

Trends in Problem Based Learning Model Based on Lesson Study on Learning Outcomes: A Bibliometric Analysis

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ABSTRACT

Twenty first century education focuses on developing critical skills, creativity, collaboration, and communication, utilizing digital technology and innovative learning models. This study aims to evaluate the effectiveness of a problem-based learning (PBL) model based on lesson study in improving student learning outcomes. This research uses bibliometric analysis method, examining the literature from 2019-2024 with Publish or Perish and VOSviewer tools. The results showed that research on lesson study-based PBL in learning is still a relatively new and promising area. Network visualization and keyword density show that this topic has potential for further development. Recent trends show that the integration of PBL and lesson study can improve students' conceptual understanding and practical skills, and address low learning outcomes. This research highlights the importance of implementing innovative learning models to support the improvement of learning quality and student learning outcomes in a broader context.



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INTRODUCTION

Twenty first century education focuses on developing the skills needed to face global challenges and rapid technological advancements. In addition to academic mastery, modern education emphasizes the importance of critical thinking, creativity, collaboration and communication skills (Chusna et al., 2024; Fahri, 2025; Humam & Hanif, 2025). Learning integrates digital technology and innovative learning models to create a dynamic and interactive learning environment, so that students acquire not only theoretical knowledge but also practical abilities relevant for success in the increasingly complex world of work and daily life (Baharuddin & Hatta, 2024). The characteristics or principles of 21st century learning are: 1) the learning approach is learner-centered; 2) participants are taught to be able to collaborate; 3) learning materials are linked to problems faced in everyday life, learning should allow learners to connect with their daily lives; and 4) in an effort to prepare learners to become responsible citizens, schools should be able to facilitate learners to engage in their social environment (Komara, 2018; Luthfan et al., 2024; Rosnaeni, 2021).

Learning in this era is expected to apply the principles of 21st century learning. Learning itself is defined as the interaction between students, between students and teachers, and learning resources in a learning environment (Hanafiah et al., 2024; Kaniawati et al., 2023). After following the learning process, there is a term regarding learning outcomes which means the development or progress of students after following the learning process. Assessment of learner learning outcomes includes aspects of attitude, knowledge, and skills. Learning outcomes show the actual abilities of students after experiencing the learning process. With learning outcomes, one can find out how far students can capture, understand and own certain subject matter (Tanjung et al., 2022).

Regarding learning outcomes, it appears that despite their recognized importance, there are still problems that arise in relation to this that researcher found in preliminary research from several other researchers previously. In preliminary research it was found that student learning outcomes in several subjects were still very low, more than 50% of students were not yet complete in several subjects (Hutasoit et al., 2014). Also conducted preliminary research based on the study of teacher documents for a class, it was seen that some students were below the minimum completeness criteria (MCC), namely 20 students out of 34 students, meaning that classical learning completeness was around 41.18%, student learning outcomes were still low (Sari et al., 2023). Low student learning outcomes are also indicated by preliminary research from (Dewi et al., 2021) marked from the results of the PAS (End of Semester Assessment) semester I only 6 students were completed above the MCC, while 13 students were not completed below the MCC.

Student learning outcomes will improve or achieve satisfactory results are strongly influenced by the teacher's ability to manage learning. One solution that can be taken by teachers is to use a learning model that is in accordance with learning objectives (Lewar et al., 2023). The problem-based learning (PBL) model is a student-centered learning model, where students learn through solving real problems that are relevant to the subject matter. The application of the PBL model causes students to develop scientific attitudes, be active in the learning process, develop interpersonal relationships and motivation in group work, generate internal motivation to learn, and can increase teacher and student activities in the learning process. The application of the PBL model can improve student learning outcomes in cognitive, affective and psychomotor aspects (Suswati, 2021). Problem based learning is able to encourage students to learn more actively and more actively because students are directly involved in developing their understanding and assignments in solving a problem. Problems based on real-life problems selected to meet educational objectives (Firawati, 2023).

The implementation of problem-based learning model will be conducted by teachers in the classroom, where later teachers will use professional competence to plan, implement, and evaluate learning. Lesson study, a strategy for developing learning through collaboration, allows improving the quality of learning by involving teachers and other parties such as observers (other teachers/partners, lecturers, and others) to provide feedback on the learning process (Mutiani et al., 2020). In the learning process, collaboration between teachers and students is needed to provide the best solution to the problems faced by students (Wowiling et al., 2024). In lesson study, teachers work together to formulate learning objectives, plan learning activities, observe learning, and reflect together to improve future learning practices (Sunardi et al., 2023). Based on several previous studies, it is known that the application of problem-based learning models through lesson study is proven to improve student learning outcomes (Ratnasari et al., 2023).

Due to limited time and access to directly examine how the application of the lesson study-based problem-based learning (PBL) model on student learning outcomes, this research will be conducted by bibliometric analysis. This method will help in identifying and analyzing the current research landscape regarding PBL based on lesson study within the last five years. The results of this bibliometric analysis are expected to provide valuable insights into the effectiveness of lesson study-based PBL models in improving student learning outcomes in various educational contexts.

METHODS

This research uses bibliometric analysis. This research method is a type of descriptive qualitative research using a biometric approach. Bibliometric is the application of statistical methods which is one of the options for presenting the results of a review of scientific articles regarding information retrieval and clustering through a literature review of a publication (Kurdi & Kurdi, 2021). In this research, the bibliometric analysis method is used, an approach to evaluate and find structured patterns in the literature related to a particular topic. Through bibliometric analysis, researchers can investigate bibliographic content and analyze citations from each article found through Harzing's Publish or Perish database.

The bibliometric approach is an analytical method used to measure, analyze, and understand the characteristics, trends, and patterns in scientific literature and other information sources. The purpose of this approach is to gain insight into the development of a particular field of science, identify collaborations between researchers, measure the impact of scientific publications, and determine the direction of research development. The steps taken in this research include determining search keywords, saving initial search results, completing search result metadata, compiling data statistics, and analyzing data (Kurdi & Kurdi, 2021).

Bibliometric analysis is a method that uses quantitative and statistical approaches to analyze publications such as journal articles, including their number of citations (Reuters, 2008). To achieve research objectives that involve analyzing directions, trends, and developments in the field of knowledge management, various literature review methods can be used, one of which is bibliometric. This research utilizes Google Scholar as the main source for article searches. The process of collecting, classifying, and mapping various research sources from Google Scholar is done objectively by following a series of in-depth search and review procedures through various filtering stages.

Literature search and collection were conducted using the Publish or Perish application. Keywords used were lesson study-based PBL and learning outcomes. Articles were filtered for the last 5 years, namely 2019 to 2024. The filtering process within the last 5 (five) years is intended to clearly show the latest developments in the focus of lesson study-based problem-based learning research. Filtering can also see various relationships/relationships with other research focuses, without losing the essence of previous developments.

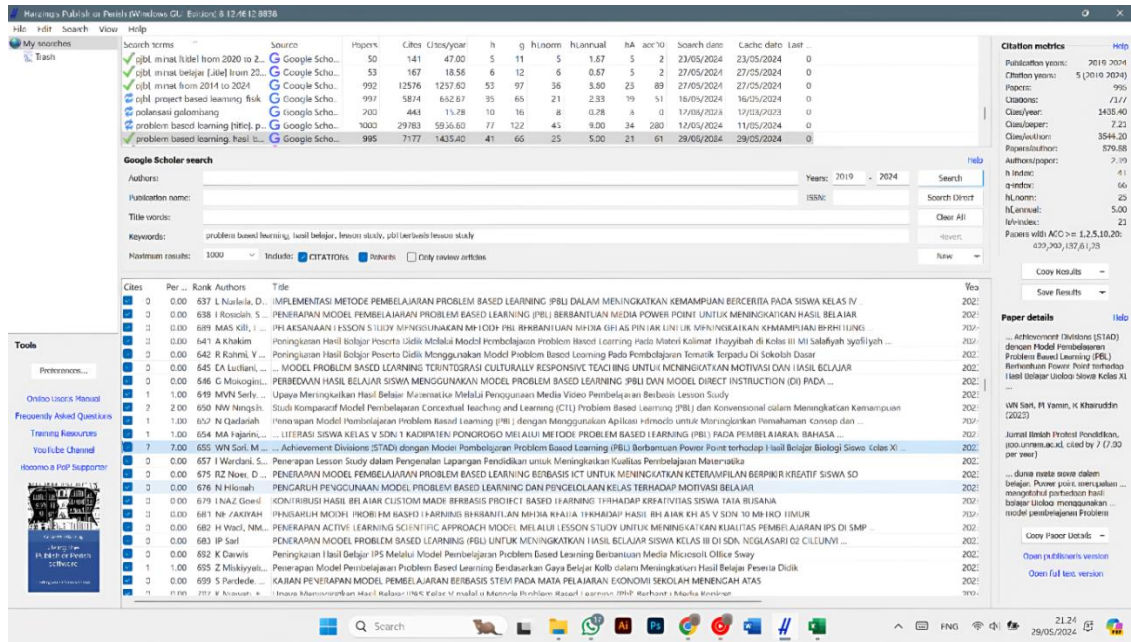


Figure 1. Data Collection Through Publish or Perish

The next step is to extract data based on the collection and classification process. Data collection obtained 995 documents from Google Scholar which is stored in .ris file format. After the data was inputted into Mendeley, filtering and adding information about the article was carried out. Selection was made by selecting document types such as conference paper, article, and review, so that the total number of downloaded documents was 176 documents. These documents were saved in .ris file that included citation information, bibliographic information, abstracts and keywords, and references, providing comprehensive information about the literature for more detailed analysis in later stages of the study.

VOSviewer is a free software developed to create and view bibliometric maps (Van Eck & Waltman, 2010). In VOSviewer, each node represents a different parameter such as country/region, journal, author, keyword, and so on. The size of the node is determined by parameters such as the number of published articles, number of citations, or frequency of occurrence; the higher the weight, the larger the node. The color of a node is determined by the cluster it belongs to, with same-colored nodes indicating the same cluster, and different clusters distinguished by different colors. Distances between nodes indicate proximity and similarity between subject terms, while lines between nodes indicate relatedness.

Bibliometric analysis using VOSviewer includes co-authorship analysis and co-occurrence analysis. Co-authorship analysis is an author network analysis, while co-occurrence analysis is a keyword or co-word analysis. Co-word analysis is a technique that examines the actual content of publications, with words in co-word analysis often derived from "author keywords" (Soesanto & Handalani, 2023).

The steps for using the VOSviewer software are as follows. First, turn on the VOSviewer software on a laptop or PC. Second, select the "create" button on the file tab until a dialog box appears. Third, select the "create a map based on text data" option, and then click the "next" button. Fourth, select the data source "read data from reference manager files" and continue by clicking the "next" button. Fifth, select the "RIS" tab, then select the file and select 3 research themes of article metadata from Publish or Perish that have been saved, then click the "next" button. Sixth, select "title and abstract fields" and click the

“next” button. Seventh, select the “binary counting” method and click the “next” button. Finally, fill in the threshold with the number 1, then click “next”. The following is the flow of what is done in this research:

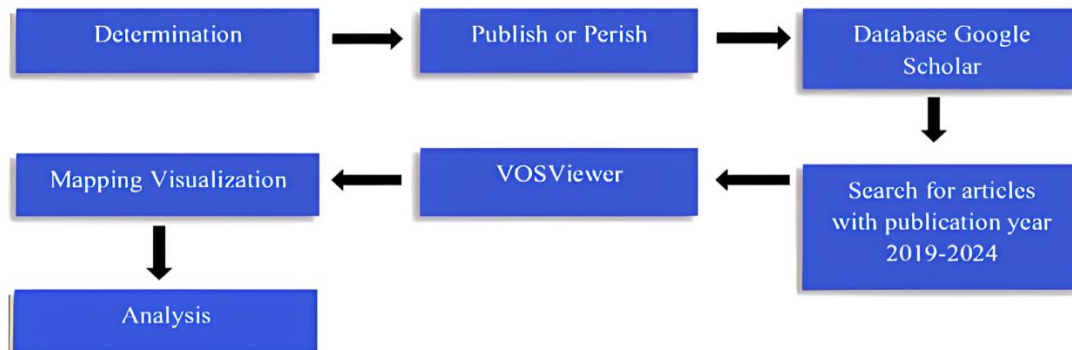


Figure 2. Research Flow of Bibliometric Analysis

RESULTS AND DISCUSSION

This study aims to evaluate the effectiveness of the Problem-Based Learning (PBL) model based on lesson study in improving student learning outcomes. The method used in this study is bibliometric analysis to identify the latest research trends in the 2019-2024 time spans. The search was conducted by limiting the maximum number of results to 176 articles and the time span of the last 5 years (2019-2024). After collecting 176 articles, the data was saved in CSV format for Microsoft Excel and RIS format for use in VOSviewer software. The following are the results of the bibliometric analysis that has been carried out, which includes network visualization and visualization.

Network Visualization

In this study, the researcher used the VOSviewer tool to visualize the interrelationships between keywords appearing in the related literature. This analysis helps in understanding research trends and areas that still require further exploration. Below is an image of the network visualization that shows the relationship between keywords in this study.

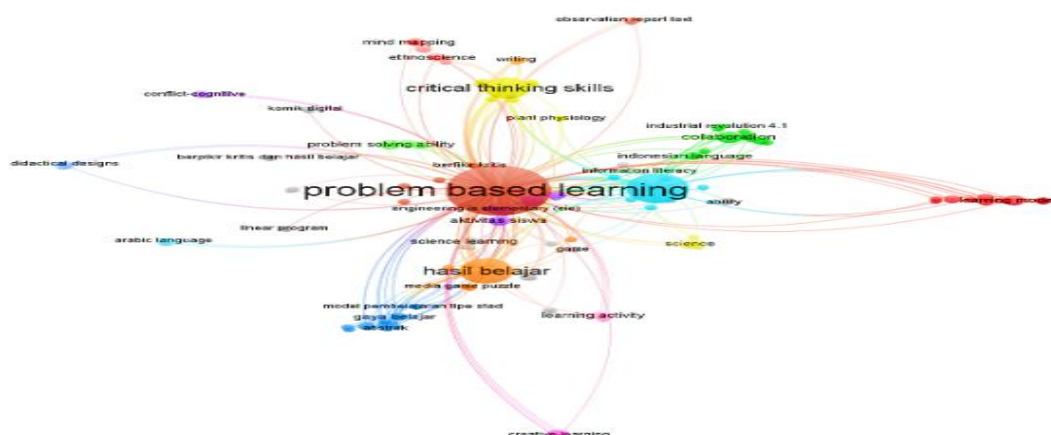


Figure 1. Network Visualization

Density Visualization

Advanced analysis in this study was conducted through density visualization using the VOSviewer tool. This technique provides greater insight into the research focus in this area and potential new research directions. This technique helps us to visualize the distribution and density of keywords in the literature we reviewed. By looking at these density patterns, we can explore time trends and identify areas that require more research in the future. Here is an image of the density visualization that shows the results of our analysis.

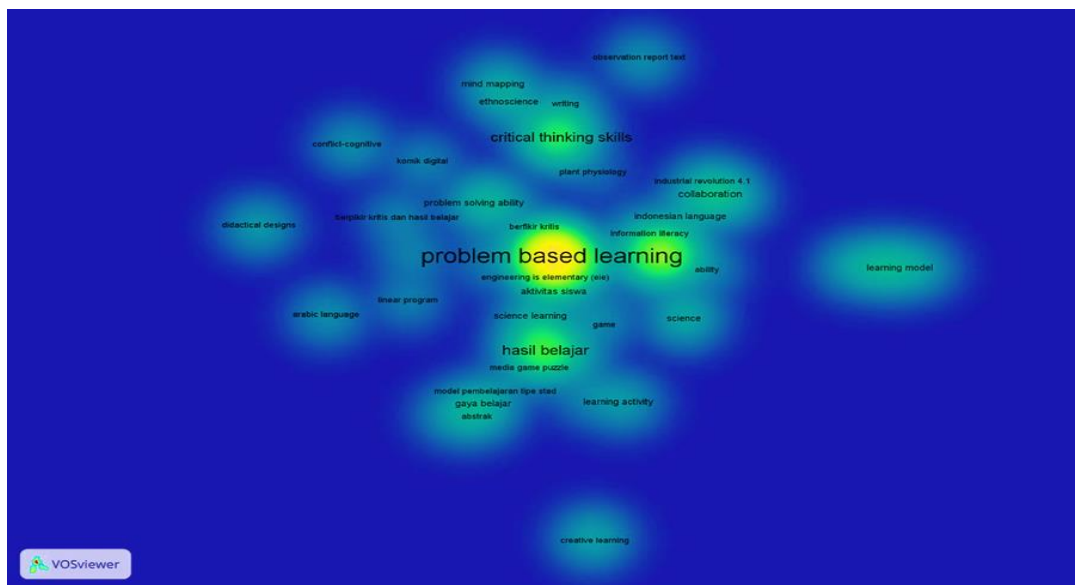


Figure 3. Density Visualization

This figure shows that items belonging to clusters are displayed on the density visualization screen, where each item is marked with a color according to its density level in a particular period. Light colors reflect research areas that are still actively being explored, particularly in 2020 and above, indicating the potential for new research and innovation. Conversely, dark-colored areas indicate that the topic has been extensively researched in 2020 and below, although there is still room for further research to expand understanding or re-test existing findings. The analysis also provides insight into the evolution of the topic over time; changes from light to dark colors or vice versa may indicate a change in interest or new approaches to research. Overall, density visualization provides an in-depth view of developments and trends in the literature, as well as providing direction for research directions that can be taken to further understand and develop the field in the future.

There has been a lot of research on the problem based learning (PBL) model. For example, a meta-analysis study by Festiyed and his colleagues in 2022 showed that there is a relationship between the application of PBL models and the science competence of high school students. An analysis of 25 articles that used the PBL model in high school showed that PBL was more often applied to physics and chemistry subjects than biology. The effect size results of the study were in the medium to very high category. In terms of grade level, PBL is most effectively used in grade XI with high criteria. In addition, the application of the PBL model produces a high effect size on the critical thinking, problem solving, and cognitive aspects of students, this makes the PBL model proven effective in teaching science in high school (Roza et al., 2022). Further research conducted by Ayu, et al. found several

journal reviews showing that problem-based learning is effectively applied in physics learning to improve students' concept understanding from various levels, ranging from elementary to high school (Ayu et al., 2024).

This research does not only focus on the application of the PBL model alone, but based on lesson study. This is a novelty in this research. Lesson study research is very useful in learning. According to Kraft, et al. Research, lesson study in science teacher candidate education (PSST) proved transformative, enriching pedagogical and content knowledge, shaping beliefs, encouraging collaboration, and influencing teaching practices. Lesson study significantly contributes to the professional growth of science teacher candidates, preparing them for effective, student-centered teaching (Kraft & Rodríguez, 2024). However, in contrast to the research of Kraft, et al, Kager's research found a weakness of lesson study that the lack of transparency in the communication of the observation and reflection stages undermined the field of lesson study. In addressing this, Kager et al. recommend better communication practices and propose a checklist to aid lesson study implementation and documentation. The importance of explicit descriptions of lesson study interventions and adoption of Open Science practices was also raised to improve replicable of research. The review emphasized the need for further theoretical development, especially on the observation and reflection stages of lesson study (Kager et al., 2024)

CONCLUSION

Based on the results and discussion, it can be concluded that research on the problem based learning (PBL) model based on lesson study on student learning outcomes has shown a significant trend within five years. Network and density visualization analysis shows that this is still a relatively new area of research, especially in the context of keywords such as “Problem Based Learning” and “lesson study”. This finding indicates the potential for further development in this area, focusing on the application of these learning models in diverse contexts and on other problems. As such, future research is expected to utilize these findings to support the improvement of learning quality and student learning outcomes more broadly. It can also provide guidance for education policy to strengthen the integration of innovative models in the school curriculum, promoting more effective and relevant learning.

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