.

Name	Publications	Citations	Citations Mean
Lecture Notes in Computer Science	296	1.885	6.37
Encyclopedia of the UN Sustainable Development Goals	235	211	0.90
Behavioral and Brain Sciences	143	296	2.07
American Ethnologist	124	32	0.26

Name	Publications	Citations	Citations Mean
Contemporary Sociology A Journal of Reviews	111	92	0.50
Modern Language Journal	108	68	0.83
NWU Self-Directed Learning Series	104	179	1.72
Communications in Computer and Information Science	101	361	3.57
Religious Studies Review	95	7	0.07
Advances in Social Science, Education and Humanities Research	78	67	0.86

Based on Table 2, it is known that research related to the scaffolding inquiry learning model integrated with local wisdom to improve students' science literacy has been published through various primary sources. Lecture Notes in Computer Science is the source with the largest number of publications, namely 296 and the highest total citations of 1,885, with an average citation per publication of 6.37. This shows that this journal is the main platform for disseminating research related to this topic among academics, especially in the fields of computer science and education.

Other sources such as the Encyclopedia of the UN Sustainable Development Goals have a total of 235 publications, with a total of 211 citations and an average citation of 0.90. Although the average citation is low, this source plays an important role in disseminating research that links science literacy to the sustainable development goals (SDGs). Behavioral and Brain Sciences stands out with a total of 296 citations from 143 publications, resulting in an average citation of 2.07. This reflects that this source has a significant influence in integrating the scaffolding inquiry approach with local wisdom in science literacy through a deep understanding of students' cognitive and neuropsychological aspects. Publications such as the NWU Self-Directed Learning Series have 104 publications, with an average citation of 1.72 and Communications in Computer and Information Science has 101 publications, an average citation of 3.57 showing an important contribution in bridging learning approaches that are relevant to technological developments and science literacy. In contrast, Religious Studies Review has the lowest average citation of 0.07 from 95 publications, indicating that research related to this topic in this source has received less academic attention than other sources.

Overall, these data reflect that research related to the scaffolding inquiry learning model integrated with local wisdom has attracted attention on various publication platforms. The dominance of Lecture Notes in Computer Science in terms of the number of publications and total citations shows that this journal is the main choice for researchers. Sources with high citation rates, such as Communications in Computer and Information Science and Behavioral and Brain Sciences, indicate that there are publications with significant impact even though the number is not dominant. This trend shows a growing interest in locally-based research that is relevant to global issues, such as scientific literacy and local wisdom. Table 3 also presents the ten most frequently cited article titles in research on scaffolding inquiry learning models integrated with local wisdom to improve students' scientific literacy.

Table 3. Top 10 main citations of research trends on local wisdom integrated scaffolding inquiry learning models to improve students' science literacy in 2014-2024.

Cites/year	Year	Author	Title
6.00	2023	Yuliarti, Y., Suwandi, S., Andayani, A., & Sumarwati, S.	Learning Model Inquiry-Based Local Wisdom Dilemmas Stories and Their Effects on Critical Thinking and Scientific Writing Abilities
19.14	2017	Dewi, I. N., Poedjiastoeti, S., & Prahani, B. K.	ELSII learning model based local wisdom to improve students' problem solving skills and scientific communication
19.50	2022	Sukmawati, W., Sari, P. M., & Yatri, I.	Online Application of Science Practicum Video Based on Local Wisdom to Improve Student's Science Literacy
7.00	2022	Syahmani, S., Rahmatilah, J., Winarti, A., Kusasi, M., Iriani, R., & Prasetyo, Y. D.	Development of Guided Inquiry Lesson Based on Ethnoscience E-Modules to Improve Studentsâ€™ Problem-solving Ability in Chemistry Class
3.50	2022	Siswanto, J., Harjanta, A. T. J., Suminar, I., & Suyidno, S.	Digital Learning Integrated with Local Wisdom to Improve Students' Physics Problem-Solving Skills and Digital Literacy
33.75	2020	Fadli, A.	The Effect of Local Wisdom-Based Elsii Learning Model on the Problem Solving and Communication Skills of Pre-Service Islamic Teachers.
1.78	2015	Davis, E. A.	Scaffolding learning
11.00	2021	Hikmawati, H., Suastra, I. W., Suma, K., Sudiatmika, A. I. A. R., & Rohani, R.	The Effect of Problem-Based Learning Integrated Local Wisdom on Student Hots and Scientific Attitude

30.00	2023	Purnadewi, G. A. A., & Widana, I. W.	Improving student's science numeration capability through the implementation of PBL model based on

Cites/year	Year	Author	Title
			local wisdom
1.75	2020	Ramdani, A., Utami, S. D., Efendi, I., Dewi, I. N., & Rohyani, I. S.	Local wisdom integrated biology learning program as an alternative to increase generic science skills

The research data in Table 3 shows that the scaffolding inquiry learning model integrated with local wisdom has become the main focus in efforts to improve students' scientific literacy. The article by Fadli (2020) is the most cited with an average of 33.75 citations per year. This study highlights the effectiveness of the local wisdom-based learning model on the problem-solving and communication skills of prospective teacher students, showing great attention to the integration of local wisdom in learning to produce 21st-century competencies.

Research by Purnadewi and Widana (2023) also stands out with an average of 30 citations per year. This study emphasizes the importance of developing students' science numeracy skills through the Problem-Based Learning (PBL) model based on local wisdom, which is relevant to the needs of contextual and culture-based science learning.

The article by Dewi et al. (2017), with an average of 19.14 citations per year, is another important contribution. This study develops a local wisdom-based ELSII learning model designed to improve students' problem-solving and scientific communication skills. This study reflects efforts to integrate local wisdom with scientific literacy to face the challenges of learning in the modern era. In addition, Sukmawati et al. (2022) with an average citation of 19.50 per year developed an online application based on videos of science practicums based on local wisdom to improve students' scientific literacy. This shows the trend of utilizing technology in local-based learning to answer the challenges of digitalization in education.

Research by Hikmawati et al. (2021), with an average citation of 11.00 per year, focuses on the influence of a problem-based learning model integrated with local wisdom on students' higher order thinking skills (HOTS) and scientific attitudes. This study shows the importance of a problem-based approach to encourage more critical and analytical learning. Other studies, such as by Syahmani et al. (2022) with an average citation of 7.00 per year and Yuliarti et al. (2023) with an average citation of 6.00 per year, focuses on the development of ethnoscience-based learning modules and a dilemma story-based approach to improve critical thinking and scientific writing skills. This study emphasizes the relevance of local cultural integration in improving the quality of education.

Overall, these data illustrate that research related to local wisdom-based scaffolding inquiry learning models has developed with an innovative approach. The high focus of research on improving critical thinking skills, problem solving, scientific literacy, and numeracy shows the relevance of this topic in equipping students with relevant competencies to face global challenges, such as climate change, digital literacy, and sustainable development. This trend also confirms that local-based educational approaches not only maintain cultural values but also provide contextual solutions to modern learning needs. Table 4 below displays the ten most frequently used keywords in research on local wisdom-integrated scaffolding inquiry learning models to improve students' scientific literacy.

Table 4. Ten keywords for research trends in integrated local wisdom scaffolding inquiry learning models to improve students' scientific literacy in 2014-2024.

Terms	Occurrences	Relevance
Inquiry science environment	4	3.83
Critikal thinking skill	3	2.18
Technology	5	1.87
PBL model	3	1.33
Scientific inquiry	8	1.27
Ethnoscience	4	1.25
Science education	6	1.21
Local wisdom	9	0.99
Scientific literacy	6	0.80
Scaffolding	4	0.80

Based on Table 4, the ten main keywords in the research trend of the scaffolding inquiry learning model integrated with local wisdom to improve students' scientific literacy in 2014–2024 show a significant focus on core concepts in science education that are based on local and scientific.

The term "local wisdom" has the highest frequency of occurrence of 9 times with a relevance level of 0.99, indicating the importance of integrating local wisdom in the learning model. This term reflects the main focus of the research to link science learning with local cultural values as a contextual and relevant approach. Meanwhile, "scientific inquiry" appears 8 times with a relevance of 1.27, confirming that the scientific method is the main framework in scaffolding inquiry-based learning. The use of this approach aims to improve students' scientific thinking skills.

"Scientific literacy" and "science education" each appear 6 times with a relevance of 0.80 and 1.21. This shows that research related to this learning model has a strong orientation towards improving students' scientific literacy. Science literacy is considered a core competency to face the challenges of the 21st century, such as critical thinking and scientific-based problem solving.

The term "ethnoscience" appeared 4 times with a relevance of 1.25, emphasizing that a local culture-based approach is an important element in this research trend. The ethnoscience approach allows students to understand science concepts through their cultural lens, enriching science learning with a more contextually relevant perspective.

Keywords such as "PBL model" 3 times, relevance of 1.33 and "technology" 5 times, relevance of 1.87 indicate that problem-based learning and technology play an important role in supporting scaffolding inquiry learning. The use of technology provides opportunities to create more interactive and effective learning in integrating local wisdom.

The term "critical thinking skill" appeared 3 times with a relevance of 2.18, emphasizing the importance of this skill as one of the main objectives in scaffolding inquiry-based learning. This reflects the focus of the research on developing students' analytical thinking skills in the context of local-based learning.

The term "inquiry science environment" appears 4 times with a relevance of 3.83, emphasizing the importance of scientific inquiry-based learning in an environment that supports exploration and experimentation. This shows that this study emphasizes experiential learning to improve students' scientific literacy.

In general, these data reflect that research on the scaffolding inquiry learning model integrated with local wisdom focuses on developing students' scientific literacy through the integration of local culture, strengthening scientific methods, and the use of technology. The emergence of keywords such as local wisdom, scientific literacy, and critical thinking skills shows that this trend is towards learning that is more contextual, relevant, and oriented to global needs. By combining elements of local culture, science-based approaches, and modern technology, this learning model provides an innovative solution in supporting quality science education in the 21st century.

The results of bibliometric mapping for the shared keyword network in articles related to the topic of the scaffolding inquiry learning model integrated with local wisdom to improve scientific literacy are shown in Figure 2.

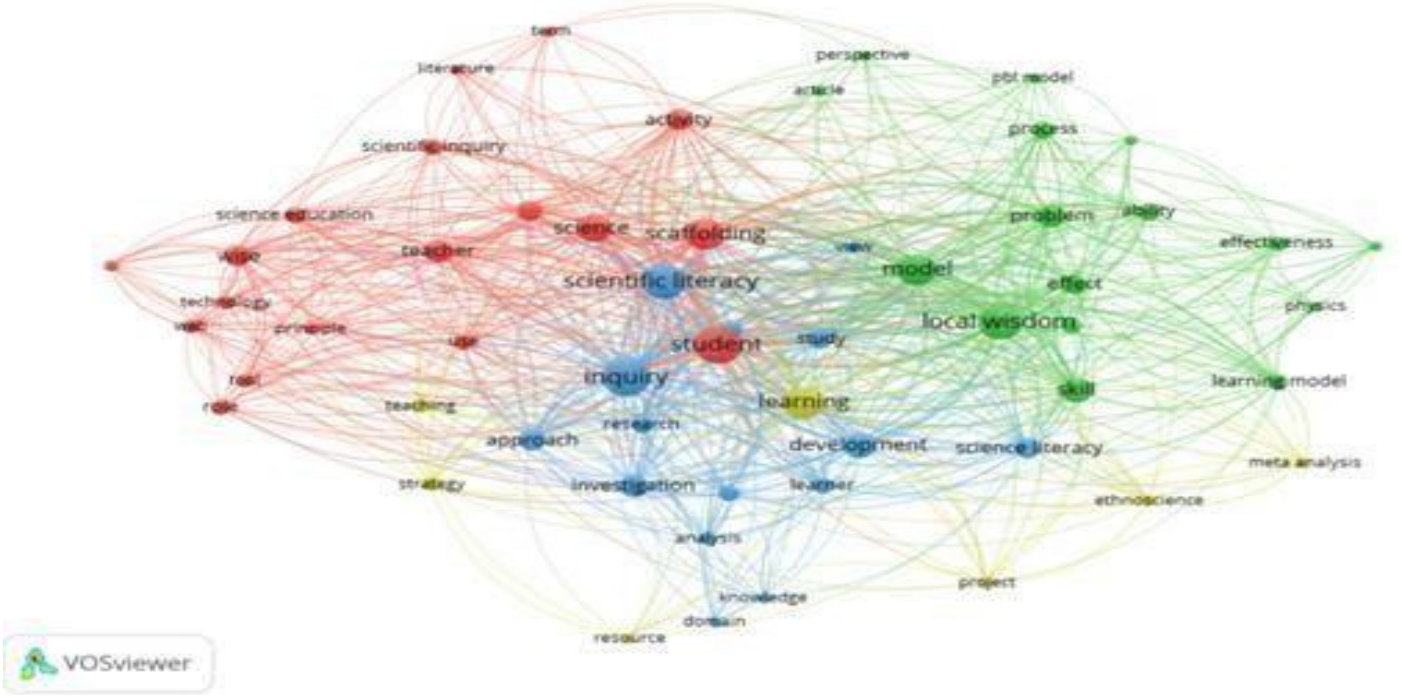


Fig. 2. Network visualization of research trends on integrated local wisdom scaffolding inquiry learning models to improve students' scientific literacy in 2014-2024.

Figure 2 shows the results of the keyword network visualization in the study of the scaffolding inquiry learning model integrated with local wisdom to improve students' scientific literacy. This visualization illustrates the relationships and interconnections between key concepts that frequently appear in research, providing insight into the trends and main focuses of studies in this field.

The network consists of several clusters grouped based on keyword relationships, marked with different colors. The following is an explanation of each cluster: (1) Red Cluster; includes keywords such as "scientific literacy", "scientific inquiry", "scaffolding", and "science education". This cluster shows that scientific literacy and scientific inquiry methods are at the core of the scaffolding inquiry learning model. The emphasis on scientific literacy reflects the main objective of this study, which is to build students' skills in understanding and using scientific concepts through an inquiry-based approach. (2) Green Cluster; contains keywords such as "local wisdom", "PBL model", "problem", and "ethnoscience". This cluster highlights the integration of local wisdom in a problem-based learning approach. This approach aims to connect science learning with the local cultural context of students, so that learning becomes more relevant and meaningful. (3) Blue Cluster; includes terms such as "student", "learning", "development", and "science literacy". This cluster shows a focus on developing student competencies through an interactive learning approach. Research in this cluster tends to explore how learning models can improve students' critical thinking, problem-solving, and science literacy skills. (4) Yellow Cluster; displays keywords such as "technology", "effectiveness", and "learning model". This cluster emphasizes the role of technology as a tool to support science learning based on local wisdom. Technology not only increases the accessibility of learning but also enables innovation in teaching methods. (5) Purple Cluster; involves keywords such as "implementation", "contribution", and "meta-analysis". This cluster emphasizes the importance of implementing and evaluating learning models to ensure their effectiveness in improving students' science literacy. Studies in this cluster usually

focus on the real impact of local wisdom-based learning in various educational contexts.

This visualization provides insight into how research related to the scaffolding inquiry learning model integrated with local wisdom is developing. The main focus on science literacy, integration of local wisdom, technology development, and evaluation of effectiveness shows that this topic has great relevance to the challenges of education in the 21st century. This trend reflects the commitment of academics to develop learning models that are responsive to local cultural contexts while at the same time aligned with global needs. Future research directions involve optimizing technology in learning, further exploring the effectiveness of locally-based approaches, and developing educational policies that support the widespread application of this concept. This network visualization is an important guide in understanding the direction of research trends and their implications for more inclusive and contextual science education.

Furthermore, the results of the overlay visualization of research trends on the scaffolding inquiry learning model integrated with local wisdom to improve students' science literacy are presented in Figure 3 below.

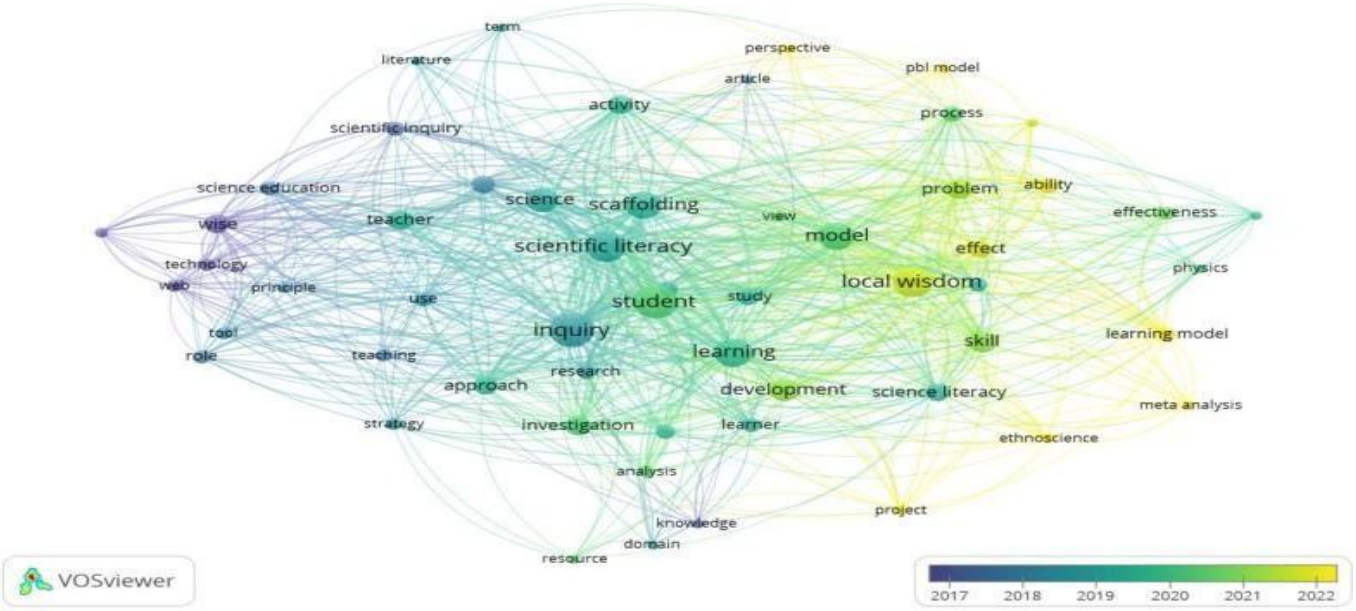


Fig. 3. Overlay visualization of research trends on integrated local wisdom scaffolding inquiry learning models to improve students' science literacy in 2014-2024.

Figure 3 shows an overlay visualization depicting the temporal trend of research related to the local wisdom-integrated scaffolding inquiry learning model to improve students' scientific literacy. This visualization uses a color scale to indicate the year the keywords appeared in the research, with dark blue representing older research (2017–2018) and yellow indicating newer research (2021–2022).

At the center of the network, keywords such as "scientific literacy", "scaffolding", "local wisdom", and "inquiry" are visible. These terms have a central position in the research, indicating their relationship to other relevant topics, such as local wisdom-based science education and scientific inquiry methods. The greenish blue color of some of these keywords reflects that the focus of the research has begun to develop since several years ago.

Keywords such as "technology", "learning model", and "ethnoscience" are seen in lighter colors, indicating newer research trends. This highlights the importance of technology and culture-based approaches in supporting scaffolding inquiry-based learning. The emphasis on technology indicates a transition towards using digital tools to enhance learning that is relevant to students' local contexts.

Keywords such as "effectiveness," "problem-solving," and "meta-analysis" in yellow indicate that research in this topic is increasingly directed at measuring the impact of learning models. This study aims to identify the effectiveness of a local wisdom-based scaffolding inquiry approach on students' scientific literacy.

The presence of keywords such as "development," "critical thinking skills," and "science education" in bright colors indicates increasing attention to improving students' critical thinking skills through a local-based approach and scientific methods.

Based on the explanation above, this visualization shows that the research trend on the local wisdom-integrated scaffolding inquiry learning model continues to grow. The main focus of the research includes technology integration, the use of local wisdom, and the development of students' critical thinking skills and scientific literacy. These topics reflect the need for learning models that are relevant to the challenges of the 21st century while also contextual to local cultural values.

This visualization also provides an overview of research development, with an initial focus on a local-based approach and scientific inquiry, then shifting to technology integration and measuring effectiveness in the broader context of science education. This trend indicates that future research will continue to explore the potential of local technologies and approaches in improving students' scientific literacy at various levels of education.

In addition, keywords are also presented for research on scaffolding inquiry learning models integrated with local wisdom to improve students' scientific literacy based on density visualization.

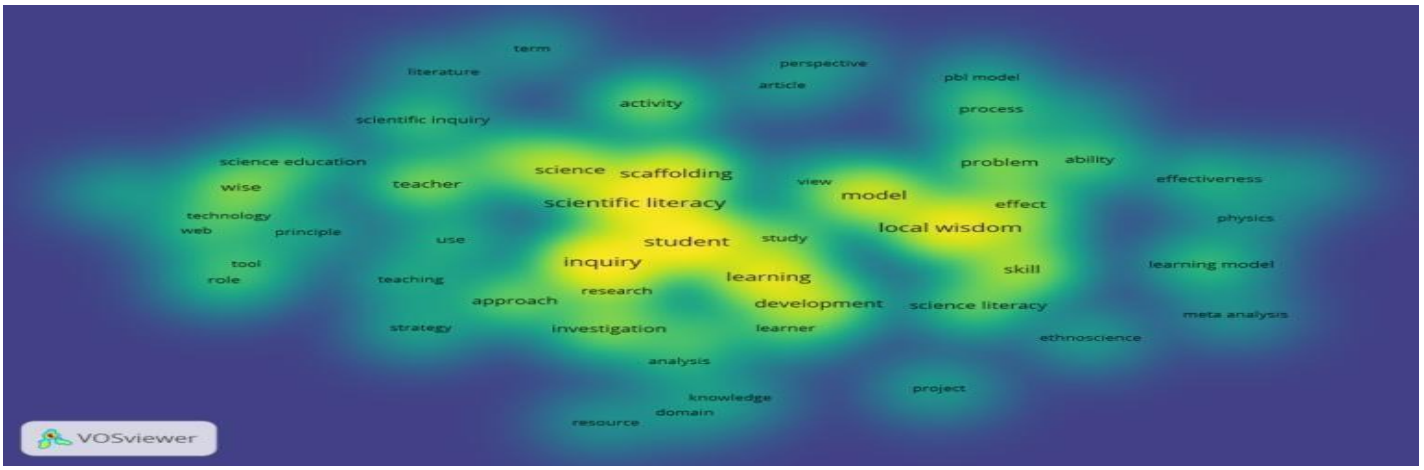


Fig. 4. Density visualization of research trends on integrated local wisdom scaffolding inquiry learning models to improve students' scientific literacy in 2014-2024.

Figure 4 displays a visualization of the density of research themes on the trend of scaffolding inquiry learning integrated with local wisdom to improve students' scientific literacy. The density of the theme is indicated by color, where bright yellow indicates keywords with high frequency in the literature, while dark blue indicates lower frequency.

Keywords such as "scientific literacy", "scaffolding", "local wisdom", "inquiry", and "student" have a bright yellow color, indicating that these themes appear most frequently in research. The high density of these keywords indicates that the main focus of the research is on the integration of scientific methods with local culture-based approaches to improve students' scientific literacy. "Scientific literacy" is one of the main focuses, reflecting the importance of students' ability to understand and use scientific concepts in the context of everyday life. "Local wisdom" is also a main keyword, indicating the role of local wisdom as a relevant contextual element in science learning to improve students' relevance and understanding of the material.

Keywords such as "technology", "problem-solving", "learning model", and "ethnoscience" have medium density (blueish green). This theme shows a growing trend, especially in the use of technology to support local wisdom-based learning. The emphasis on "technology" indicates the development of a digital approach that is relevant to 21st-century learning. The term "ethnoscience" reflects a culture-based approach in connecting science to students' local contexts.

Keywords such as "meta-analysis", "physics", and "effectiveness" are colored dark blue, indicating that this theme is relatively rarely researched. However, these topics offer opportunities for further research development, especially in meta-analysis and evaluation of the effectiveness of learning models.

This visualization provides a clear picture of the focus and direction of research on the scaffolding inquiry learning model. The high density of keywords such as "scientific literacy" and "local wisdom" reflects the urgent need to develop contextual and culture-based learning. Meanwhile, great potential is seen in keywords with low density such as "meta-analysis" and "physics", which can be the focus of future research.

Research on the scaffolding inquiry learning model integrated with local wisdom is expected to continue to grow along with technological advances and the need for educational approaches that are relevant to the challenges of the 21st century. The use of technology is an important element in integrating scientific concepts with local values. Through the use of technology, students can learn in a more interactive, interesting, and experiential way.

For example, the implementation of local-based projects such as environmental conservation, natural resource conservation, or traditional cultural preservation can be part of learning (Damopolii et a., 2024; Rukanda et al., 2024; Zahro & Fauziah, 202). These projects allow students to apply science concepts in real-world contexts that are close to their lives. In addition, local-based activities like this can also encourage students to develop critical thinking skills, collaborate with peers, and solve problems creatively, all of which are key competencies in the modern era (Ali et al., 2024; Kertopati, 2024).

This approach is relevant to the challenges of global education because it supports the development of scientific literacy that is not only technical but also contextual. Students are not only taught to understand science, but are also empowered to use that knowledge to solve problems relevant to their communities. This not only strengthens students' global competencies, such as scientific thinking and problem solving, but also builds their awareness of local cultural values (Ahsani et al., 2024; Okada, 2024; Liu, 2009; Tsai, 2018; Bouillion & Gomez, 2001).

This research trend supports the vision of sustainability-oriented education, which is to connect science with the preservation of the environment and local culture. With this approach, education not only equips students with 21st-century skills but also helps them understand the importance of their role in preserving cultural heritage and the environment. As a result, this approach strengthens students' cultural identity, fosters a sense of social responsibility, and contributes to the development of a more sustainable society.

Conclusion

Research on the local wisdom-integrated scaffolding inquiry learning model to improve students' scientific literacy has shown significant development during the 2014-2024 period. This study highlights the importance of a local culture-based learning approach and scientific methods in building scientific literacy, which is a core competency of the 21st century. The results of the analysis show that the publication trend of this research peaked in 2021, reflecting great interest in the relevance of this topic. The

dominance of publication types in the form of chapters and edited books indicates that this topic is often discussed in comprehensive academic references. In addition, journals such as Lecture Notes in Computer Science are the main platforms for disseminating the findings of this research.

Keywords such as local wisdom, scientific literacy, and scientific inquiry indicate the focus of research on the integration of local cultural values with scientific literacy based on scientific methods. The use of technology is also an important element in supporting more interactive and contextual learning. The network visualization and density of this research trend underscore the importance of evaluating the effectiveness of local wisdom-based learning in improving students' scientific literacy, problem-solving, and scientific understanding.

Overall, the research trend of integrated local wisdom scaffolding inquiry model has become the main focus in developing relevant and contextual science education with the needs of the 21st century. The contribution of this research is as a guide for teachers and policy makers in designing adaptive and contextual curriculum, which is responsive to global challenges while strengthening local cultural values.

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References

[1] Parno, L. Yuliati, F. M. Hermanto, and M. Ali, "A case study on comparison of high school students' scientific literacy competencies domain in physics with different methods: PBL-stem education, PBL, and conventional learning," *J. Pendidik. IPA Indones.*, 2020, doi: 10.15294/jpii.v9i2.23894.

[2] D. Höttecke and D. Allchin, "Reconceptualizing nature-of-science education in the age of social media," *Sci. Educ.*, 2020, doi: 10.1002/sce.21575.

[3] H. MacDonald, "Students Think Science Literacy is Important and Improves with Lifelong Learning," 2021. doi: 10.18438/eblip29926.

[4] M. C. CHRISPIM, "Resource recovery from wastewater treatment: challenges, opportunities and guidance for planning and implementation," *Front. Neurosci.*, 2021.

[5] Andreas Schleicher, "PISA 2018 Insights and Interpretations FINAL," *OECD*, 2019.

[6] D. Hopkins, "Mejora escolar, liderazgo y reforma sistémica: una retrospectiva (School improvement, leadership and systemic reform: a retrospective)," *Rev. Eletrônica Educ.*, 2019, doi: 10.14244/198271993075.

[7] OECD, *"PISA 2018 Mathematics Framework", in PISA 2018 Assessment and Analytical Framework,*. 2019.

[8] C. H. D. Gill and E. Berezina, "School performance in three South East Asian countries: lessons in leadership, decision-making and training," *Eur. J. Train. Dev.*, 2020, doi: 10.1108/EJTD-01-2020-0014.

[9] U. Toharudin, L. F. Damaianti, I. Y. N. Hizqiyah, and I. Setia Kurniawan, "Developing Students' Scientific Literacy through Wikipedia Digital Library," *Int. J. Emerg. Technol. Learn.*, 2023, doi: 10.3991/ijet.v18i24.45605.

[10] L. N. Jescovitch *et al.*, "Comparison of Machine Learning Performance Using Analytic and Holistic Coding Approaches Across Constructed Response Assessments Aligned to a Science Learning Progression," *J. Sci. Educ. Technol.*, 2021, doi: 10.1007/s10956-020-09858-0.

[11] M. Azzam and R. Easteal, "Neuroanatomical Approaches to Improving Student Learning in Science Education," *FASEB J.*, 2020, doi: 10.1096/fasebj.2020.34.s1.02109.

[12] P. Löffler, M. Pozas, and A. Kauertz, "How do students coordinate context-based information and elements of their own knowledge? An analysis of students' context-based problem-solving in thermodynamics," *Int. J. Sci. Educ.*, 2018, doi: 10.1080/09500693.2018.1514673.

[13] E. Slovinsky, M. Kapanadze, and C. Bolte, "The Effect of a Socio-Scientific Context-Based Science Teaching Program on Motivational Aspects of the Learning Environment," *Eurasia J. Math. Sci. Technol. Educ.*, 2021, doi: 10.29333/ejmste/11070.

[14] C. Chu, J. L. Dewey, and W. Zheng, "An Inorganic Chemistry Laboratory Technique Course using Scaffolded, Inquiry-Based Laboratories and Project-Based Learning," *J. Chem. Educ.*, 2023, doi: 10.1021/acs.jchemed.3c00547.

[15] T. L. Killpack, S. M. Fulmer, J. A. Roden, J. L. Dolce, and C. D. Skow, "Increased Scaffolding and Inquiry in an Introductory Biology Lab Enhance Experimental Design Skills and Sense of Scientific Ability," *J. Microbiol. Biol. Educ.*, 2020, doi: 10.1128/jmbe.v21i2.2143.

[16] S. A. Rodzalan, N. N. M. Noor, L. S. M. Arif, and M. M. Saat, "Factors Influencing the Improvement of Students' Critical Thinking and Problem-Solving Skill An Industrial Training Intervention," *Int. J. Emerg. Technol. Learn.*, 2020, doi: 10.3991/ijet.v15i22.16303.

[17] I. B. A. P. Manuaba, Y. No, and C. C. Wu, "The effectiveness of problem based learning in improving critical thinking, problem-solving and self-directed learning in first-year medical students: A meta-analysis," *PLoS One*, 2022, doi: 10.1371/journal.pone.0277339.

[18] A. Fadli and Irwanto, "The effect of local wisdom-based ELSII learning model on the problem solving and communication skills of pre-service islamic teachers," *Int. J. Instr.*, 2020, doi: 10.29333/iji.2020.13147a.
[19] J. Sayono, N. Jauhari, L. Ayundasari, and W. D. Sulistyo, "Development of projo bale model based on android application in history and local wisdom studies of Malang," *Int. J. Emerg. Technol. Learn.*, 2020, doi: 10.3991/IJET.V15I07.13219.
[20] R. M. Mudjid, Supahar, H. Putranta, and D. S. Hetmina, "Development of Android Physics Learning Tools Based on Local Wisdom Traditional Game Bola Boy as a Learning Source," *Int. J. Interact. Mob. Technol.*, 2022, doi: 10.3991/ijim.v16i06.27855.
[21] A. Kervinen, W. M. Roth, K. Juuti, and A. Uitto, "The resurgence of everyday experiences in school science learning activities," *Cult. Stud. Sci. Educ.*, 2020, doi: 10.1007/s11422-019-09968-1.
[22] J. P. Ayotte-Beaudet *et al.*, "Exploring the impacts of contextualised outdoor science education on learning: the case of primary school students learning about ecosystem relationships," *J. Biol. Educ.*, 2023, doi: 10.1080/00219266.2021.1909634.
[23] E. B. Santos, "Do impresso ao digital: o processo de transição no jornalismo local e do 'interior,'" *Carbohydr. Polym.*, 2019.
[24] U. Aiman, S. Hasyda, and Uslan, "The influence of process oriented guided inquiry learning (POGIL) model assisted by realia media to improve scientific literacy and critical thinking skill of primary school students," *Eur. J. Educ. Res.*, 2020, doi: 10.12973/EU-JER.9.4.1635.
[25] E. T. Ong, B. L. Keok, J. Yingprayoon, C. K. S. Singh, M. T. Borhan, and S. W. Tho, "The effect of 5E inquiry learning model on the science achievement in the learning of 'Magnet' among year 3 students," *J. Pendidik. IPA Indones.*, 2020, doi: 10.15294/jpii.v9i1.21330.
[26] A. Hasani, D. E. Juansah, I. J. Sari, and R. A. Z. El Islami, "Conceptual frameworks on how to teach stem concepts in bahasa indonesia subject as integrated learning in grades 1–3 at elementary school in the curriculum 2013 to contribute to sustainability education," *Sustain.*, 2021, doi: 10.3390/su13010173.
[27] A. Saleh, C. Yuxin, C. E. Hmelo-Silver, K. D. Glazewski, B. W. Mott, and J. C. Lester, "Coordinating scaffolds for collaborative inquiry in a game-based learning environment," *J. Res. Sci. Teach.*, 2020, doi: 10.1002/tea.21656.
[28] T. Michalsky, "When to Scaffold Motivational Self-Regulation Strategies for High School Students' Science Text Comprehension," *Front. Psychol.*, 2021, doi: 10.3389/fpsyg.2021.658027.
[29] H. A. El-Wakeel, R. Abdellatif, D. H. Eldardiry, D. F. Al-Saleh, M. I. Shukri, and K. M. N. Ansari, "Brain-based learning in design and visual arts education: a bibliometric assessment of Scopus indexed literature," 2023. doi: 10.12688/f1000research.110294.3.
[30] O. Zawacki-Richter, V. I. Marín, M. Bond, and F. Gouverneur, "Systematic review of research on artificial intelligence applications in higher education – where are the educators?," 2019. doi: 10.1186/s41239-019-0171-0.
[31] P. Hallinger and C. Chatpinyakoop, "A bibliometric review of research on higher education for sustainable development, 1998-2018," 2019. doi: 10.3390/su11082401.
[32] P. Hallinger and V. T. Nguyen, "Mapping the landscape and structure of research on education for sustainable development: A bibliometric review," 2020. doi: 10.3390/su12051947.