



## Problem based learning in physics education: a systematic literature review

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### Abstract

The abstract arranged in a straight forward and concise manner and summarizes about: 1) a brief background (if any, just one or two sentences only); 2) The purpose and/or scope of research; 3) (brief) method used; 4) summary of results/ finding; 5) conclusion. Text length between 150-200 words (11pt) The purpose of this study was to examine the literature on problem-based learning models in studies related to scientific disciplines involving problem-based learning models for physics learning. The model is able to prove the conventional learning paradigm that accommodates learning in the 21st century. This research was conducted by analyzing 37 research journals related to problem-based learning models in physics learning published in the last ten years including peer reviewed articles and full text articles from Google undergraduate and also the ones that have been selected and indexed by Scopus, WOS or Sinta. This research approach is literature review. Overall, the results of this study indicate that learning by applying PBL in high school is the most widely used learning in the teaching and learning process. It is generally believed that PBL has a positive impact on education and can be used as an alternative model at all levels of Education.

**Keywords:** *Problem Based Learning, Physics Education, Systematic Literature Review*

### INTRODUCTION

The changing times that are increasingly advanced require individuals to master skills in the 21st century which have a profound impact on education. The impact on education is that there is a change in the activities of the teaching and learning process. The teaching and learning process in learning in the 21st century ensures that students must have the skills, collaboration between groups, and characters that are believed to be important to be able to achieve a successful life. The teaching and learning process activities must ensure that students have learning and innovation skills including critical skills and problem solving learning in the teaching and learning process activities. Therefore, it is necessary to have more qualified human resources, so that they can compete with other countries in the learning process.

An effective teaching and learning process is able to create a pleasant classroom learning environment. An effective learning model is one of the factors that greatly influences student achievement in class (Missildine, Fountain, Summers, & Gosselin, 2013). In addition, the models and teaching strategies provided can help students to develop skills in problem solving, understanding theory, and using knowledge (Schultz, Duffield, Rasmussen, & Wageman, 2014). If the teacher is able to deliver the material effectively, the quality of classroom learning can be improved and can encourage active participation among students. These students can

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actively instill values and acquire knowledge, skills and form competent human beings who can solve problems given in each subject (Allen, Donham, & Bernhardt, 2011).. Problem-based learning (PBL) is one of the learning models that can be used to support students to learn actively based on the concept of constructivism. Problem-based learning (PBL) is also a learning model that focuses on developing students' creativity in problem solving, but PBL also equips students with knowledge in improving problem solving, critical and creative skills, lifetime learning, communication skills, teamwork, adaptation to change and self evaluation. In problem-based learning (PBL), real-world problems are used to motivate students through problems in education (Khoiri et al., 2013).

Various studies have analyzed that learning methods can improve the quality of students in learning that involves skills to be able to generate various ideas to create practical and effective solutions in the learning process (Chuan et al., 2011). Moreover, this learning method is only available in the learning process. world of Education that can apply both from the elementary level to the upper secondary level (Hmelo-Silver, 2004). This model is also a form of learning approach that is carried out in the classroom for the learning process that can make students active during the learning process. This is because students are able to gain knowledge and exchange ideas with other classmates when the educator or teacher provides problems to be solved. This is very different from conventional and traditional models where knowledge acquisition is only one-way between teacher and student or student and student. In addition, this model is also seen as a form of learning that cultivates the inquiry model by emphasizing problems to students, problem solving and collaboration with other students in solving problems that have been given (Savery & Duffy, 2001). The model does not use a direct approach to solving problems but involves a preparation process (Graaff & Kolmos, 2003), which refers to the development of planning and delivery of content-oriented problems and real-life problems as stimuli to increase students' interest in solving them. There are three main features in the model, namely real-life problems, group-based processes and student control. It is also interpreted as a teaching and learning system that is built simultaneously between problem solving and knowledge-based strategies (Barrows, Tamblyn, & Barrows, 1980). Kilroy (2004) on the other hand states that this model focuses on issues or problems that become the measuring point in the learning process in education. Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character and skills needed by themselves, society, nation and state. This is in line with the curriculum applied in Indonesia, namely the K13 curriculum which focuses on students' affective abilities. Not only cognitive and psychomotor of the student but affective is also used as the main goal in learning. Especially in physics at the high school level. At the level of high school education, studying various sciences, one of the sciences studied is physics. Physics is a science that develops from observing natural phenomena and the interactions that occur in them. In addition, physics is a science that integrates with the behavior and symptoms of natural phenomena associated with current or current phenomena. We often liken behavior to the attitude possessed by the student.

Due to the increasing interest in understanding problem-based learning (PBL) in educational research, especially in physics education, there have been several attempts to report on literature trends, especially those using a systematic literature approach. Furthermore,

bibliometrics is the statistical and quantitative analysis of journals. Therefore, the current state of problem-based learning (PBL) model research is reviewed in this paper and its future prospects are assessed. The purpose of this study is to present a systematic review of the problem-based learning (PBL) model in the classroom.

## RESEARCH AND METHODS

### A. Research Design

This study was used to review the selection of previous studies related to the use of the Problem Based Learning (PBL) model to be used as a literature review. The purpose of the literature analysis is to develop a structured review. The guidelines proposed by Khan et al., 2003 were adapted for research purposes. According to (Khan Kunz, Kleijnen, Antes et al., 2003), this model has helped researchers in critically analyzing, evaluating, and synthesizing complex ideas.

### B. Data Collection

The data used is using journals related to research with a Problem Based Learning (PBL) model. This researcher chose to analyze 37 research journals related to Problem Based Learning (PBL) models in physics learning published in the last ten years from 2012-2022 including peer review articles and full text articles from Google Scholar. so that the journals that can be selected for review are taken from several characteristics such as the name of the journal, the number of journals available, the quartiles of each journal and the journals indexed, so it can be seen in Table 1.

Table 1. Journal Summary

Name of Journal	Total	Indexed By
International Journal of Evaluation and Research in Education (IJERE)	1	WOS
International Journal of Instruction	7	Sinta
Social and Behavioral Sciences	1	Sinta
Turkish Science Education	2	Sinta
European Journal of Educational Research	1	Sinta
International Journal of Education	1	Sinta
American Journal of Educational Research	2	Sinta
Journal for the Education of Gifted Young	2	Sinta
Sage Open	1	Sinta
EURASIA Journal of Mathematics Science and Technology Education	3	Sinta
International Review of Social Sciences and Humanities	1	Sinta
Eurasian Journal of Physics and Chemistry Education	1	WOS
Jurnal Pendidikan IPA Indonesia	1	Sinta
Cakrawala Pendidikan	1	Sinta
International Journal of Progressive Sciences and Technologies (IJPSAT)	1	WOS
Education and Science	1	WOS
The Turkish Online Journal of Educational Technology	1	WOS
Atlantis Press	2	Sinta
JIPF (Jurnal Ilmu Pendidikan Fisika)	3	WOS
IJIS Edu : Indonesian Journal of Science Education	1	WOS
Education Sciences	1	WOS
Journal of Research in Science Education	1	WOS

Based on table 1 above, it can be explained that the journals selected for review consist of 37 international journals consisting of 7 WOS indexed journals and 30 Sinta indexed journals. Therefore, this research can be selected for review and can be justified.

### C. Data Analysis

This research was formed based on the search for questions and topics raised in previous research. Researchers have conducted a preliminary search to identify previous studies on systematic reviews related to implementation. Then the data were collected in the form of tables and pictures and analyzed descriptively. The results of the analysis are in the form of numerical data or percentage data. Then in the discussion, the researcher explains how the relationship between the results of the study and the results of previous studies is. The results of the discussion can explain the advantages and disadvantages of the Problem Based Learning (PBL) approach in physics subjects.

### D. Research Procedure

The researcher adapts the research procedure taken from the research of Barbara Kitchenhan and Stuart M. Chartesrs 2007, which explains that there are several stages that can be used in a systematic research literature review. The procedure for the literature review process can be seen in Figure 1. The stages of the procedure in this study are as follows:

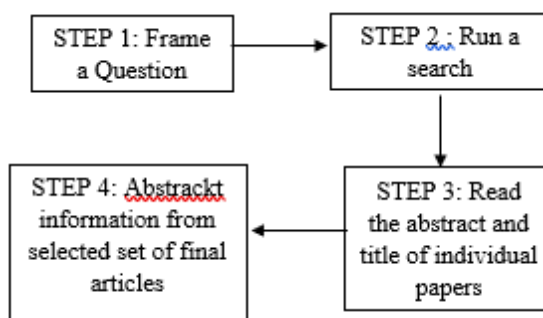


Figure 1. Stages of the Review Process

The first step is to make a question. Researchers will ask questions. For example, researchers want to focus on problem-based learning interventions, researchers look at problem-based learning and conventional learning.

The second step is to run a literature database search. After the researcher has known what he wants, the researcher conducts a literature database search. This helps researchers to identify suitable search terms.

For the third step selected articles for literature review analysis by reading the title, abstract and full text. The researcher creates a scheme in which the researcher decides to select and reject articles for analysis of the literature review. For example, the article is relevant to the study question, the article does not discuss the results of interest for this study and the article is published outside the date range. Therefore only 37 articles were selected for analysis. The last step is to abstract the information from the article. In this case, the researcher abstracted the information from the articles and then entered all the required information into the matrix synthesis table according to the subthemes: authors, problem-based learning steps applied, the realm of creativity in problem solving, study findings and research gaps between all articles. .

From the analysis of the table, researchers can make some similarities and differences from the thirty-seven studies.

## RESULT AND DISCUSSION

### A. Topic 1. Representation of Research According to General Characteristics

In this study, the representation of general characteristics consists of the type of publication, the year of publication, and the research approach to the journal.

#### 1. Representation of Journal Characteristics by Type of Publication

The results in this study show representations related to the characteristics of journals based on the type of publication which can be seen in table 2 below:

Table 2. Representation of Research by Type of Publication

No	Type Publication	Z	Persentase
1	Book	0	0%
2	Science Forum	0	0%
3	Presentation Article	37	100%
4	Scientific Report	0	0%
5	Scientific Writing	0	0%
		37	100%

Seen in the table shows that the types of publications selected for review came from 37 articles. This research does not take from books, scientific forum presentations, scientific reports and scientific writings. Therefore, the articles selected for review can be declared of good quality. And this 37 article is also an international journal.

#### 2. Representation of Journal Characteristics by Year of Publishing

Furthermore, it is seen from the representation of the characteristics of the journal based on the year of publication. In this study, the journal was taken with limitations from 2012-2022. The representation of the characteristics of the journal based on the year of publication can be seen in Figure 2.

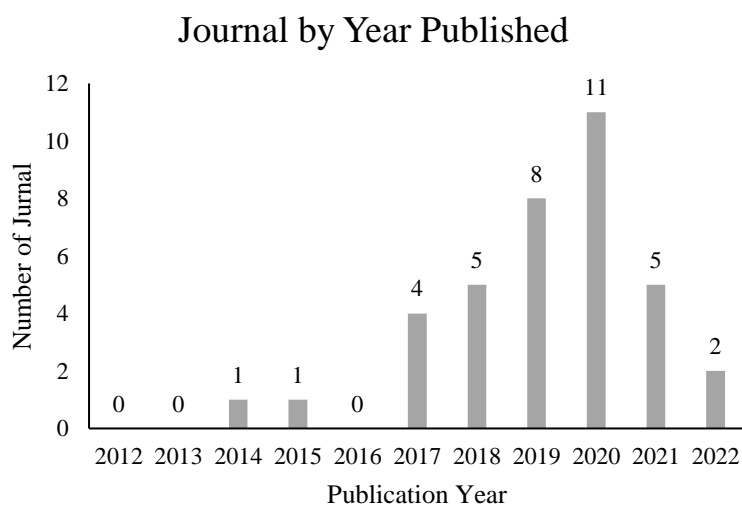


Figure 2. Representation of Journal Characteristics by Year of Publishing

It can be seen from the picture that it is explained that 37 articles were selected and selected from the last 10 years starting from 2012-2022 on the Problem Based Learning (PBL) model in

physics learning that as many as 37 articles consisted of 0 articles (2012), 0 articles (2013), 1 article (2014), 1 article (2015), 0 articles (2016), 4 articles (2017), 5 articles (2018), 8 articles (2019), 11 articles (2020), 5 articles (2021), and 2 articles (2022). The most obtained articles and reviewed for research are 11 articles published in 2020. And the least obtained articles published in 2014-2015 are 1 article and 0 articles obtained in 2012, 2013, and 2016. Based on The data obtained can be concluded that the articles obtained for review are those reviewed from the last 10 years. This shows that the articles reviewed every year have increased to be researched and used the Problem Based Learning (PBL) model. So that this research can be used by other researchers for the interests of physics learning or future researchers who want to use the Problem Based Learning (PBL) model for learning physics in the classroom.

### 3. Representation of Journal Characteristics Based on Research Approach

The representation of journal characteristics based on the research approach consists of qualitative, quantitative, and mixed model approaches. The results of the analysis showed that the research consisting of 37 articles selected to be reviewed can be seen from table 3.

**Table 3.** Representation of Journal Characteristics Based on Research Approach

No	Research Approach	Z	Persentase
1	Quantitatif	9	24%
2	Qualitatif	8	22%
3	Mixeds Method	20	52%
	<b>Z</b>	37	100%

Based on table 3, it shows that the most widely used research approach for research is using a mixed method approach with a percentage of 52%, while the least used approach is a qualitative model approach with a percentage of 22%. Based on the research data, it can be concluded that the approach using the Problem Based Learning (PBL) model in learning physics in the classroom consists of qualitative, quantitative, and mixed models.

### 4. Results of the Review of Problem Based Learning (PBL) Models in Physics Learning

In this study, the results of the review on the Problem Based Learning (PBL) model in physics learning were divided based on the author, the title of the article, and the content of the article, the results of the review can be seen in table 4.

**Table 4.** Results of the Review of Problem Based Learning (PBL) Models in Physics

Author and Year	Article Title	Article Content
( Naqiyah , Rosana , Sukardiyono , & Ernasari , 2020)	Developing Instruments to Measure Physics Problem Solving Ability and Nationalism of High School Student	Problem based learning aims to develop an instrument to measure physics problem solving and student nationalism that can be used with good criteria
(Zainuddin, et al., 2020)	The Correlation of Scientific Knowledge-Science Process Skills and Scientific Creativity in Creative Responsibility Based Learning	Problem based learning can be used to determine the relationship between science and science process skills with scientific creativity
(Funa & Prudente, 2021)	Effectiveness of Problem-Based Learning on Secondary Students' Achievement in Science: A Meta-Analysis	Problem based learning can be used for the effectiveness of problem-based learning on student achievement
(Astutik & Prahani , 2018)	The Practicality and Effectiveness of Collaborative Creativity Learning (CCL)	Problem based learning can be used for Practicality and Effectiveness of

Author and Year	Article Title	Article Content
	Model by Using PhET Simulation to Increase Students' Scientific Creativity	Collaborative Creativity Learning (CCL) Model Using PhET Simulation
(Mustofa & Hidayah , 2019)	The Effect of Problem-Based Learning on Lateral Thinking Skills	Problem based learning can be used for lateral thinking skills and using conventional models on physics material
(Palupi & Subiyantoro , 2019)	The Effectiveness of Guided Inquiry Learning (GIL) and Problem-Based Learning (PBL) for Explanatory Writing Skill	Problem based learning can be used as conventional learning and can also be used to determine the effectiveness of guided inquiry learning (GIL) for elementary school students.
(LaForce, Noble, & Blackwell, 2017)	Problem-Based Learning (PBL) and Student Interest in STEM Careers: The Roles of Motivation and Ability Beliefs	Problem based learning can be used by using learning through student interest in STEM in the role of motivation and ability to believe in physics material
(Ramadani, Umam, Abdurrahman, & Syali, 2019)	The Effect of Flipped-Problem Based Learning Model Integrated with LMS-Google Classroom for Senior High School Students	Problem based learning can be used with the Flipped model which is integrated with LMS for high school students
(Akhdirwanto, Agustini, & Jatmiko, 2020)	Problem-Based Learning With Argumentation As A Hypothetical Model To Increase The Critical Thinking Skills For Junior High School Students	Problem based learning can also be used with argumentation as a hypothetical model in improving students' critical thinking skills on science material in junior high schools.
(Manurung & Panggabean , 2020)	Improving Students' Thinking Ability In Physics Using Interactive Multimedia Based Problem Solving	Problem based learning can also be used with students' thinking skills based on interactive multimedia in physics learning
(Serevina, Sunaryo , Raihanati , Astra , & Sari , 2018)	Development of E-Module Based on Problem Based Learning (PBL) on Heat and Temperature to Improve Student's Science Process Skill	Problem based learning can be used by using E-module assisted learning on measurement materials, substances, heat, and heat transfer in science process skills
(Tania & Jumadi, 2020)	The Application of Physics Learning Media Based on Android with Learning Problem Based Learning (PBL) to Improve Critical Thinking Skills	The existence of the application of learning media on physics material using Android using the PBL model and critical thinking skills
( Tarigan , 2017)	Critical Thinking with Problem Based Learning in Physics Class	The existence of critical thinking analysis in physics learning and problem based learning in physics learning
(Anwar, et al., 2019)	Effect Size Test of Learning Model ARIAS and PBL: Concept Mastery of Temperature and Heat on Senior High School Students	Adanya perbedaan model pembelajaran Assurance, Relevance, Interest, Assessment, and Satisfaction (ARIAS) dan Problem Based Learning (PBL)
(Retna Tinon Kawur, Ishafit, & Fayanto, 2019)	Efforts To Improve The Learning Activity And Learning Outcomes Of Physics Students With Using A Problem-Based Learning Model	The existence of learning activities and learning outcomes using a problem based learning model in physics learning in high school
(Tanti, Kurniawan, Sukarni, Erika, & Hoyi, 2021)	Description of Student Responses Toward the Implementation of Problem-Based Learning Model in Physics Learning	Problem based learning can be used in the description of responses to students

Author and Year	Article Title	Article Content
(Shishigu, Hailu, & Anibo, 2017)	The Effect of Problem Based Learning Approach on Conceptual Understanding in Teaching of Magnetism Topics	Determine problem-based learning strategies on students' problem-solving skills and their roles
(Dağyar & Demirel, 2015)	Effects of Problem-Based Learning on Academic Achievement: A Meta Analysis Study	There is an effect of PBL on student achievement when compared to traditional teaching on physics material
(Liana & Nursuhud, 2020)	Problem-Based Learning Approach with Supported Interactive Multimedia in Physics Learning: Its Effects on Critical Thinking Ability	The existence of a PBL approach with the support of interactive multimedia in physics learning and critical thinking skills
( Oktavia, Usmeldi, & Yohandri, 2018)	Development of Physics Learning Material Based on Problem Based Learning by Integrating Local Wisdom West Sumatra to Improve Critical Thinking Ability of Students	In physics learning in high school students can use the PBL model by integrating local wisdom in their respective regions, but in this article in West Sumatra in order to improve students' critical thinking skills
(Jay & Walag , 2020)	Utilizing Problem-Based and Project-Based Learning in Developing Students' Communication and Collaboration Skills in Physics	PBL can be utilized by developing communication and collaboration skills in physics
(Putri, Sunarno, & Marzuki, 2021)	Analysis of The Students' Argumentative Skills of Senior High School in Covid-19 Pandemic using Problem Based Learning in Static Fluid	Analyzing argumentative skills during the covid-19 period using PBL for high school students with static fluid material
(Shishigu, Hailu, & Anibo, 2018)	Problem-Based Learning and Conceptual Understanding of College Female Students in Physics	Exploring the role of Problem Based Learning (PBL) by implementing a five-step problem-solving strategy in improving conceptual understanding
(Gunawan, Harjono, Herayanti, & Husaein, 2019)	Problem-Based Learning Approach with Supported Interactive Multimedia in Physics Course: Its Effects on Critical Thinking Disposition	In interactive multimedia, you can use a PBL approach that can also be used with critical thinking
(Bara & Xhomara, 2020)	The Effect of Student-Centered Teaching and Problem-Based Learning on Academic Achievement in Science	There is a relationship between student-centered teaching approaches, problem-based learning, and academic achievement in science teaching
(Bara & Xhomara, 2020)	The Effect of Problem Based Learning (PBL) Instruction on Students' Motivation and Problem Solving Skills of Physics	Knowing the relationship between student-centered teaching approaches, problem-based learning, and academic achievement in science teaching
(Čavić, Stanislavljević, Bogdanović, & Pavkov-Hrvojević, 2022)	Project-Based Learning of Diffusion and Osmosis: Opinions of Students of Physics and Technology at University of Novi Sad	In physics learning, PBL is used for project-based diffusion and osmosis learning for physics students in physics courses
(Yustina, Mahadi , Ariska, Arnentis , & Darmadi, 2022)	The Effect of E-Learning Based on the Problem-Based Learning Model on Students' Creative	Analyzing the effect of problem-based learning (PBL)-based e-learning on



Author and Year	Article Title	Article Content
(Taşoğlu & Bakaç, 2014)	Thinking Skills During the Covid-19 Pandemic	students' creative thinking skills during the COVID-19 pandemic
(Saputra , Joyoatmojo , Wardani , & Sangka , 2018)	The Effect of Problem Based Learning Approach on Conceptual Understanding in Teaching of Magnetism Topics	The learning approach using PBL has an effect on conceptual understanding in physics learning, especially magnetism hats
(Simanjuntak , Hutahaean, Marpaung , & Ramadhani , 2021)	Developing Critical-Thinking Skills through the Collaboration of Jigsaw Model with Problem-Based Learning Model	Testing the effectiveness of Jigsaw collaboration and problem-based learning (PBL) models in developing students' critical thinking skills.
(Sahyar, Sani, & Malau, 2017)	Effectiveness of Problem-Based Learning Combined with Computer Simulation on Students' Problem-Solving and Creative Thinking Skills	Knowing the effectiveness of problem-based learning combined with problem solving simulations and students' creative thinking.
(Nair , 2020)	The Effect of Problem Based Learning (PBL) Model and Self Regulated Learning (SRL) toward Physics Problem Solving Ability (PSA) of Students at Senior High School	Problem Solving Ability of students that taught by the Problem Based Learning Model is better than conventional learning
(Yuberti, et al., 2019)	Revitalizing Education through Problem based Learning Practices	The effectiveness of problem-based learning can vary from team, group, classroom, and individual student. Research on problem-based learning shows that a list of questions can get students on the right track.
(Julaeha, Nugraha, & Feranie, 2019)	Approaching Problem-Solving Skills of Momentum and Impulse Phenomena Using Context and Problem-Based Learning	Determine problem-based learning strategies on students' problem-solving skills and their roles
(Jumandi, Perdana, Riwayani, & Rosana, 2021)	The Effect of Project in Problem-Based Learning on Students' Scientific and Information Literacy in Learning Human Excretory System	the effect of Project in Problem Based Learning on scientific literacy
(Bara & Xhomara, 2020)	The impact of problem-based learning with argument mapping and online laboratory on scientific argumentation skill	tested the effect of Problem Based Learning (PBL) with Argument Mapping and Online Laboratory in improving scientific argumentation skills. He explained the importance of the differences between participants who learn through the PBL model, PBL with Online Laboratory (PBL-OL), Problem Based Learning with Argument Mapping and Online Laboratory (PBL-AMOL).
(Bara & Xhomara, 2020)	The Effect of Student-Centered Teaching and Problem Based Learning on Academic Achievement in Science	the relationship between student-centered teaching approaches, problem-based learning, and academic achievement in science teaching.

From table 4 it can be seen that the Problem Based Learning (PBL) model can be used as a solution to educational problems in the teaching and learning process carried out in class on physics material. The results of 37 reviewed journals can be concluded that Problem Based.

## DISCUSSION

The research has reviewed 37 reputable international journals related to Problem Based Learning (PBL) models in physics learning. This study describes the research representation according to its general characteristics. The characteristics consist of the type of publication, year of publication, research approach, and level of education. The author also examines how effective the Problem Based Learning (PBL) model is in learning physics. Several previous studies analyzed the presentation of research characteristics to explain the general characteristics of the articles reviewed (e.g. Nanang Winarno, Dadi Rusdiana, Achmad Samsudin, Eko Susilowati, Nur Jahan Ahmad, & Ratih Mega Ayu Afifah, 2020; Martín-Páez, Aguilera, Perales-Palacios, & Vílchez-González, 2019; Jayarajah, Saat, Rauf, & Amnah, 2014, ). Representation of research based on publication, year of publication, method used is one of the initial stages that needs to be explained in a systematic literature review. Based on the analysis of the data obtained, the representation of the research characteristics shows that the selected articles are used for review, namely those published in the last ten years, from 2012 to 2022. Part of the data obtained is based on international journals indexed by Simago or Web of Science, so the authors provide a guarantee that the article is well reviewed.

Based on this review, PBL is an established method in Mathematics education that aims to develop reasoning skills (Kazemi & Ghoraishi, 2012; Lou, Shih, Diez, & Tseng, 2011; Tarmizi & Bayat, 2012). Recently, the use of this method aims to increase meaningful learning and is used as a physics education method in learning. Of the 37 articles obtained, then all of them were reviewed using a very varied research approach such as qualitative methods, quantitative methods, and mixed methods. The research that is widely used is mixed methods, while the method that is used very little is qualitative. Some research approaches use quantitative methods. The data collection is using test instruments, interviews, questionnaires, observations, audio/video recordings, and other research representations.

In addition, other disciplines also use PBL as a teaching and learning method, but the number of studies that touch on these disciplines is very limited. For the effect of problem-based learning in education, 95% of studies show that PBL has a positive impact on the teaching and learning process. This is because PBL is a method of social constructivism that is able to create an active learning environment among students (Kirschner Sweller, & Clark, 2006; Nakada, Okada, Yoshihara, Namiki, & Hiroi, 2017; Pepper, 2014).

## CONCLUSION

Based on the results and discussions that have been described regarding the Problem Based Learning (PBL) model using a systematic literature review, it can be concluded that learning using the Problem Based Learning (PBL) model is one of the models used from the last ten years in physics learning that is implemented in the classroom. This can be seen from the research and surveys conducted regarding the Problem Based Learning (PBL) model. As well as learning carried out using this model is considered good and very influential on learning physics in the classroom. So it can be used as input and reference related to the model by physics teachers to be able to apply the Problem Based Learning (PBL) model in the teaching and learning process in the classroom. Of the 37 articles reviewed using different methods such as qualitative methods, quantitative methods, mixed methods. The research that is widely used in

the articles reviewed is mixed methods, while the method that is used the least is qualitative methods.

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## REFERENCES

- Čavić, M. R., Stanisavljević, J. S., Bogdanović, I. Z., Skuban, S. J., & Pavkov-Hrvojević, M. (n.d.). Project-Based Learning of Diffusion and Osmosis: Opinions of Students of Physics and Technology at University of Novi Sad. *SAGE Open*.
- Taşoğlu, A. K., & Bakaç, M. (2014). The Effect of Problem Based Learning Approach on Conceptual Understanding in Teaching of Magnetism Topics. *Eurasian J. Phys. & Chem. Educ.*, 110-122.
- AKÇAY, B. (2009). Problem-Based Learning in Science Education. *TÜRK FEN EĞİTİMİ DERGİSi*, 26-36.
- Akhdinirwanto, R., Agustini, R., & Jatmiko, B. (2020). Problem-Based Learning With Argumentation As A Hypothetical Model To Increase The Critical Thinking Skills For Junior High School Students. *Jurnal Pendidikan IPA Indonesia*, 340-350.
- Allen, D. E. (2011). Problem-Based Learning. *New Directions for Teaching and Learning*, . 21-29.
- Anwar, C., Saregar, A., Yuberti, Zellia, N., Widayanti, Diani, R., & Wekke, I. S. (2019). Effect Size Test of Learning Model ARIAS and PBL: Concept Mastery of Temperature and Heat on Senior High School Students. *EURASIA Journal of Mathematics, Science and Technology Education*.
- Argaw, A. S., Haile, B. B., & Ayalew, B. T. (2017). The Effect of Problem Based Learning (PBL) Instruction on Students' Motivation and Problem Solving Skills of Physics. *EURASIA Journal of Mathematics Science and Technology Education*, 857-871.
- Bara, G., & Xhomara, N. (2020). The Effect of Student-Centered Teaching and Problem Based Learning on Academic Achievement in Science. *TÜRK FEN EĞİTİMİ DERGİSi*, 180-199.
- Bara, G., & Xhomara, N. (2020). The Effect of Student-Centered Teaching and Problem Based Learning on Academic Achievement in Science. *TÜRK FEN EĞİTİMİ DERGİSi*, 180-199.
- Barrows, H. S. (1980). *Problem-Based Learning: An Approach to Medical Education*. New York: Springer Publishing Company.
- Celik, P., Onder, F., & Silay, I. (2011). The effects of problem-based learning on the students' success in physics course. *Procedia - Social and Behavioral Sciences*, 656-660.
- Chuan, T. Y. (2011). Problem-Based Learning: With or without Facilitator? *Procedia—Social and Behavioral Sciences*, 18, 394-399.
- Dağyar, M., & Demirel, M. (2015). Effects of Problem-Based Learning on Academic Achievement: A Meta-Analysis Study. *Education and Science*, 139-174.
- Graaff, E. D. (2003). Characteristics of Problem-Based Learning. *International Journal of Engineering Education*. 19, 657-662.
- Gunawan, G., Harjono, A., Herayanti, L., & Husein, S. (2019). Problem-based learning approach with supported interactive multimedia in physics course: Its effects on critical thinking disposition. *Journal for the Education of Gifted Young Scientists*, 7(4), 1075-1089.
- Hmelo-Silver, C. E. (2004). Problem-Based Learning: What and How Do Students Learn? *Educational Psychology Review*. 16, 235-266.
- Juleha, S., Nugraha, I., & Feranie, S. (2019). The Effect of Project in Problem-Based Learning on Students' Scientific and Information Literacy in Learning Human Excretory System. *Indonesian Society for Science Educator*.
- Jumadi, J., Perdana, R., & Rosana, D. (2021). The Impact of Problem-Based Learning with Argument Mapping and Online Laboratory on Scientific Argumentation Skill. *International Journal of Evaluation and Research in Education*, 10(1), 16-23.

- Kazemi, F. &. (2012). Comparison of Problem-Based Learning Approach and Traditional Teaching on Attitude, Misconceptions and Mathematics Performance of University Students. . *Procedia— Social and Behavioral Sciences*, 46, 3851-3856.
- Khan, K. S. (2003). Five Steps to Conducting a Systematic Review. *Journal of the Royal Society of Medicine*, 96, 118-121.
- Khoiri, W., Rochmad, & Cahyono, A. N. (2013). Problem Based Learning Berbantuan Multimedia Dalam Pembelajaran Matematika Untuk Meningkatkan Kemampuan Berpikir Kreatif. *Journal Of Mathematics Education 2 (1)*.
- Kirschner, P. A. (2006). Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, . *Educational Psychologist*, 41, 75-86.
- Kitchenham, B. (2007). *Guidelines for performing Systematic Literature Reviews in Software Engineering*. Durham: Department of Computer Science University of Durham.
- LaForce, M., Noble, E., & Blackwell, C. (2017). Problem-Based Learning (PBL) and Student Interest in STEM Careers: The Roles of Motivation and Ability Beliefs. *Educattion Sciences*.
- Liana, Y. R., & Nurusuhud, P. I. (2020). Problem-Based Learning Approach with Supported Interactive Multimedia in Physics Learning: Its Effects on Critical Thinking Ability. *JIPF (JURNAL ILMU PENDIDIKAN FISIKA)*, 88-97.
- Mahadi, I., & Ariska, D. (2022). The Effect of E-Learning Based on the Problem-Based Learning Model on Students' Creative Thinking Skills during the COVID-19 Pandemic. *International Journal of Instruction*, 15(2), 329-348.
- Manurung, S. R., & Pangabean, D. D. (2020). Improving Students' Thinking Ability In Physics Using Interactive Multimedia Based Problem Solving. *Cakrawala Pendidikan*.
- Masek, A., & Yamin , S. (2011). The Effect of Problem Based Learning on Critical Thinking Ability: A Theoretical and Empirical Review. *International Review of Social Sciences and Humanities*, 215-221.
- Missildine, K. F. (2013). . Flipping the Classroom to Improve Student Performance and Satisfaction. *Journal of Nursing Education*, 52, 597-599.
- Nair, S. S., Smritika, S., & Thomas, K. A. (2020). Revitalizing Education through Problem based Learning Practices. *International Journal of Education s*.
- Oktavi, R. A., Usmeldi, & Yohandri. (2018). Development of Physics Learning Material Based on Problem Based Learning by Integrating Local Wisdom West Sumatra to Improve Critical Thinking Ability of Students. *International Journal of Progressive Sciences and Technologies (IJPSAT)*, 2509-0119.
- Putri, W. E., Sunarno, W., & MARzuki, A. (2021). Analysis of The Students' Argumentative Skills of Senior High School in Covid-19 Pandemic using Problem Based Learning in Static Fluid. *Journal of Research in Science Education*, 335-343.
- Ramadhani, R., Umam, R., Abdurahman, & Syazali, M. (2019). The Effect of Flipped-Problem Based Learning Model Integrated with LMS-Google Classroom for Senior High. *Journal for the Education of Gifted Young School Students*, 137-158.
- Sahyar, Sani, R. A., & Malau, T. (2017). The Effect of Problem Based Learning (PBL) Model and Self Regulated Learning (SRL) toward Physics ProblemSolving Ability (PSA) of Students at Senior High School. *American Journal of Educational Research*, 279-283.
- Saldo, I. J., & Walag, A. M. (2020). Utilizing Problem-Based and Project-Based Learning in Developing Students' Communication and Collaboration Skills in Physics. *American Journal of Educational Research*, 232-237.
- Saputra, M. D., Joyoatmojo, S., Wardani, D. K., & Sangka, K. B. (2018). Developing Critical-Thinking Skills through the Collaboration of Jigsaw Model with Problem-Based Learning Model. *International Journal of Instruction*, 1077-1094.
- Savery, J. R. (2011). Problem Based Learning: An Instructional Model and Its Constructivist Framework. Bloomington: The Center for Research on Learning and Technology.
- Schultz, D. D. (2014). Effects of the Flipped Classroom Model on Student Performance for Advanced Placement High School Chemistry Students. *Journal of Chemical Education*, 91, 334-1339.
- Serevina, V., Sunaryo, Raihanati, Astra, I. M., & SAri, I. J. (2018). Development of E-Module Based on Problem Based Learning (PBL) on Heat and Development of E-Module Based on Problem

- Based Learning (PBL) on Heat and. *Development of E-Module Based on Problem Based Learning (PBL) on Heat and.*
- Shishigu, A., Hailu, A., & Anibo, Z. (2017). Problem-Based Learning and Conceptual Understanding of College Female Students in Physics. *EURASIA Journal of Mathematics, Science and Technology Education*, 145-154.
- Simanjuntak, M. P., Hutahaean, J., Marpaung, N., & Ramadhani, D. (2021). Effectiveness of Problem-Based Learning Combined with Computer Simulation on Students' Problem-Solving and Creative Thinking Skills. *International Journal of Instruction*, 14(3), 519-534.
- Tania, R., & Jumadi. (2021). The Application of Physics Learning Media Based on Android with Learning Problem Based Learning(PBL) to Improve Critical Thinking Skills. *Advances in Social Science, Education and Humanities Research*.
- Tanti, Kurniawan, D. A., Sukarni, W., Erika, & Hoyi, R. (2021). Description of Student Responses Toward the Implementation of Problem-Based Learning Model in Physics Learning. *JIPF (JURNAL ILMU PENDIDIKAN FISIKA)*, 30-38.
- Taringan, R. (2017). Analysis of Critical Thinking with Problem Based. *Advances in Social Science, Education and Humanities Research Learning in Physics Class*.
- Tinon Kawuri, M. R., Ishafit, & Fayanto, S. (2019). Efforts To Improve The Learning Activity And Learning Outcomes Of Physics Students With Using A Problem-Based Learning Model. *IJIS Edu : Indonesian J. Integr. Sci. Education*, 105-114.
- Winarno, N., Rusdiana, D., Samsudin, A., Susilawati, E., Ahmad, N. J., & Afifah, R. M. (2020). Synthesizing Results from Empirical Research on Engineering Design Process in Science Education: A Systematic Literature Review. *EURASIA Journal of Mathematics, Science and Technology Education*, 16(12).
- Yanto, F., Festiyed, & Enjoni. (2021). Problem Based Learning Model For Increasing Problem Solving Skills In Physics Learning. *JIPF (JURNAL ILMU PENDIDIKAN FISIKA)*, 53-65.
- Yuberti, Misbah, Latifah, S., Saregar, A., Nugraha, A., & Jermisittiparsert, K. (2019). Approaching Problem-Solving Skills of Momentum and Impulse Phenomena Using Context and Problem-Based Learning. *European Journal of Educational Research*, 1217-1227.