ABSTRACT

The purpose of this study is to describe the use of PBL models to improve student learning outcomes. This research method uses library research. The data studied were obtained from Google Scholar and Scopus from 2018 to 2022 in a total of 30 articles. The scope of the data analyzed is physics learning with the PBL model and its relationship to enhancing learning outcomes. The descriptive qualitative analysis was used to analyze the data. From this study it can be concluded that: (1) The main advantage of using the PBL model is that it can stimulate students to discover new knowledge and develop it, while the disadvantages lies in requiring a lot of time to implement PBL with maximum results; (2) The PBL model is effectively used to improve student learning outcomes in face-to-face, mixed and online learning; (3) PBL model can be done in collaboration with other technologies such as digital books, PhET, augmented reality, and others. This learning model can also be a solution to increase students' interest in physics subjects that are difficult to learn. Further research can be carried out by directly implementing the PBL model to determine its effect on student learning outcomes.

INTRODUCTION

Learning and teaching activities are a process of acquiring knowledge from students and sharing knowledge with teachers, so there is an interaction between the two. Learning can be done anywhere, including schools, homes, libraries, and other places that aim to gain better knowledge (Aprianto et al., 2021; Ni’mah et al., 2021). One of the teacher’s duties is to teach (Uno & Nina Lamatenggo, 2022). In carrying out learning, proper knowledge of the theory and principles of learning will determine the success of a learning process (Aspi & Syahrani, 2022). Learning is successful if the goals are achieved (Calalb, 2023; Rindiantika, 2021). Apart from the teacher's factors determining success, students are among the other factors (Juliya & Herlambang, 2021). The effectiveness of a teaching and learning process is also determined by the level of student learning motivation (Harahap et al., 2021; Radulović et al., 2022). Motivation can arise from internal factors, which include physical and psychological, while external factors include the condition of the surrounding environment.
and humans, including teachers, parents, and the environment (Barelli & Levrini, 2022; Zuleni & Marfilinda, 2022).

The teacher's skills in choosing suitable learning models and methods will be essential in developing student learning outcomes. The teacher uses the learning method in interacting with students in the class (Ardiana et al., 2021; Nasution, 2018; Qudsyi et al., 2022). Learning outcomes are critical because learning success is based on the process of teaching and learning activities that can be seen from it (Botari et al., 2022; Gola et al., 2022). Learning outcomes are accomplishments that individuals make as a result of learning activities (Harefa, 2020; Reski, 2018; Telaumbanua, 2022). In order to perform well, students try to achieve the best learning results. However, according to research by Nurul (2022), learning physics is considered to contain abstract concepts, so it requires an approach that links theory to events in everyday life. With this approach, students will more easily understand the material presented.

Learning physics is different from mathematics. Physics learning does not only solve problems mathematically with formulas but there are concepts in it that students must understand (Del Barco et al., 2022; Nikat et al., 2021). An approach to material physics with everyday life can be made through simple problems that often occur (Saputra et al., 2021). Not infrequently, students also experience difficulties in solving simple physics-related problems (Mardatila et al., 2019; Rahmah, 2021; Sujarwanto et al., 2022). Thus, this study describes using PBL models to improve student learning outcomes. This research analyzed all physics education studies using the PBL model found in databases (Google Scholar and Scopus). Reinforced by Tuxtaevich et al. (2022) that a learning model that can train problem-solving skills is a scientific approach that emphasizes student-centered learning with the help of technological media, for example, PBL. This PBL model encourages students not only to have conceptual abilities but also to encourage them to solve the given problems actively (Kanyesigye et al., 2022). In addition, this learning model has an external target in the form of artifacts which become students' original work in solving problems independently (Febriani et al., 2021). However, the explanation regarding PBL is in contrast to the results of research by Pristianti & Prahani, (2022) regarding student profiles that by implementing PBL in schools it turns out that student learning outcomes in physics are still low, namely 159 students out of a total of 162 students scored in the low category. So the need for further literature review related to the PBL model to improve student learning outcomes.

The novelty of this study is that the literature review used comes from the two largest databases, namely Google Scholar and Scopus, both national and international articles. So that the literature used is very broad and the results of the review will provide accurate results. In addition, this literature review can also provide information on the success rate of applying the PBL model, especially in learning physics. Research questions from this study include:

1. What are the advantages and disadvantages of using the PBL model?
2. What is the effectiveness of the PBL model to improve students' physics learning outcomes?
3. How can the PBL model improve student learning outcomes?

METHODS

This form of research involves a literature review, hence library research is used. Secondary data from literature reviews in the form of articles from journals that can be accounted for on a national and international scale (Acciarini et al., 2023; Maman et al., 2021; Sanjaya et al., 2022). The data studied were obtained from Google Scholar and Scopus. Because Scopus is the largest database for various topics and is multidisciplinary (Purnell, 2022). The scope of the data studied is related to learning physics with a PBL model and its relation to improving learning outcomes. Data were collected using limited data from 2018 to
2022 after collecting various publications linked to PBL models and enhancing learning outcomes. A literature review was used to examine data using descriptive qualitative analysis. This study uses a qualitative methodology to generate descriptive data (Rosairo, 2023). Adapted from Miles & Huberman (1994), the stages of data analysis in qualitative research are generally shown in Figure 1.

![Figure 1. Qualitative data analysis chart](image)

Four phases are involved in the analysis of qualitative data, namely:
1. To gather the data required to accomplish research goals, data collection is the process of gathering data in the field (both from journal studies and trials).
2. Data reduction involves summarizing, selecting the key elements, and concentrating on crucial elements to create a clear picture from the data collected and to make it simpler for the researcher to access the data that follows.
3. Narrative text in the form of succinct descriptions, charts, and relationships between individuals is the most frequently utilized type of data presentation in qualitative research.
4. Verification and conclusion concern novel discoveries that have never been made previously.

RESULTS AND DISCUSSION

This PBL model is a learning model that invites students to explore their thinking skills, because basically PBL is problem oriented and students are required to be able to solve it based on the knowledge students have. PBL was originally developed as a response to the fact that many young doctors who had just graduated from medical school in Ontario, Canada in the 1960s had very rich and broad knowledge (Devi et al., 2021). The main purpose of this PBL model is to develop student’s skills and the ability to build their own knowledge (Fathurohman et al., 2021). Research by Bektiarso & Dewi, (2021) emphasizes that the teacher as a facilitator plays an important role to help students become independent and create a classroom environment where students receive systematic instruction in conceptual, strategic, and reflective reasoning which will ultimately make students more successful in subsequent investigations. Wibowo, (2021) also emphasizes that group work is an important part of PBL for several reasons. Group work can develop a social spirit and physics learning community so that students feel comfortable developing ideas and asking questions. Group work can improve communication skills. In the end, group work is interesting and motivates students to be actively involved in physics learning and can improve their learning outcomes. However, groups do not always function effectively without guidance (Simamora & Sianipar, 2022). The teacher can provide facilities and monitor the interaction of each group.

It can be understood that PBL has strong characteristics to present learning that originates from a real problem in physics. From these problems it is expected to be able to motivate students to develop their abilities, thus making students more challenged to gain new knowledge which in turn can improve their learning outcomes (Kanyesigye et al., 2022;
The advantages of the PBL model include that the PBL model can stimulate students to discover new knowledge and develop it (Singh & Dutt, 2022). PBL can encourage students to apply their knowledge in the real world and lifelong learning. Problem solving in PBL does not only give students awareness to depend on the teacher's presence, but also depends on students’ intrinsic motivation (Khusaeri, 2022). PBL can motivate, encourage and develop the knowledge learned to be applied in solving real life problems based on scientific principles. PBL can also increase students’ self-confidence to be skilled at solving problems independently, so that the teacher is only a facilitator (Malan, 2022). So there is great potential that PBL can improve student learning outcomes. On the other hand there is disadvantages that can be observed from using the PBL model in physics learning are that it takes a lot of time to implement PBL with maximum results because when students have no interest and lack of confidence so that they perceive that the problem to be investigated is difficult. Furthermore, it will arise in students who are reluctant to try to solve the problem. The ability to understand the problems of different students also influences the implementation of the PBL model, so that PBL teaching has not been able to show students' problem solving steps in a systematic way (Gunawan et al., 2019; Yusdarina, 2019). How to solve students' problems can be observed through the ongoing learning process, in this case it will reflect the mindset of students (Herliana et al., 2020).

The PBL model can be implemented by integrating other technologies. PBL models and the addition of animated video have a positive effect on student physics learning outcomes (Pawlak et al., 2020). The PhET simulation developed to meet the eligibility requirements can be used in physics learning activities using the PBL model to improve critical thinking and student learning outcomes (Darta, 2020). Website-based physics learning in the classroom can be integrated with the PBL model which is oriented towards investigative activities (Hindriyani et al., 2020). An example of the results of website development with the PBL model for physics learning can be seen in Figure 2 and 3.

![Figure 2](image1.png)

**Figure 2.** The home display of web-enhanced with problem-based learning model  
Source: (Diani & Syarlisjiswan, 2018)

![Figure 3](image2.png)

**Figure 3.** The display of student exercises  
Source: (Diani & Syarlisjiswan, 2018)
Website-based physics learning can help students explore material more broadly and independently to solve problems. This can be one way to make the PBL model in physics more effective in improving student learning outcomes. So it can be concluded that computer technology is effective to be applied as media in the PBL model. According to the facts and analysis, utilizing the PBL model, which contains five learning phases, students are more active, and their learning outcomes increase. Physics learning outcomes are the results achieved after carrying out learning activities, these results are shown in the form of letters, which can usually be seen in the list of values in physics subjects (Pane et al., 2021; Prima, 2020; Safitriani & Hidayat, 2020). To find out the learning outcomes achieved by students in the teaching and learning process, measurement and evaluation will be carried out (Sumalong et al., 2021). Many national and international research journals with higher physics learning outcomes are summarized in Table 1 for the review.

Table 1. Top 10 results from literature review journals

<table>
<thead>
<tr>
<th>No</th>
<th>Source Journal</th>
<th>Citation</th>
<th>Learning Types</th>
<th>Results of Literature Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jurnal Pendidikan Fisika dan Teknologi Vol. 4 No. 1, 2018: 111-120. (Munandar et al., 2018)</td>
<td>57</td>
<td>Face-to-face learning</td>
<td>Journal results: PBL models and the addition of animated media have a positive effect on student physics learning outcomes Review results: The use of PBL can be an alternative solution to improve physics learning outcomes</td>
</tr>
<tr>
<td>2</td>
<td>Jurnal Pendidikan Fisika dan Teknologi Vol. 4 No. 2, 2018: 283-290. (Pitriah et al., 2018)</td>
<td>9</td>
<td>Face-to-face learning</td>
<td>Journal results: PBL, with the help of three-dimensional teaching aids, can improve student learning outcomes in physics lessons Review results: PBL is effective to apply because it is proven to improve student learning outcomes</td>
</tr>
<tr>
<td>3</td>
<td>AIP Conference Proceedings Vol. 2014 Article No. 020046 2018: 1-6 (Nizami &amp; Mahmudi, 2018)</td>
<td>6</td>
<td>Face-to-face learning</td>
<td>Journal results: The percentage of implementation of learning by teachers using PBL at each meeting has increased and is in an outstanding category from the first meeting to the last meeting Review results: The application of PBL can have a positive impact on student interest and learning outcomes</td>
</tr>
<tr>
<td>4</td>
<td>Jurnal Ikatan Alumni Fisika Universitas Negeri Medan Vol. 4 No. 2, 2018: 1-3. ISSN: 2461-1247. (Tanjung, 2018)</td>
<td>4</td>
<td>Face-to-face learning</td>
<td>Journal results: The average class value given PBL shows a higher category than conventional learning. Review results: With PBL, students are more active in discussing, asking questions, and enthusiastically completing assignments.</td>
</tr>
<tr>
<td>5</td>
<td>Journal of Physics: Conference Series Vol. 1140 No. 1 2018: 1-9 ISSN: 1742-6588 (Perwitasari, 2018)</td>
<td>1</td>
<td>Mixed learning</td>
<td>Journal results: PBL in blended learning has more influence on student learning outcomes than direct instruction learning Review results: PBL combined with blended learning can be used by teachers to overcome the limitations of space and time in learning at school and can be used as alternative learning to improve student learning outcomes</td>
</tr>
</tbody>
</table>
Some journal results from Table 1 state that the PBL model is beneficial for increasing student understanding, giving students the potential to be more interested in physics subjects. This improved understanding will aid pupils in achieving successful learning outcomes (Kristianto & Gandajaya, 2023). Students are not bored with teaching physics which is considered too mathematical and difficult to understand because, with PBL, students are directed to solve problems close to their lives (Suari, 2018; Sulisworo & Basriyah, 2021).
This research can provide information regarding the success rate of implementing the PBL model in physics learning and potential research related to PBL in the future.

The series of learning using the PBL model in a structured manner consists of five phases. The PBL model phase begins with giving problems, organizing students, guiding investigations, developing work, and evaluating (Abarang & Delviany, 2021; Auly, 2020; Zhang, 2023). Besides improving student learning outcomes, using the PBL model for physics in learning can also improve students’ conceptual understanding through generating inferences and problem solving (Kumullah et al., 2018; Parwata et al., 2023). Students are better trained to think critically because they are involved in solving authentic problems (Herayanti et al., 2020; Yulianti & Gunawan, 2019). The PBL model is positively feasible, and students react well to the learning model. The learning procedure physics, particularly the PBL model, can be classified as a practical innovation since it allows students to actively learn, which is important for skill development and knowledge acquisition (Shofiyah & Wulandari, 2018). The PBL model of knowledge focuses on solving problems from contexts, which leads to the restoration of the scientific method inside the natural sciences framework (Reinsini et al., 2021; Sari et al., 2019).

CONCLUSION

From this study it can be concluded that: (1) The main advantage of using the PBL model is that it can stimulate students to discover new knowledge about physics and develop it, while the weakness lies in requiring a lot of time to implement PBL with maximum results; (2) The PBL model is effectively used to improve student physics learning outcomes in face-to-face, mixed and online learning. The PBL model can be used as an alternative to face-to-face and online learning; (3) PBL model can be done in collaboration with other technologies such as digital books, 3D, PhET, augmented reality, ethnoscience learning, LKS, and others. This learning model can also be a solution to increase students' interest in physics subjects that are difficult to learn. Learning was carried out online during the COVID-19 pandemic, so a PBL model was urgently needed to help students understand.

The implications of this research can be a reference in developing a physics learning model that can improve student learning outcomes and become a reference for researchers who raise topics related to the PBL model. The limitation of this research is the limited access to several journals. Further research can be carried out by directly implementing the PBL model to determine its effect on student learning outcomes.

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