

Literature study: various abilities of high school students obtained from the application of problem-based learning models in the field of natural science

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Article information	ABSTRAK
Article history Received October 12, 2022 Revised Dec 8, 2022 Accepted Dec 9, 2022	Salah satu kemampuan pendidikan abad 21 adalah meningkatkan kemampuan berpikir kritis. Akan tetapi, yang terjadi di lapangan adalah kemampuan berpikir kritis siswa SMA masih rendah. Oleh karena itu dibutuhkan model pembelajaran yang memiliki potensi untuk meningkatkan kemampuan berpikir kritis, model tersebut yaitu Problem Based Learning (PBL). Penelitian ini bertujuan untuk mengetahui kemampuan apa saja yang diperoleh dari penerapan model pembelajaran Problem Based Learning (PBL) maupun PBL modifikasi. Jenis penelitian ini adalah penelitian studi literatur dengan desain narrative review. Penyajian data menggunakan tabel dan analisis data menggunakan analisis deskriptif. Artikel yang didapatkan yaitu 36 artikel yang berkaitan dengan model PBL dan kemampuan berpikir kritis. Hasil penelitian menunjukkan bahwa model pembelajaran PBL dan PBL modifikasi dapat meningkatkan kemampuan lain seperti pemahaman dan penguasaan konsep materi, keaktifan siswa, hasil belajar siswa, kemampuan berpikir ilmiah, kemampuan memecahkan masalah dan kemampuan berpikir kreatif.
Kata kunci: Kemampuan berpikir kritis Problem-based Learning (PBL) Model Pembelajaran PBL modifikasi Studi Literatur	ABSTRACT Literature study: various abilities of high school students obtained from the application of problem-based learning models in the field of natural science. One of the capabilities of 21st-century education is to improve critical thinking skills. However, what happens in the field is that high school students' critical thinking skills are still low. Therefore, a learning model is needed that has the potential to improve critical thinking skills. The model is Problem Based Learning (PBL). This study aims to determine what abilities are obtained from the application of Problem Based Learning (PBL) and modified PBL learning models. This type of research is a literature study with a narrative review design. Presentation of data using tables and data analysis using descriptive analysis. The articles obtained were 36 articles related to the PBL model and critical thinking skills. The results showed that the modified PBL and PBL learning models could improve other abilities, such as understanding and mastery of material concepts, student activity,
Keywords: Critical thinking skills Problem-based Learning (PBL) Modified PBL Learning Model Literature Studies	

student learning outcomes, scientific thinking skills, problem-solving abilities, and creative thinking skills.

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INTRODUCTION

Along with the development of the times, there have been changes in almost all areas of life, one of which is the field of education, it requires teachers and students to master 21st century learning. According to the United Nations, the challenges of education in the 21st century are building a knowledgeable society that has the ability to be literate in Information and Communication Technology (ICT), the ability to think critically, the ability to solve problems, the ability to communicate effectively and the ability to cooperate collaboratively (Pustekkom Kemendikbud, 2017). Therefore, to answer these challenges, teachers and students must master life skills, one of which is the ability to think critically.

Another problem for students in school is that there are often students whose critical thinking skills are low. According to Lestari (2020) and Koropit (2017), students' low critical thinking skills can be seen from students' lack of activity in asking questions and students not daring to express opinions when given a problem during learning. Another important component in Teaching and Learning Activities (KBM) in schools is the teacher. Teachers have an important role in the development of students' thinking abilities. However, there is a problem that is often encountered in schools, namely that teachers have not implemented learning that can trigger critical thinking skills. According to Husni (2015), attempts to train students' critical thinking skills often go unnoticed by teachers. This can be seen from the learning activities carried out by teachers who provide more information, followed by discussions and exercises with very limited frequency.

One of the learning models that can improve critical thinking is Problem Based Learning (PBL) because the model requires students to think critically through real problems that are often encountered. The PBL learning model can be combined/combined with other models. The PBL learning model will be more effective in improving students' critical thinking skills when combined with other models, methods or media. The example of the combination of PBL with other models can be seen from the results of Hariatika's research (2017), that the PBL model accompanied by Socratic Dialogue (DS) is better than students who are taught using the PBL model.

Based on these problems, this research is important to do. This literature study research aims to find out what abilities are obtained from the application of PBL and modified PBL learning models. This study analyzes the results of previous research on PBL learning models from various sources of scientific articles within a period of 10 years (2010-2020) to determine the application of PBL to critical thinking skills.

METHOD

This type of research is literature study research with a narrative review design. Literature searches are searched through the Google Scholar website, Sinta, Directory of Access Journals (DOAJ) and Garuda Portal with keywords, namely problem-based learning, problem-based, and critical thinking. The article to be used is validated first with 5 criteria including the credibility of the source not included in the predatory journal, the quality of the research methodology is clear, the object in the research is high school students, the material in scientific articles including natural science, the reference is up to date and relevant to the 10-year time span and the location of the study in Indonesia. Data presentation using tables and data analysis using descriptive analysis.

RESULTS AND DISCUSSION

Based on the results of literature validation obtained 36 scientific articles consisting of 2 international journals, 29 accredited national journal, 4 non-accredited national journals, and 1 national proceedings. The scientific articles that are used as research data are presented in the Table 1.

Table 1. Research Data

No	Article Title
1	Application of Problem-Based Learning Model to Improve Critical Thinking Ability of Sma Negeri 2 Metro Students
2	Implementation of the PBL (<i>Problem Based Learning</i>) Model to improve Student Learning Outcomes and Critical Thinking Ability
3	Comparative Study of the Application of Problem-Based Learning Models and Cooperative Learning Models Type STAD to Critical Thinking Ability and Scientific Performance of High School Biology
4	Application of a Problem-Based Learning Approach to Improving Critical Thinking Ability in the Concept of the Human Respiratory System
5	The Effect of <i>Problem Based Learning</i> Learning Strategies and Guided Inquiry on Metacognitive Abilities, Critical Thinking, and Cognitive Learning Outcomes of High School Students
6	The Effect of <i>Problem Based Learning</i> Model on High School Students' Critical Thinking Ability on Protista Material
7	Application of <i>Problem Based Learning</i> (PBL) Model on Business and Energy Concepts to Improve Critical Thinking and Creative Thinking Skills of High School Students
8	Application of the PBL Learning Model to Improve Students' Mastery of Concepts and Critical Thinking Skills on the Concept of Elasticity and Hooke's Law at SMA Negeri Unggul Harapan Persada
9	Implementation of Environmental-Based Chemistry Learning with <i>Problem Based Learning</i> (PBL) to Increase Interest and Critical Thinking Ability in High School Students
10	The Influence of Model <i>Problem Based Learning</i> (PBL) on Students' Understanding of Biological Concepts and Critical Thinking Ability about Ecosystems and the Environment in Class X SMA Negeri 1 Sigi
11	The Effect of <i>Problem Based Learning</i> Model on Students' Critical Thinking Ability of Excretion System Material
12	Comparison of <i>Problem Based Learning</i> and Guided Inquiry Learning Models towards Students' Critical Thinking Ability
13	The Effect of the PBT Model on Critical Thinking Ability and Creative Thinking Ability of High School Students
14	Problem-Based Learning To Improve Students' Critical Thinking Skills On Redox Reaction Materials
15	Critical Thinking Ability of Students <i>Problem Based Learning</i> Learning Model and Community Science Technology on the Concept of Viruses
16	Application of <i>Problem Based Learning</i> (PBL) Learning Model with Audio Visual Media on Chemical Bond Material towards Mastery of Concepts and Critical Thinking of Sma Negeri 1 Panga Students
17	<i>Project- Based Learning and Problem- Based Learning: Are They Effective To Improve Student's Thinking Skills?</i>
18	The Effect of <i>Problem Based Learning</i> Learning Model Combined with <i>Student Facilitator And Explaining</i> on Critical Thinking Ability of Class X Students of SMAN 6 Kediri on the Subject of Fungi
19	Improving Critical Thinking Skills and Science Process Skills of High School Students through the Implementation of <i>Problem Based Learning</i> combined with <i>Think Pair Share</i>
20	The Influence of Learning Media on Mastery of Virus Material Concepts Using <i>Problem Based Learning</i> (PBL) Models on Critical Thinking Ability at SMA Negeri 1 Tomohon
21	The Effect of Learning using Strategies (PBL) on the Critical Thinking Ability of State High School Students 3 Tondano
22	Application of <i>Problem Based Learning</i> Model to Improve Learning Outcomes and Critical Thinking Ability of Students on Buffer Solution Material
23	The Effect of <i>Reciprocal Teaching</i> and <i>Problem Based Learning</i> on the Critical Thinking Ability of High School Students on Reproductive System Material
24	Application of <i>Problem Based Learning</i> with SETS Approach to Students' Critical Thinking Ability
25	Application of Problem-Based Learning to Critical Thinking Ability of Students of SMAN 5 Soppeng
26	The Effect of <i>Problem Based Learning</i> Model on Students' Critical Thinking Ability on Calorific Material

27	<i>Problem Based Learning (PBL) Learning Model: Its Effect on Concept Understanding and Critical Thinking</i>
28	<i>Analysis of Students' Critical Thinking Ability in the Application of Problem Based Learning Assisted by Ethnoscience-Charged Student Worksheets</i>
29	<i>Students' Critical Thinking Skills in Islamic Schools: The Effect of Problem-Based Learning (PBL) Model</i>
30	<i>The Effect of Problem Based Learning Model on Students' Critical Thinking Ability of Biodiversity Material</i>
31	<i>Comparison of Students' Critical Thinking Ability with Problem-Based Learning Models and Numbered Heads Together Based On Student Created Case Studies</i>
32	<i>The Effect of Problem-Based Learning Models (PBM) on Critical Thinking Ability and Biology Learning Outcomes of Students of SMA Negeri 06 Bengkulu City</i>
33	<i>Application of Problem Based Learning (PBL) to Improve Critical Thinking Ability of Class X MScience 2 Students of SMA Negeri 6 Surakarta Academic Year 2014/2015</i>
34	<i>The Effect of Applying the Ethnoscience Approach Problem Based Learning Model on Reproductive System Material on Students' Critical Thinking Ability</i>
35	<i>Empowering Higher Order Thinking of High School Students in Biology Learning</i>
36	<i>Application of the PBL Model to Improve Critical Thinking Skills In Terms of Students' Academic Abilities On Biology Materials</i>

Abilities obtained by high school students from the Application of Problem Based Learning (PBL) Learning Models with Problem Based Learning (PBL) Modifications

Critical thinking ability is one of the abilities that can be improved through a modified PBL/PBL model. Meanwhile, there are many other abilities that can be improved through this learning model. Other abilities that can be improved from the modified PBL/PBL model include mastery of concepts, student learning outcomes, creative thinking skills and so on.

Research conducted by Muslim (2015), revealed that the application of the PBL model can improve the mastery of concepts in the cognitive aspects of students. This is because students are given the opportunity to solve problems according to the learning material, students are given the opportunity to discuss with their friends in order to find solutions to their problems, students in taking data and interpreting it are guided by the teacher, students are given the opportunity to present the results of their investigations, and at the end the teacher helps to straighten out inappropriate concepts. In addition, research conducted by Husni (2015), also revealed that there was an increase in mastery of the concept of petroleum material in students who got learning with the PBL learning model.

Based on the results of the Anova test from research conducted by Yulianti (2019), it shows that the application of the PBL model affects students' understanding of concepts and critical thinking. This is because learning that applies the PBL model requires students to find their own answers to their problems by using their thinking skills to the fullest. Finally, a concept will automatically form in the learner about the material being studied. In line with research conducted by Temuningsih (2017), that the application of the PBL model with an ethnoscience approach can optimize all the potential that exists in students to learn to find their own concepts, so that students are easier to understand the concepts of the material taught by the teacher.

The PBL model, in addition to affecting critical thinking skills, also affects students' cognitive learning outcomes. Like the research conducted by Koropit (2017), the PBL model has the potential to improve critical thinking skills because the model can involve students to actively cooperate in the search for solutions to the problems studied. The involvement of all students to be active in learning can stimulate critical thinking skills and affect student learning outcomes, especially cognitive learning outcomes.

Research conducted by Koropit (2017), revealed that the ability to think critically has an impact on the achievement of student learning outcomes. The PBL model has the potential to improve critical thinking skills because it can involve students to actively cooperate in the search for solutions to the problems studied. The involvement of all students to be active in learning can stimulate critical thinking skills and also affect student learning outcomes, especially cognitive learning outcomes.

Based on the results of research by Lidyawati (2017), that the application of the PBL model can improve learning outcomes and critical thinking skills (KBK) of students. This is because the PBL model is a model that can develop students' potential, improve thinking skills, increase student activity in the problem-solving process so that it can improve learning outcomes and students' critical thinking skills. Laili's research (2015), also revealed that the application of the PBL model to reaction rate materials can improve critical thinking ability with an average increase of 0.7 which is relatively high and is able to improve student learning outcomes with classical completeness reaching 100%.

The PBL model can improve other high-level thinking skills besides KBK. According to Muskitta (2016), there is a significant influence on the application of the PBL model with the ability to think critically and think creatively. The findings of this study are that the PBL model is a student-centered model (Student Center), in this model students are placed as learning subjects so that students more easily understand difficult concepts by discussing them with other students. These discussion activities can bring out students' critical and creative thinking skills.

Another ability that can be obtained from PBL learning is student activity. Like research conducted by Ayuningrum (2015), mentioning that PBL learning can increase student activity. These activities include students' activeness in asking and answering, motivating students in learning, appreciating, and responding to friends.

The PBL model combined with a concept map can make students actively think scientifically. This is like the research conducted by Hasan (2018), the learning process in the experimental class using PBL combined with a concept map can make students actively think scientifically about the real problems presented in the discussion. The combination of the PBL model with the concept map is an excellent combination in stimulating students to actively think scientifically in the face of a problem to facilitate students' acceptance and understanding of the material presented in achieving learning objectives.

According to Karmana (2013), the PBL model can develop thinking and problem-solving skills. This is because the characteristic of the PBL model is to use real-world problems as context, so that students will be motivated to learn about how to think critically and solve a problem. In addition, the PBL model can also train students to acquire essential knowledge and concepts from a subject matter. In line with research conducted by Apriyani (2017), that group activities in PBL syntax prioritize teamwork, so that it can help in the process of solving group problems, as a result, directly the learning can train students' critical thinking skills.

CONCLUSION

Based on the results of research and discussion, conclusions were obtained, namely the abilities obtained by students from the application of the Problem Based Learning learning model with Problem Based Learning modifications including the ability to understand and master material concepts, student activity, scientific thinking ability, problem-solving ability and creative thinking ability.

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