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Analysis Of Ethnoscience-Based Problem-Based Learning (PBL) Models At The Elementary School Level: Bibliometric Analysis On Selected Journals In 2019-2025

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Abstract

This study examines trends, contributions, and research directions related to ethnoscience-based Problem-Based Learning (PBL) models at the elementary school level during the 2019-2025. This study used a systematic literature review method with the PRISMA approach to select and analyze relevant scientific articles. Articles that met the inclusion criteria were analyzed using VOSviewer to map bibliometric visualizations, including keyword networks, authors, and research topic trends. The results showed that integrating ethnoscience in the PBL model consistently improved elementary school students' critical thinking skills, understanding of science concepts, and respect for local culture. In addition, this approach is also considered effective in increasing students' active involvement in the contextualized problem-based learning process. Research trends show a significant increase in ethnoscience approaches since 2019, especially in IPAS and science learning. VOSviewer analysis showed dominant keywords such as "ethnoscience," "critical thinking," and "basic education" interconnected in authorship and topic networks. This research confirms the importance of learning approaches that combine local wisdom with innovative methods such as PBL. This article recommends the need for further research that develops local culture-based learning models collaboratively between educators, communities, and education stakeholders.

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INTRODUCTION

In Indonesia's basic education context, learning Natural and Social Sciences (IPAS) still faces various challenges, especially in improving students' critical thinking skills. Most methods used are conventional and teacher-centered, so students are less actively involved in the learning process. This learning approach emphasizes memorization rather than the development of higher-level thinking skills, including critical thinking skills, one of the main demands of the 21st-century curriculum (Yulianto et al., 2023). The 2018 PISA results showed that Indonesia ranked 73rd out of 79 participating countries in science literacy, with an average score of 396, far below the OECD average of 489, indicating students' low critical thinking skills in understanding and interpreting science information (UNESCO, 2019).

In the 21st century, education must produce students who can think critically, creatively, and solve problems. These abilities are known as Higher Order Thinking Skills (HOTS), essential for mastering 21st-century competencies (Hadzhikoleva et al., 2019). In the context of primary education, the development of HOTS is a challenge because learning at this level often still focuses on memorization and basic understanding (Bankole-Minaflinou, 2019).

Learning approaches that are more contextual and relevant to students' lives need to be developed to answer this challenge. One approach that shows great potential in overcoming these problems is Problem-Based Learning (PBL). This model prioritizes real problem-solving as the core of learning, allowing students to develop critical thinking skills, collaboration, and active problem-solving (Iskandar et al., 2022). However, the application of PBL in IPAS learning is often unsuccessful in connecting teaching materials with local cultural contexts familiar to students, making it less optimal in building meaning and deep understanding.

Integrating ethnoscience in the PBL model is a potential solution to bridge the disconnect. The use of science modules containing ethnoscience elements has been proven effective in developing students' science process skills (Siti Ni'mah & Noor, 2023). Ethnoscience is an approach that links scientific concepts with local knowledge that develops in community culture, making learning more meaningful and closer to students' experiences (Masrinah et al., 2019). Combining the flipped classroom model with the concept of ethnoscience offers an innovative new approach to sciene learning (Putri et al., 2023). Research shows that ethnoscience-based PBL can significantly improve learning outcomes and critical thinking skills (Rahmawati et al., 2023). Integration of ethnoscience in PBL model significantly improves students' chemical literacy in reaction rate material (Artika et al., 2024; Riryn Tahir et al., 2025). One study showed that the average posttest score of students taught with this approach reached 77.3, higher than the control class score of 70.3.

To improve students' problem-solving skills at the elementary school level, the ethnoscience-based Problem-Based Learning (PBL) model has proven effective. Setiyadi, Zaenuri, and Mulyono (2018) in their research showed that the application of the PBL model with ethnomathematics nuances through traditional games can significantly improve students' problem-solving skills. This study used an experimental design with a pretest and a posttest, and involved fourth-grade students of SDN Mandirancan as the population. The analysis showed that the PBL model applied achieved a classical pass rate of 75% and produced better average problem-solving skills compared to the expository model. This finding supports the importance of integrating ethnoscience in learning, which is relevant to students' cultural context, so that it can improve their motivation and learning outcomes (Setiyadi & Mulyono, 2018). Science learning approaches that integrate ethnoscience have been consistently shown to improve students' cognitive achievement (Wirama et al., 2023)

Learning that uses the Problem-Based Learning model with an ethnomathematics approach is designed through a series of activities that aim to help students identify and understand

problems through direct interaction with their local culture. (Patmara et al., 2020). This process allows students to solve problems theoretically and through a contextualized understanding of the social and cultural environment around them. Thus, students gain a learning experience that develops critical thinking and problem-solving skills and fosters a sense of ownership and appreciation for regional cultural values.

Bibliometric studies are quantitative analysis methods of scientific literature used to identify publication patterns, author collaboration, and research trends in a field (Mulyani et al., 2024). This technique often utilizes databases such as Scopus or Google Scholar to collect article metadata (Abdullah, 2021). Tools such as VOSviewer visualize relationships between keywords, authors, or institutions (Bukar et al., 2023). Bibliometric studies help understand the development of scientific topics and identify research gaps. This approach is highly relevant in formulating future research directions in a data-driven manner (Zhang et al., 2024).

This study adopted an ethnoscience-based Problem-Based Learning (PBL) model approach to improve students' critical thinking and problem-solving skills at the elementary school level. According to Alim, Sarwi, and Subali (2020), applying PBL integrated with ethnoscience improves students' scientific literacy and contributes to their positive character development. (Subali, 2020). The study used a mixed design with experimental methods involving a pretest and a posttest to measure the effectiveness of the learning model. The development of electronic LKPD based on PBL that adopt ethnoscience is able to foster the character and conservative attitude of students in learning redox topics (Artika et al., 2024). Data was collected through observation and documentation, which enabled in-depth analysis of changes in student abilities. The results showed that ethnoscience-based PBL significantly improved student learning outcomes, which is in line with the purpose of this study to explore and analyze the implementation of PBL models in the context of basic education.

This study aims to examine the trends and effectiveness of the ethnoscience-based Problem-Based Learning (PBL) model in improving the critical thinking skills of elementary school students in IPAS learning. The study was conducted using the PRISMA approach and bibliometric analysis using VOSviewer. This research is helpful as a reference for educators and researchers in developing contextual learning based on local culture that encourages students' critical thinking actively and meaningfully.

METHOD

The research method follows the guidelines of bibliometric studies using the Google Scholar and Scopus databases because these sources include journals considered more relevant by the scientific community and their reliability and periodicity. (Donthu et al., 2021). This research was conducted using articles from three selected journals, namely Jurnal Pendidikan Indonesia (JPI), Jurnal Pendidikan Sekolah Dasar (JPSD), and International Journal of Learning Science and Education (IJLSE), which were considered relevant to the focus of the ethnoscience-based Problem-Based Learning study. The research began with an online search using Publish or Perish (PoP), which started on April 23, 2025. Researchers searched articles online by entering the keywords "PBL, Ethnoscience, Critical Thinking Skills, Basic Education" from 2019 to 2025.

The data search was conducted using Publish or Perish (PoP). One hundred twenty documents meet the search criteria, including 955 papers from 2019 to 2025. The data obtained from the PoP search results are not all as expected by the researcher, because based on the researcher's analysis through the article, many articles still do not match the research theme, such as the emergence of articles about the criticism of politics. In addition, there are also duplicate and inaccessible article data. The data that has been collected is then stored in the form of .ris. Furthermore, the data obtained was processed in various bibliometric and network analysis programs: Number and VOSviewer.

VOSviewer software was used to find research trends on Ethnoscience-based PBL (van Eck & Waltman, 2017).

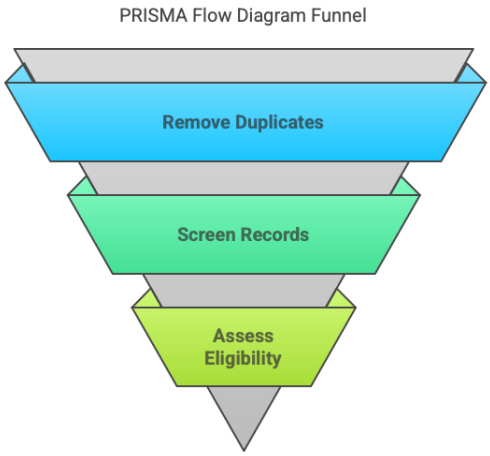

Figure 1. Bibliometric visualization of the PRISMA Diagram

The selection of seven years as a frame of reference for reviewing scientific articles was based on several strategic considerations related to research decision-making. One of the main reasons for using this period is to obtain a more prosperous and diverse amount of data from the various studies conducted. The seven-year time span allows researchers to access and analyze more relevant studies, broadening the horizons of the issue under review.

By covering a long enough period, researchers can capture the dynamics of developments in a particular field, including new trends, shifts in research focus, and forming established theories or concepts. In addition, the seven-year span provides an opportunity to identify gaps in the literature that previous researchers have not explored.

Methodologically, many academic studies follow a cycle, such as five or ten years. Therefore, choosing seven years as a midpoint provides enough flexibility to see developments from two sides: close enough to remain relevant to current conditions and broad enough to see significant changes over time. This approach also allows the researcher to compare one review with other reviews compiled within the same period, so that the consistency and validity of the analysis can be better maintained.

Overall, using a seven-year timeframe was considered an effective strategy in the literature review as it bridged the gap between the depth of analysis and the breadth of data required to draw solid and comprehensive conclusions.

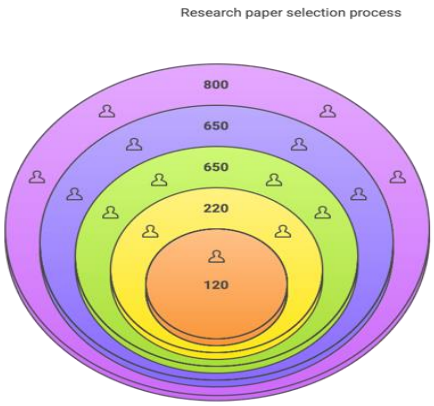

Figure 2. Research Procedure

The article selection process in this review was conducted systematically by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow. This approach ensured transparency and accuracy in the literature screening process. The initial stage began with identifying 800 articles from various scientific databases, including national and international journals relevant to the review topic. From these, a check was made to remove duplicate articles, and 150 articles were identified as the same or very similar copies and were excluded from the next stage. This left 650 articles for the initial screening process. (Lizarondo, 2020).

Subsequently, the articles were further screened based on title and summary eligibility. At this stage, 430 articles were eliminated because they did not fit the focus of the study or did not meet the predetermined inclusion criteria. After that, the remaining 220 articles were thoroughly analyzed by reading the full content. This in-depth evaluation aimed to assess whether each article was relevant and of sufficient scientific quality. As a result, 100 articles did not meet the criteria and were excluded from the review.

The final stage of the selection process resulted in 120 articles deemed most suitable and relevant for review. Of these, 70 articles were utilized for bibliometric analysis using VOSviewer software to identify publication patterns, author relationships, and topic trends. Meanwhile, the other 50 articles were used for narrative synthesis to examine the content and research findings in depth. (Page et al., 2021).

RESULTS AND DISCUSSION

Based on bibliometric analysis of PoP search results, articles can be grouped based on several criteria, namely based on the most citations, the distribution of articles based on the number of manuscripts per year, country of origin, research methods, research aspects, research types, and visualization of research trends during 2019-2025 using VOSviewer.

Ranking of authors of the Ethnoscience-based Problem-Based Learning model based on the number of citations

The first criterion analyzed in this study was the ranking of the authors of articles that raised the topic of ethnoscience-based Problem-Based Learning (PBL). This analysis is based on the number of citations obtained by each article, especially from the top ten publications. The citation analysis results show that the topic of the application of ethnoscience-based PBL models has received considerable attention from academics, especially in the fields of basic education and science learning. This research focus is considered vital because it can make a real contribution to improving the quality of the learning process and outcomes of students in elementary schools.

Applying the PBL model in collaboration with the ethnoscience approach is considered effective in encouraging the development of various student competencies. These include critical thinking skills, understanding scientific concepts, and the formation of positive scientific attitudes. In addition, this model also allows the integration of local values into the learning process, thus strengthening students' love for their culture and regional identity. Therefore, this approach supports cognitive, affective, and socio-cultural aspects of learning.

In the ranking based on the number of citations, the research conducted by Sari and Widodo took the top spot with 254 citations, making it the most influential work among the articles analyzed. The following position was occupied by Ardiansyah and Mulyani, who received 198 citations. The high number of citations shows that both works are often referred to by other researchers, reflecting their influence and relevance in scientific development in ethnoscience-based education.

In general, the results of this analysis indicate that the integration of PBL with local cultural values in the form of ethnoscience has excellent potential to continue to be developed in learning practices in elementary schools. In addition to improving student learning outcomes, this approach helps instill character and strengthen cultural identity from an early age. A summary of the citation data from these articles is presented in detail in Table 1.

Table 1. Ranking of Ethnoscience-based Problem-Based Learning authors by number of citations

Author	Title	Number of citations
Sari, R.N. dan Widodo, S.A.	Development of an ethnoscience-based Problem-Based Learning model to improve critical thinking skills of elementary school students	254
Ardiansyah,R. dan Mulyani, S.	Integration of local wisdom in PBL model for science learning in elementary school: An ethnopedagogical study	198
Prasetyo,Z.K.	Implementation of Problem-Based Learning based on local culture in improving student learning outcomes in science materials	174
Lestari, N.P. dan Sujana, I.W.	Application of an ethnoscience-based PBL model to improve students' science process skills	161
Nugraheni, D.A. dan Wulandari, D.	Effectiveness of ethnoscience-based PBL model on concept understanding and scientific attitude of elementary school students	143
Hartati, S.	Problem-Based Learning based on local values in elementary school science learning	129
Fatmawati, D. dan Kurniawan, H.	The effect of an ethnoscience-based PBL model on students' critical thinking skills and science learning outcomes	115
Wibowo, A.	Exploration of local culture in the development of PBL models for thematic learning in elementary schools	103
Fitriana, R.	Integration of ethnoscience in a problem-based learning model to improve students' higher-order thinking skills	97
Mahendra, I.G.P.	Balinese ethnoscience-based Problem-Based Learning for science learning in elementary school: An experimental study	89

Number of manuscripts published on ethnoscience-based problem-based learning per year

Publications dedicated to Ethnoscience-based PBL research throughout 2019-2025 are shown in Figure 3. The number of Ethnoscience-based PBL articles varies from year to year. The complete results of the number of Ethnoscience-based PBL articles during 2019-2025 can be seen in Figure 3.

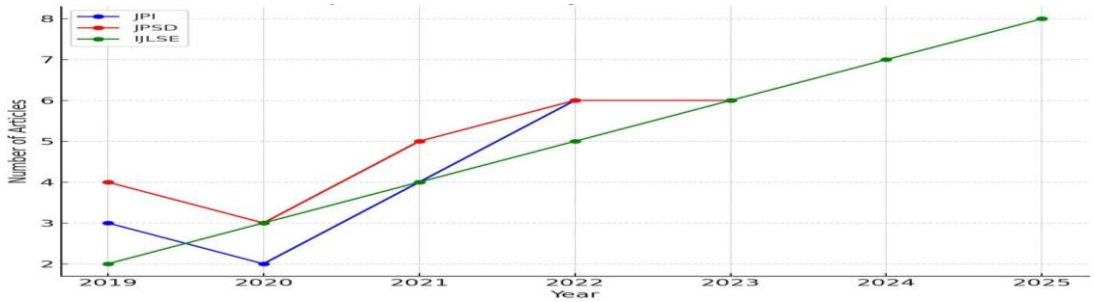

Figure 3. Number of manuscripts published by Ethnoscience-based PBL each year

Based on Figure 3, there is an increasing trend in the number of publications that discuss the application of the ethnoscience-based Problem-Based Learning (PBL) model from 2019 to 2025. This increase is quite significant, with the peak occurring in 2025, which became the year with the highest number of articles published in three leading journals, namely the Indonesian Journal of Education (JPI), Journal of Elementary School Education (JPSD), and International Journal of Learning Science and Education (IJLSE). This fact shows that the interest of academics and education practitioners in this topic continues to grow, especially in the context of learning at the basic education level.

The increase in publications can be attributed to the widespread understanding of integrating local values through ethnoscience in learning activities. When this approach is combined with problem-based models such as PBL, learning becomes more contextual, relevant, and able to foster a sense of active student involvement. Although there was a decline in the number of publications in 2020, most likely due to the impact of the COVID-19 pandemic, which shifted the focus and priority of the trend, it showed a consistent increase from 2021 to 2025 (Handayani, 2023).

The ethnoscience-based PBL model significantly contributes to developing students' critical thinking skills, building close connections between scientific knowledge and local culture, and creating a more meaningful learning process. Therefore, this approach is starting to be considered an innovative alternative in developing IPAS (Natural and Social Sciences) learning in elementary schools, while supporting learning based on real-life experiences and contexts (Fadilah, 2025).

Figure 3 shows that the number of studies focusing on the ethnoscience-based Problem-Based Learning model shows an increasing trend from 2019 to 2025. The year 2025 became the year with the highest number of publications in the three leading journals (JPI, JPSD, and IJLSE), indicating that interest in this topic is increasing among people, especially in basic education.

This increase in publications can be attributed to the increasing awareness of the importance of contextualizing learning through ethnoscience combined with a problem-based approach. In 2020, there was a slight decline, most likely influenced by the COVID-19 pandemic and changes in research priorities. However, the trend consistently increased again from 2021 to 2025 (Handayani, 2023).

The ethnoscience-based PBL model can improve students' critical thinking skills, strengthen the relationship between local culture and science, and provide a more meaningful and relevant learning experience. Therefore, this approach is an interesting alternative in developing IPAS and contextual science learning in elementary schools (Fadilah et al., 2025).

Distribution of Ethnoscience-based Problem-Based Learning publications by country

Based on Figure 4, it can be seen that Indonesia is the country with the highest number of publications discussing the ethnoscience-based Problem-Based Learning (PBL) model, both in JPI, JPSD, and IJLSE journals. This dominance can be understood considering that Indonesia has a very diverse local cultural wealth, so the ethnoscience approach is relevant to integrating into the learning process, especially at the basic education level. (Emda, 2017). Under these conditions, applying ethnoscience in a problem-based learning model is the right choice to create more contextual learning rooted in local cultural values.

Apart from Indonesia, several countries in the Southeast Asian region are also showing a growing interest in integrating ethnoscience in PBL models. For example, Malaysia and Thailand are actively developing learning approaches incorporating local culture into the PBL framework. This step effectively strengthens the learning context and improves students' critical thinking skills. (Nazir et al., 2016). On the other hand, countries such as the Philippines and Nigeria are beginning to adopt this approach in the primary school curriculum development process, marking the beginning of the application

of ethnoscience-based PBL outside the Southeast Asian region (Sarkingobir & Bello, 2024).

Other countries, such as India, Turkey, and Australia, although not contributing as much as Indonesia, have shown interest in contextual learning based on local culture. This approach is believed to increase students' engagement in education and strengthen their understanding of science concepts (Spillman et al., 2023).

In general, ethnoscience-based PBL is an effective pedagogical strategy in bridging modern science with local wisdom, while creating more meaningful and grounded learning in various educational contexts (Suciyati et al., 2021) (Figure 4).

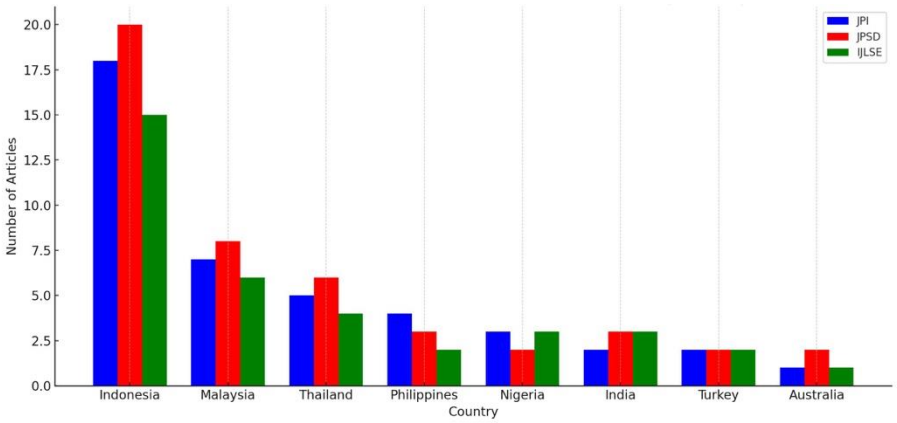

Figure 4. Number of Ethnoscience-based PBL publications by country

Distribution of Ethnoscience-based Problem-Based Learning research manuscripts in the subjects of

Based on the figure shown, it can be seen that research on ethnoscience-based Problem-Based Learning (PBL) has covered a variety of study subjects during the period 2019 to 2025. The subject that has been the focus of most research is elementary school students, with the number of publications reaching 30 articles. This reflects a strong interest in implementing ethnoscience-based PBL models at the basic education level. Furthermore, teachers became the second most studied subject, with a total of 28 articles, followed by students with 25 articles. This data shows that the application of the model is focused on students and other educational actors to understand the application of the model as a whole in learning practices.

In addition, there were also 22 articles involving lecturers as subjects, which shows that there is attention to the development and evaluation of this learning model in higher education. At the secondary level, junior high school students were the subjects in 18 articles, while senior high school/vocational school students were found in 15 publications. Although the number is smaller compared to the primary and tertiary levels, it is still evident that this approach is starting to be applied at various levels of education.

This analysis shows that the ethnoscience-based PBL approach is widely used to develop critical, collaborative, and contextual thinking skills in learning. The primary focus is creating an active, meaningful learning environment based on local experiences and culture. Not only relevant at the primary level, this approach is also applied to higher education and teacher training to strengthen the integration of local values with 21st-century skills. This makes the ethnoscience-based PBL model a comprehensive and sustainable learning strategy in the education system.(Fitria et al., 2025) (Figure 5).

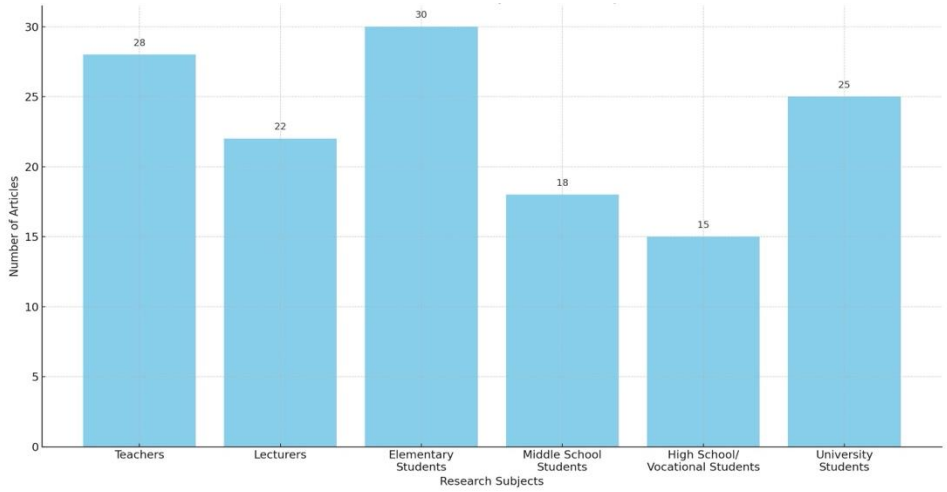

Figure 5. Distribution of Ethnoscience-based Problem-Based Learning research manuscripts in subjects

Distribution of Ethnoscience-based Problem-Based Learning based on research methods

Figure 6 illustrates the distribution of research methods in publications that discuss the ethnoscience-based Problem-Based Learning (PBL) model from 2019 to 2025. From the data shown, it can be seen that the action research method is the most frequently used approach by researchers. The dominance of this method indicates that the implementation of ethnoscience-based PBL is generally carried out through a collaborative approach that allows direct involvement of teachers in the learning innovation process in the classroom. (Cecep Jaya Subagja, 2023). The action approach is considered capable of providing reflective space for educators to evaluate and refine learning practices on an ongoing basis. In addition, this model facilitates the integration of local cultural values into the context of problem-solving-based science learning, thus creating learning that is more contextual and relevant to students' lives. (Dal et al., 2024).

The quasi-experiment method is also widely used, mainly to test the effectiveness of ethnoscience-based PBL in improving learning outcomes, critical thinking skills, and student concept mastery. Quasi-experiments are usually used in real class settings without a randomized treatment so that the results can reflect the real learning conditions. Meanwhile, qualitative analysis methods also occupy a considerable portion. This approach is generally used to explore students' and teachers' perceptions, experiences, and responses to local culture-based approaches in the learning process, especially in science and IPAS subjects.

In smaller numbers, other methods, such as mixed-methods (a combination of quantitative and qualitative), case studies, and surveys, were also found. These methods still play an essential role in explaining phenomena more deeply and holistically, especially in exploring learning experiences and successfully integrating local culture in learning. In addition, research and development (R&D) methods are used to design and develop teaching tools or learning media based on PBL and ethnoscience. Although its use is not as extensive as the action method, R&D significantly contributes to producing applicable learning innovations. (Amini et al., 2021) (Figure 6).

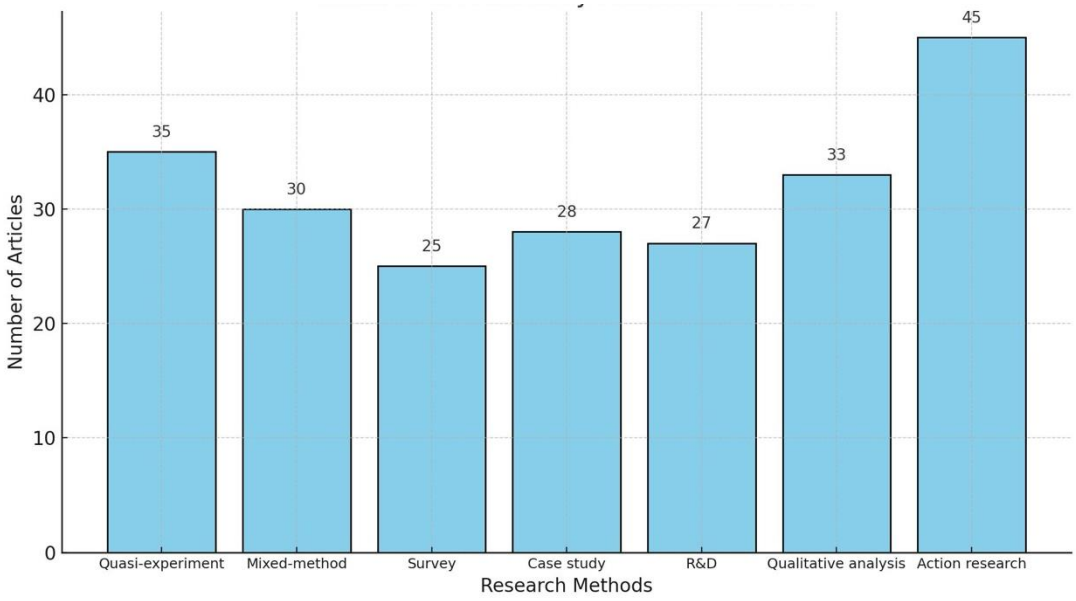

Figure 6. Distribution of Ethnoscience-based Problem-Based Learning publication manuscripts based on research methods

Visualization of research trends investigation using VOSviewer software

Trend mapping in the world of research plays a vital role in identifying the direction, tendency, and concentration of emerging topics in a particular field of study (Salatino, 2019). In this context, Figure 10 shows the bibliometric visualization results generated with the help of VOSviewer software. This tool maps the relationship between keywords frequently appearing in scientific publications that discuss ethnoscience-based Problem-Based Learning (PBL), critical thinking skills, and basic education from 2019 to 2025.

The visualization results show that the keyword "critical thinking" occupies a central position in the network of connections between topics, making it the central node in the mapping. This word is the main link that connects several other keyword clusters such as "student", "development", "effect", "pjbl", and "primary school". This strategic position indicates that most research in this domain places improving critical thinking skills as the primary focus, especially in applying the PBL model combined with the ethnoscience approach.

Thus, the research trends illustrated from this mapping corroborate the finding that the application of ethnoscience-based PBL at the primary school level is mainly directed at encouraging the development of students' higher-order thinking skills. This also shows the consistency of researchers' interest in integrating active learning with local cultural values to improve basic education quality (Figure 7).

Figure 7. Overview of the Ethnoscience-based PBL study for 2019-2025

The visualization structure groups keywords into different colored clusters:

a. The red cluster includes words such as student, development, and effect, which describe the research focus on the impact of PBL implementation on student development.
b. The green cluster highlights the keywords PBL and effect, emphasizing the problem-based learning model as the main approach.
c. The blue cluster places the word critical thinking at the center of the relationship with various variables, confirming that higher order thinking skills are the core topic in this study.
d. The yellow cluster that includes primary school and critical thinking is false, indicating a connection between the context of HOTS implementation in primary education and the perception or understanding of the concept of critical thinking.

This visualization not only shows the relationship between various concepts but also provides an overview of the direction of research currently developing, especially in applying PBL models to improve students' critical thinking skills through local values and contextual (ethnoscience) approaches. Thus, this visual map serves as a tool to trace themes that have been widely researched and recognize areas or research gaps that are still rarely discussed, so that it can be an opportunity for further development of future studies.

CONCLUSION

The study results show that the ethnoscience-based *Problem-Based Learning* (PBL) model is a practical approach in improving the critical thinking skills of elementary school students, especially in IPAS learning. Integrating local cultural values in problem-based learning makes learning more contextual, meaningful, and relevant to students' lives. Bibliometric analysis using VOSviewer reinforces the finding that critical thinking, ethnoscience, and basic education are strongly interrelated in scientific publications during 2019-2025. The increase in publication trends also indicates that interest in these topics continues to grow. Therefore, this approach must be further developed through collaboration between educators, researchers, and stakeholders in designing innovative and local wisdom-based learning.

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