Problem Based Learning (PBL) Model with Technological, Pedagogical, and Content Knowledge (TPACK) Approach

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Article Info	Abstract
	This research aims to determine whether there is an influence of applying the Problem Based Learning (PBL) Model with the Technological, Pedagogical, and Content Knowledge (TPACK) Approach on the historical learning outcomes of high school students of Sultan Iskandar Muda Medan. This study uses a quasi-experiment research method. The population in this study involves all students of class XI of High School (SMA) Sultan Iskandar Muda Medan, with a sample of class XI of Social Sciences (IPS) 1 as an experiment class and class XI of Social Sciences (IPS) 3 as a control class selected by simple random sampling method. The experiment class is taught with the PBL Model with the TPACK Approach, while the control class is taught with the Discovery Learning Model. The research instrument used is in the form of test questions totaling 25 multiple choice questions that have been declared valid. In this study, two stages of the test were given, namely pretest and posttest, in the form of multiple-choice questions that have been declared valid. The pretest is given to both sample classes to determine the student's initial ability before being given treatment, while the posttest is given to both sample classes to determine the final ability of learners after treatment. Based on posttest data, the experiment class obtained an average score of 80.3 and an average score in the control class of 68.4. The data proved to be a normal and homogeneous distribution through statistical test analysis, so a hypothesis test was carried out, namely a one-party t-test that showed a significance level of $\alpha = 0.05$. Thus, Ho was rejected, and Ha was accepted, meaning that there was an influence of the PBL Model with the TPACK Approach on the historical learning outcomes of the high school students.

Introduction

Technology and knowledge are developing rapidly, so students must keep up with the times. Besides, students are expected to think logically and creatively and can independently solve problems and make decisions. Problem-solving is often applied to learning activities in the field of social sciences (IPS), with the agreement to

help in mastering knowledge related to historical learning so that students can solve it in everyday life. Education is also an intentional effort to realize the learning atmosphere and learning process so that students can actively develop their potential, and have spiritual, religious, self-control, personality, intelligence, noble morals, and skills needed by themselves and society.

Education plays an essential role in creating and forming quality human resources that can produce a life that has creativity and independence in society. Education is a dynamic thing, so it always demands continuous improvements with the development of information technology. Global demands also require the world of education to adjust technological developments to efforts to improve the quality of education, especially adjustments to the use of information and communication technology for education, especially in the world of learning.

The learning process is an essential thing in the world of education. Teachers play a crucial role in the learning process, creating a pleasant learning atmosphere and causing students' interest in learning. History is one branch of science that systematically tests the overall development, the process of change, or dynamics of people's lives with all aspects of life that occurred in the past. Historical learning has a vital role in shaping the nation's character and instilling cultural values. However, at this time, historical learning tends to be considered uninteresting and unimportant because it only discusses the past, even though history learning is a subject that must be learned and understood so that students can appreciate the struggle of the heroes and history of the Indonesian nation so that there is a sense of love for the nation itself.

Information obtained during observation at High School (SMA) Sultan Iskandar Muda Medan that historical learning is carried out online and still uses a very conventional and less varied learning model. In addition, information was also obtained that the results of learning student history, from the score of odd semesters, repeat scores of students are still relatively low. Namely, many students' grades are still below the Minimum Completion score because the learning model used by teachers is not appropriate. Hence, it affects learning outcomes, whereas, in the learning process, teachers still use learning which is still dominated by lecture methods interspersed with question-and-answer sessions and assignments carried out individually and in groups where learning like this is only centered on teachers and the role of students is less actively involved in learning. The low learning outcomes of students are caused by several factors, such as students' attitudes towards history subjects, which always assume that history subjects are very monotonous and unattractive, so students first feel saturated before learning them.

In this problem-based learning model, students can be done individually and in collaborative groups to find out the needs of the problem-solving process. The problems presented in learning using the Problem Based Learning Model are problems that have something to do with everyday life because the Problem Based Learning Model is appropriately applied to biological learning (Aulia et al., 2019). Problem Based Learning combined with Blended Learning methods encourages students to apply it to life based on advances from existing technology, information, and communication so that students can solve problems in the surrounding environment.

In the learning process, it is necessary to apply a varied learning model so that students can be interested and understand historical learning. One of the learning models that can be applied in historical learning is the Problem Based Learning Model using the TPACK (Technological, Pedagogical, and Content Knowledge) approach. Based on the above problems, researchers are interested in researching the influence of Problem Based Learning Models with the TPACK Approaches on the historical learning outcomes.

Literature Review

History Learning Outcomes

According to Saefuddin and Berdiati (2016), learning is a whole series of activities carried out by conscious addition of knowledge by a person and resulting in changes in him that concern many aspects, both because of maturity and because of practice. Sunhaji (2014) stated that learning is a series of activities of the body-soul to obtain a change in behavior due to the individual's experience in interaction with his environment, which concerns cognitive, affective, and psychomotor. Jumardi and Silvi (2017) explained that historical learning has a strategic meaning in forming a noble character and forming Indonesian people who have a sense of nationality and love of the homeland.

According to Fitrianingtyas and Radia (2017), learning results are results achieved in numbers or scores after giving students a test of learning results within a particular time. Fahreza and Husna (2017) explained that learning outcomes are behavioral changes in someone from ignorant to knowing. Behavioral changes that include learning outcomes include knowledge, emotional, understanding, social relationships, habits, ethical skills, ethics, ethics, appreciation, and attitudes. They concluded that learning results are an outcome obtained by students after doing learning and learning activities and evidence of success that a person has achieved by involving cognitive, affective, and psychomotor aspects expressed in symbols, letters, and sentences. At the same time, the results of historical learning are outcomes obtained by students that include the cognitive, affective, and psychomotor realms of a learning process about past experiences and their influence on the present and future.

Problem Based Learning (PBL) Model

Suardana (2019) stated that the Problem Based Learning Model is a series of learning activities that emphasize the process of solving problems faced scientifically. Meanwhile, Sudiatmika (2019) posits that the Problem Based Learning Model is a learning model that expects students to work on authentic problems to compile their knowledge, develop inquiries, and think skills higher, developing independence and confidence. According to Wulandari and Surjono (2013) and Yilmaz (2008), the Problem Based Learning Model is one of the innovative learning models that depart from learners' real-world problems to learn how to think critically in solving a problem. Based on several understandings of problem-based learning models according to the experts above, it can be concluded that the learning model is a learning model that involves students solving problems that exist in the real world in learning and aims to stimulate high-level thinking skills in solving these problems.

Technological, Pedagogical, and Content Knowledge (TPACK) Approach

Knowledge (*K*) how to teach (*Pedagogy/P*) and master learning materials according to the field (*Content*/C)) is known as *Pedagogy Content Knowledge* (PCK). Shulman first introduced the term PCK in 1986. However, PCK is not just a slice or combination of knowledge about pedagogy and material mastery but is strengthened by teachers' experiences (*tacit knowledge*). The development of information and communication technology has significantly influenced the learning process, so the 21st century encourages having knowledge related to information and communication technology (ICT). The term PCK evolved into TPCK, where "T" is technology. To facilitate the mention of TPCK changed to TPACK and developed involving many knowledge domains. The concept of TPACK involves seven domains of knowledge because there are new slices or synthesizes, namely:

    a. Material knowledge (*content knowledge*) is mastery of the field of study or learning materials.

    b. Pedagogical *knowledge* (PK) is knowledge of learning processes and strategies.

    c. Technological knowledge (TK) is knowledge of how to use digital technology.

    d. Pedagogical *content knowledge* (PCK) combines knowledge about the field of study or learning materials with learning processes and strategies.

    e. Technological and material knowledge (*TCK*) is knowledge of digital technology and the field of study or learning materials.

    f. Knowledge of technology and pedagogy (PK) is knowledge of digital technology and learning processes and strategies.

    g. Knowledge of technology, pedagogy, and materials (*technological, pedagogical, content knowledge*) is knowledge of digital technology, learning processes and strategies, and knowledge of the field of study or learning materials.

TPACK is a comprehensive integration of knowledge and skills in materials and pedagogy combined with technological development. TPACK was first created by Shulman in 1987 and later developed by Koehler and Mishra. So, and Kim (2019) stated that the Technological, Pedagogical, and Content Knowledge approach is a learning approach that combines materials, pedagogy, and technology that is integrated with a learning model that can train students to discover new knowledge independently but still get guidance from teachers. According to Urip (2016), Technological, Pedagogical, and Content Knowledge is an approach to integrating technology in the world of education. The primary basis in this TPACK consists of three main components: content, pedagogy, and technology, coupled with the relationship between the three components.

Discovery Learning Deployment Model

According to Agustina (2018), discovery learning is learning that involves students in problem-solving to develop knowledge and skills. Discovery Learning is one of the learning models in which relationship problems occur in the real world, and the problem is used as a concept for students to think critically and skillfully in problem-solving and acquiring knowledge. Discovery learning above it can be concluded that Discovery Learning is learning that emphasizes direct experience and the importance of understanding important structures

or ideas for a discipline through the involvement of students actively in learning to find a concept through data or information obtained by students.

In this Discovery Learning Model, students are invited to discover for themselves what is learned and then construct that knowledge by understanding its meaning. In this model, the teacher is only a facilitator. The main characteristics of the Discovery Learning Model are; 1) explore and solve problems to create, combine and generalize knowledge; 2) student-centered; 3) activities to combine new knowledge and existing knowledge. According to Wicaksono (2015), discovery learning is useful in; 1) increased intellectual potential of students; 2) the transfer from extrinsic to intrinsic rewards; 3) thorough learning through the process of finding; 4) tools to train memory. Furthermore, Puspita et al. (2016) wrote that the Discovery Learning model emphasizes the importance of understanding a concept through the active involvement of students in the learning process.

This learning model emphasizes forming students' knowledge from experience during learning. The application of the Discovery Learning Model in learning is expected to arouse learning motivation so that students' learning achievements become improved. In line with the research results by Rosarina et al. (2016), it is recommended that applying the Discovery Learning Model is an alternative to improving student learning achievement. Furthermore, Cintia et al. (2018) explained that the application of the Discovery Learning Model could improve students' creative thinking skills and learning achievements. Discovery Learning is a learning process in which a concept is not presented in the finished (final) form, but students are required to organize their way of learning by finding concepts.

Methodology

This research was carried out at High School (SMA) Sultan Iskandar Muda Medan, which is quasi-experiment research, which was carried out involving two sample classes, namely practical classes and control classes. The experiment class was treated using the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach, while the control class was treated with a Discovery Learning Model. This study's data collection techniques were conducted through observation, learning outcome tests, and documentation.

Before implementing the study, researchers conduct validity tests, reliability tests, difficulty tests, and question differentiating power. Researchers used 25 questions about the test of learning results valid for use in pretests and posttests. The data analysis techniques used in this study are normality tests, homogeneity tests, and data hypothesis tests.

Results and Discussion

Pre-tests are given to experimental classes and control classes at the time before the treatment of the two classes. The pre-test value data of experiment class students can be seen in Table 1.

Table 1. Experiment Class and Control Class Pre-test Result Data

Experimental Pre-test					Control Pre-test				
Interval	F	Average	Std. Dev.	Variance	Interval	F	Average	Std. Dev.	Variance
36-40	9				32-36	8			
41-45	4				37-41	5			
46-50	6				42-46	5			
51-55	5	51.2	9.422	88.779	47-51	4	48.4	10.748	115.528
56-60	8				52-56	9			
61-65	5				57-61	3			
66-70	3				62-66	6			

Table 1 shows the comparison of pretest results in experimental classes and control classes. The results of the experiment class Pre-test, with a total of 40 students, had an average score of 51.2. As for the results of the control class pre-test score of 40 students, it has an average score of 48.4. Based on these data, it can be described through the histogram in Figure 1.
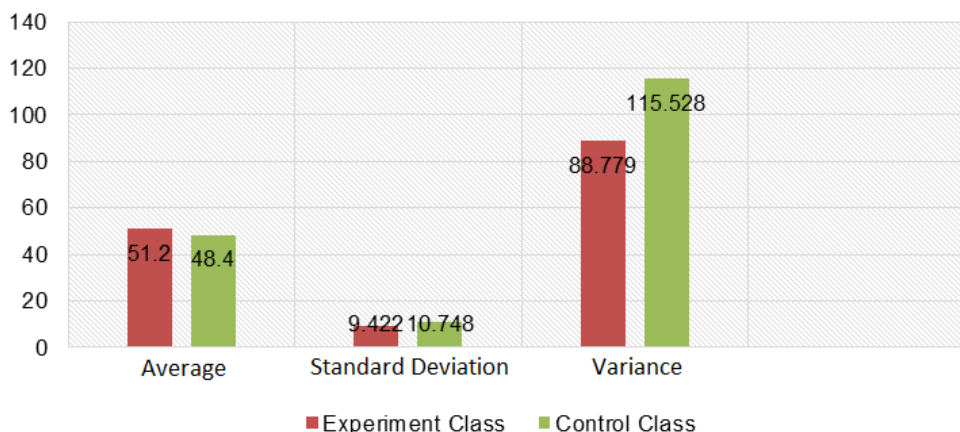

Figure 1. Histogram Pre-test Results in the Experiment Class and Control Class

Post-test is given to the assessment class and the control class at the time after being given special treatment to both classes. The post-test value data of the experiment class and the control class are given in Table 2.

Table 2. Experiment Class and Control Class Posttest Result Data

Experimental Pretest					Control Pretest				
Interval	F	Average	Std. Dev.	Variance	Interval	F	Average	Std. Dev.	Variance
64-68	4				52-57	7			
69-73	3				58-63	5			
74-78	7	80.3	8.222	67.600	64-69	8	68.4	9.620	92.554
79-83	10				70-75	8			
84-88	11				76-81	8			
89-93	3				82-87	3			
94-98	2				88-93	1			

Table 2 shows a comparison of the results of the experiment class post-test and the control class, with the average post-test value of the experiment class being 80.3 and the standard deviation being 8,222. While the average post-test result of the control class is 68.4, and the standard deviation is 9.620. Based on these data, it can be described through the histogram in Figure 2.
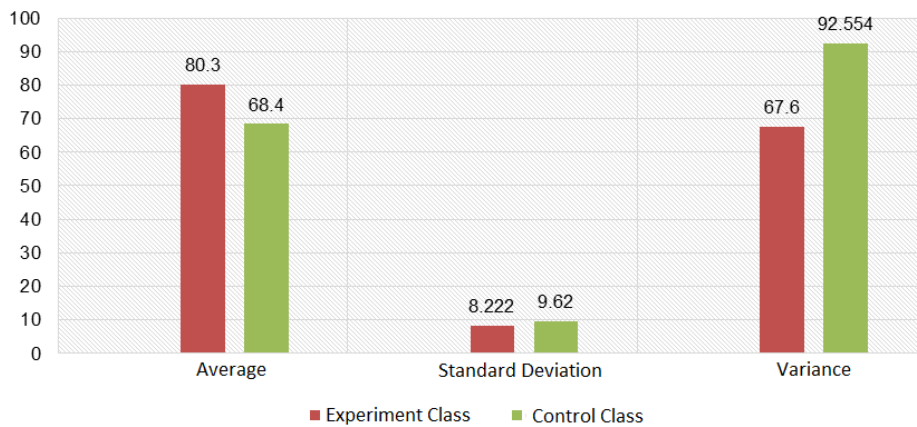

Figure 2. Experiment Class Post-test Data and Control Class

Normality Test

Table 3 shows the results of normality tests for both classes, namely experimental classes with normal distribution pre-test and post-test data and control classes, where pretest and post-test data are also normal distribution. By the criteria of $L_{count} < L_{table}$, the above results for the overall value of pre-test and post-test are normal.

Table 3. Data Normality Test

Statistics	Experiment Class		Control Class	
	Pretest	**Posttest**	**Pretest**	**Posttest**
N	40	40	40	40
$\bar{X}$	51.2	80.3	48.4	68.4
Standard Deviation	9.422	8.222	10.748	9.620
L_{count}	0.107929	0.114553	0.110242	0.126293
L_{table}	0.140	0.140	0.140	0.140
Conclusion	Usual	Usual	Usual	Usual

Homogeneity Test

In Table 4, it can be seen that the results of pretest and posttest homogeneity tests in the experiment class and control class are homogeneous. With the criteria and from the results of the test above, it can be concluded that the overall pre-test and posttest values in both classes are homogeneous.

Table 4. Data Homogeneity Test

No	Class Data	Variance	F_{count}	F_{table}	Conclusion
1	Pre-test Experiment	88.779	1.301	1.7045	Homogeneous
2	Pre-test Control	115.528			
3	Post-test Experiment	67.600	1.369		Homogeneous
4	Post-test Control	92.554			

Hypothesis Test

Table 5 explains the results of the student pre-test hypothesis test of the class of the experiment and control class, where obtained t_{count} of 1.242 and T table with a degree of significance α = 0.025 and degrees of freedom=78 is 1.994. The hypothesis test criteria are that if $t_{count} < t_{table}$, namely, $t_{count}=1.242 < t_{able}=1.994$, then Ho is accepted that students in both sample classes have the same initial knowledge.

Table 5. Pre-test Data Hypothesis Test

No	Average Value	Average Value	t_{count}	t_{table}	Conclusion
1	Experiment class	51.2			Students have the same
2	Control class	48.4	1.242	1.994	initial abilities

Table 6 shows the result of the student's posttest hypothesis test of the experiment class and control class, of which $t_{count} =5.964$ was obtained, and t_{able} was 1.667 (at the significance level of 0.05). The hypothesis criteria are if $t_{count} > t_{able}$. Since $t_{count}= 5.964 > t_{able}=1.667$, Ho is accepted and Ha is rejected. The meaning is that the results of experiment class learning are higher than those of learning control classes. Then there is a significant influence between the use of learning models, namely problem-based learning models with Technological, Pedagogical, and Content Knowledge approaches in experiment classes and Discovery Learning Models in control classes.

Table 6. Post-test Data Hypothesis Test

No	Class Data	Average	t_{count}	t_{table}	Conclusion
1	Class Experiment	80.3	5.964	1.667	There is a significant difference in learning outcomes, namely the results of experiment class learning that use the PBL learning model with a higher TPACK Approach than the control class learning results that use the Discovery Learning Model.

This research was carried out at High School (SMA) Sultan Iskandar Muda Medan using different learning models in experiment and control classes. The learning experiment class was conducted using the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach. While in control class, learning is done using the Discovery Learning Model. From the results of hypothesis testing, there is a significant difference between learning outcomes using the Problem Based Learning Model and the Technological, Pedagogical, and Content Knowledge approach using the Discovery Learning Model.

The student's learning outcome before being given the treatment had an average pretest score of 51.2 for the experimental class, and for the pretest average score control class was 48.4. Students after being treated had an average posttest score of 80.3 in experiment classes using the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach, and for control classes using the Discovery Learning Model had a posttest average score of 68.4. This data shows that there is a significant difference in learning outcomes after both classes are treated. This result can be seen from the difference in the increase in the average pretest and post-test scores in the experiment class and control class.

The availability of student learning outcomes due to the influence of the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach is evaluated by a hypothesis test with the requirements of the normality test and homogeneity test. The normality test results and the homogeneity test state that the population is distributed normally and homogeneously. This finding is seen in Table 4 and Table 5, with normality criteria and homogeneity testing criteria.

The hypothesis tests used in this study are the two-party t-test and the one-party t-test. A two-party t-test is used on pretest data to see if both sample classes have the same initial knowledge. Then a hypothesis test is conducted, namely a one-party t-test, to see differences in student learning outcomes in both sample classes after being given treatment using learning models. The experiment class is treated using the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach, while a control class uses the Discovery Learning Model. There was a difference in learning outcomes between the experimental and control classes in both posttest scores. The results of this study showed that the results of experiment class learning were higher than the results of learning control classes, so the alternative hypothesis (Ha) is accepted that there are differences in the results of learning the history of experiment class students by using the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach with control classes that use the Discovery Learning Model.

Based on researchers' observations, there are several advantages of using problem-based learning models with Technological, Pedagogical, and Content Knowledge (TPACK) approaches compared to Discovery Learning Models. Based on the steps of the learning model above, it can be concluded that the steps in the learning model are effective in improving the science literacy skills of learners compared to direct instruction learning. The application of Problem Based Learning Models based on Blended Learning makes students more targeted in the group discussion process because students become structured, making it easier to receive knowledge. If students follow the stages well and correctly, then students understand and solve every problem. This problem-based

learning model with a TPACK Approach emphasizes solving a problem related to the real world and solved in groups. In addition, in this learning model, teachers also use TPACK approaches in the learning process, such as the use of technology in the delivery of learning materials, where the learning material is packaged or explained in the form of a learning video made by the teacher so that students are more interested in following the learning process. In this learning process, students are also required to think critically in solving problems given by teachers, and students also become active in learning (Urip, 2016). At the beginning of learning, students are given a learning video about Colonialism and European Imperialism in Indonesia, after which students are given a problem to solve together. Then students are also given a student worksheet (LKPD) which contains problems related to the material on Colonialism and European Imperialism in Indonesia. In this learning, students who are in the experiment class are very eager to compete with other groups in answering the questions on the learner worksheet (LKPD), although at the time of discussion, learners have difficulty in using the Zoom breakout feature, where some learners have not updated their Zoom application so that they cannot use the Zoom breakout feature. At the end of the learning, teachers and learners can deduce the material of European Colonialism and Imperialism in Indonesia, and students can benefit from such learning for everyday life. In addition, students in experiment classes are more active and focused on learning than learners in control classes since students solve problems given by teachers both individually and in groups.

Learning in the Problem Based Learning Model based on Blended Learning should involve observations to determine the initial ability, obtained the results of students who have not mastered literacy skills (Ampera et al., 2021; Banila et al., 2021). This result can be seen from the low value of each indicator of scientific literacy ability (Mukharomah et al., 2021). Five indicators of science literacy ability include understanding phenomena, identifying problems, explaining differences, using materials, and solving problems scientifically. Many students have not mastered it (Ampera, 2017; Zulfa & Haryanto, 2021). The value of each indicator on literacy skills is still low and still below average. Through the Problem Based Learning Model based on Blended Learning, students will be trained to master science literacy skills (Ulandari & Mitarlis, 2021). There is a step of activity problem-based learning model based on Blended Learning consisting of five stages (Fadhilatunnisa et al., 2020): the first stage of orientation on the problem carried out by students, where the educator explains the flow and process of evaluating in learning. Furthermore, the second stage is that educators become facilitators for learners of previously identified problems (Heong et al., 2012; Nurhayati, 2021).

As for learning in the control class using the Discovery Learning Model in this learning process, the teacher provides a stimulus in the form of images related to learning materials. Then the teacher will explain the learning material through an animation PowerPoint. After explaining the learning material, the learners will be divided into several groups and then given a worksheet of learners (LKPD) to each group to discuss. After the worksheet for LKPD learners is completed, the teacher will call the group to concentrate on the group's results. After all the groups have finished concentrating on the results of their discussions, the teacher and the learners conclude the learning meter together.

Factors that make learning outcomes in experimental classes higher than the results of learning control classes are in experiment classes using problem-based learning models with Technological, Pedagogical, and Content

Knowledge approaches, where at the beginning of learning, students are given a problem to solve, thus making students more motivated and interested in learning to solve the problem. In addition, teachers also use learning videos in delivering materials. While using the Discovery Learning Model in the control class, the teacher control class explains learning only through power points. In this learning, students are required to identify problems related to learning materials, which later the problem must be solved by students. However, in this learning process, students have difficulty identifying problems, so sometimes teachers have to provide problems that must be solved by students and help students solve these problems, so it is less encouraging for students to learn.

Conclusion

Based on the results of this study, the following conclusions can be made. Firstly, there is a positive and significant influence of the Problem Based Learning Model and the Technological, Pedagogical, and Content Knowledge (TPACK) Approach on the history learning outcomes of students of class XI of Social Sciences (IPS) at High School (SMA) Sultan Iskandar Muda Medan. Secondly, student learning activities in class XI Social Sciences (IPS) 1 using the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach are successful and very satisfying. Learning can be categorized as active, characterized by students who are passionate and enthusiastic in following the learning process. This case is based on the significant difference in learning outcomes between the experiment and control classes. In the learning, there is an obstacle, namely in the use of Zoom breakout, where some students have difficulty using Zoom breakout because the Zoom application owned by students has not been updated or updated. Overall, teachers, especially history teachers, can use the Problem Based Learning Model with a Technological, Pedagogical, and Content Knowledge approach because this learning model can make students active and enthusiastic in the learning process.

Acknowledgments

References

Agustina, M. (2018). Problem Based Learning (PBL): A Learning Model to Develop Students' Creative Thinking Ways. *Journal of Islamic Religious Education, 10*(2).

Ampera, D. (2017). Addie Model Through the Task Learning Approach in Textile Knowledge Course in Dress-Making Education Study Program of State University of Medan. *International Journal of GEOMATE, 12(*30), 109-114. DOI: http://dx.doi.org/10.21660/2017.30.TVET005.

Ampera, D., Iskandar, M.Y. & Tabieh, A.A. (2021). The Role of Visuals in Cultural Learning in the EFL Classroom. *Asian ESP Journal, 17*(3).

Aulia, L. N., Susilo, S., & Subali, B. (2019). Efforts to Increase Student Learning Independence with Edmodo Media-Assisted Problem-Based Learning Model. *Journal of Educational Innovation IPA, 5*(1), 69–78. https://doi.org/10.21831/jipi.v5i1.18707

Banila, L., Lestari, H., & Siskandar, R. (2021). Application of Blended Learning with STEM Approach to Improve Students' Science Literacy Skills in Biological Learning During the Pandemic. *Journal of Biology Learning, 3*(1), 25–33.

Cintia, N. I., Firosalia, K., & Indri, A. (2018). The Implementation of Discovery Learning Model in Increasing Students Thinking Creative Ability and Students Learning Outcome. *Journal of Science Perspectives. Elementary School Teacher Education, Satya Wacana Christian University. 32*(1), 69-77.

Fadhilatunnisa, D., Rosidah, & Fakhri, M.M. (2020). The Effectiveness of The Blended Learning Model on The Students' Critical Thinking Skills and Learning Motivation in Accounting Department. *Education Lanterns, 23*(2), 194–208.

Fahreza, F. & Husna, N. (2017). The Effect of Learning Strategies on IPS Learning Outcomes of Class V Students of Paya Peunuga State Elementary School, West Aceh Regency. *Journal of Bina Gogik, 4*(2).

Fitrianingtyas, A. & Radia, E. H. (2017). Improving IPA Learning Outcomes Through Discovery Learning Model of Class IV students of SDN. *Gedanganak 02, 1*(6).

Heong, Y. M., Yunos, J. M., Othman, W., Hassan, R., Kiong, T. T., & Mohamad, M. M. (2012). The needs analysis of learning higher order thinking skills for generating ideas. *Procedia-Social and Behavioral Sciences, 59*, 197-203.

Jumardi & Silvi M. P. (2017). The Role of History Lessons in Student Character Development Through Local Historical Value-Based Learning at SMA Negeri 65 West Jakarta. *Journal of Historical Education, 6*(2).

Kemmis, S., & McTaggart, R. (2005). *Action Research Planner* Third Edition. Deakin University.

Khan, W.B., & Inamullah, H.M. (2011). A Study of Lower-order and Higher-order Question at Secondary Level. *Asian Social Science, 7*(9), 149-157.

Mukharomah, F., Wiyanto, & Putra, N.M. D. (2021). Analysis of The Literacy Ability of Physical Science of High School Students on Kinematics Material of Straight Motion during the Covid-19 Pandemic. *JoTaLP: Journal of Teaching and Learning Physics, 1*(6), 11–21

Nurhayati, Ampera, D., Chalid, S., Farihah, & Baharuddin (2021). Development of blended learning type and flipped classroom-based cultural arts subjects. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9*(4), 655-667. https://doi.org/10.46328/ijemst.

Puspita, G., Rizky, A. N. C. S., & Ashadi. (2016). Application of Discovery Learning Model to Increase Student Interest and Learning Achievement in Solubility Materials and Results of Class XI Mia 3 Even Semesters of High School N 1 Terrace of the 2015/2016 School Year. *Journal of Chemical Education, Sebelas Maret University, 5*(4), 115.

Rosarina, G., Ali, S., Atep, S. (2016). Application of Discovery Learning Model to Improve Student Learning Outcomes on Material Changes in the Form of Objects. *Journal of Scientific Pens, 1*(1), 371-380.

Saefuddin, A. & Berdiati, I. (2016). *Effective Learning*. Bandung. PT. Rosdakarya Teen Offset

Suardana, P. (2019). Application of Problem Based Learning (PBL) Learning Model with Demonstration Methods to Improve Bullet Repellent Game Learning Outcomes. *Journal of Education Action Research. 3*(3).

Sunhaji. (2014). Class Management Concepts and Their Implications in Learning. *Journal of Education, II*(2).

Ulandari, A., & Mitarlis. (2021). Development of Green Chemistry-Minded Learner Worksheets (LKPD) To Improve Science Literacy Skills in Acid-Base Materials. *Journal of Chemical Education Innovation, 15*(1), 2764–2777.

Urip, N. (2016). *Technological Pedagogical Content Knowledge (TPCK) Through Facebook Social Media Network and Google Drive*. Writing of the 2016 Teacher Symposium.

Wicaksono. (2015). *Language Learning Theory (A Short Note)*. Yogyakarta: Garudhawaca.

Wulandari, B., & Surjono, H. D. (2013). The Effect of Problem-Based Learning on Learning Outcomes is reviewed from PLC Learning Motivation in Vocational School. *Journal of Vocational Education, 3*(2), 178-191.

Yilmaz, K. (2008). *Constructivism: Its Theoretical Underpinnings, Variations, and Implications for Classroom Instruction.* Turkey: Educational Horizons.

Zulfa, L. N., & Haryanto. (2021). The Influence of Macromedia Flash Media on Science Literacy and Student Democratic Attitudes. *Indonesian Journal of Science Education, 9*(1), 52–64. https://doi.org/10.24815/jpsi.v9i1.18266.

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