

PROBLEM BASED LEARNING MODEL WITH BLENDED LEARNING APPROACH TO THE EFFECTIVENESS OF STUDENT LEARNING OUTCOMES

Alfiah Alfiah¹

Subandowo Subandowo²

Sugito Sugito³

alfiahmasduki@gmail.com

subanindi@gmail.com

soegitounipa@gmail.com

Abstract: *The low completion of student learning in a subject is the reality of the quality of education in schools. The model in learning is one of the factors that can cause an impact on students' learning achievements. The use of the learning model must be adjusted to the characteristics of the students themselves and the subjects taught. This article is intended to reveal the differences in blended-based Problem Based Learning (PBL) learning and Problem Based Learning (PBL) learning to the learning outcomes of students of Class X at SMK Negeri in Bangkalan and describe the influence of interaction between blended-based Problem Based Learning (PBL) learning model and learning motivation for the learning outcomes of students of Class X at SMK Negeri in Bangkalan.. This research used quantitative research with experimental methods. In this case, it used two tools, namely questionnaire survey and learning result test. The experimental classes in this study used the blended-based Problem Based Learning (PBL) model conducted online learning and offline and face-to-face learning, while the control classes used the PBL (Problem Based Learning) model for face-to-face learning. This quantitative research used the data analysis technique through the two-way variant analysis (ANOVA) technique. The results showed that the baseline estimate of student learning outcome using the PBL learning model was 40, the highest score was 90, the average score was 72.33, and the standard deviation was 16,439. Compared to the learning outcome of students who used the problem-based learning (PBL) model the lowest score was 45, the highest score was 95, the average score was 80.67, and the standard deviation was 11,502. Seeing from the results of the exploration, it can be concluded that the results of the blended-based Problem Based Learning model are higher, or in other words, students' learning outcomes become more effective by using the approach.*

Keywords: *Problem Based Learning, blended learning model, learning outcomes.*

Abstrak: *Rendahnya ketuntasan belajar siswa pada sebuah mata pelajaran merupakan realitas mutu pendidikan di sekolah. Model di dalam pembelajaran merupakan salah satu faktor yang dapat menyebabkan dampak terhadap prestasi belajar siswa. Penggunaan model pembelajaran haruslah menyesuaikan dengan*

¹ Pascasarjana Teknologi Pendidikan Universitas PGRI Adi Buana Surabaya

² Pascasarjana Teknologi Pendidikan Universitas PGRI Adi Buana Surabaya

³ Pascasarjana Teknologi Pendidikan Universitas PGRI Adi Buana Surabaya

karakteristik siswa itu sendiri dan mata pelajaran yang diajarkan. Artikel ini dimaksudkan untuk mengungkapkan perbedaan pembelajaran Problem-Based Learning (PBL) berbasis blended dan pembelajaran Problem-Based Learning (PBL) terhadap hasil belajar siswa kelas X SMK Negeri di Bangkalan. dan mengetahui pengaruh interaksi antara model pembelajaran Problem Based Learning (PBL) berbasis blended dan motivasi belajar terhadap hasil belajar siswa kelas X di SMK Negeri di Bangkalan. Penelitian ini menggunakan penelitian kuantitatif dengan metode eksperimental. Dalam hal ini menggunakan dua alat yaitu survei angket dan tes hasil belajar. Kelas eksperimen dalam penelitian ini menggunakan model pembelajaran Problem Based Learning (PBL) berbasis blended yang dilakukan secara online, offline dan tatap muka, sedangkan kelas kontrolnya menggunakan model pembelajaran PBL (Problem Based Learning) untuk pembelajaran tatap muka. Penelitian kuantitatif ini menggunakan teknik analisis data melalui teknik analisis varian (ANOVA) dua arah. Hasil penelitian menunjukkan bahwa estimasi dasar hasil belajar siswa yang menggunakan model pembelajaran PBL adalah 40, nilai paling tinggi 90, nilai rata-rata 72.33, dan standar deviasi 16.439. Dibandingkan dengan hasil belajar siswa yang menggunakan model pembelajaran Problem Based Learning (PBL) nilai terendah 45, nilai paling tinggi 95, nilai rata-ratanya 80.67, dan standar deviasi 11.502. Dilihat dari hasil eksplorasi tersebut, dapat disimpulkan bahwa hasil model pembelajaran Problem Based Learning berbasis blended learning adalah lebih tinggi atau dengan kata lain bahwa hasil belajar siswa menjadi lebih efektif dengan menggunakan pendekatan tersebut.

Kata kunci: Problem Based Learning, blended learning, model, hasil belajar

Introduction

The Fourth Industrial Revolution or Industrial Revolution 4.0 has brought about change, namely the emergence of new business sectors, and this can destroy existing business sectors and replace existing innovations. This digital age not only affects the modern industrial environment but also affects the elementary or secondary school environment. Schools in modern times are called Education 4.0, where advanced innovation cannot be separated from the interaction of learning, so learning must be done anytime and anywhere without being limited by existence. Thus the quality of graduates can compete by meeting existing development needs. To perform effective learning in a digital environment, it is necessary for learners to develop a skill referred to as digital literacy (Kintu et al., 2017).

Online learning forces teachers and students to become technologically literate in this pandemic situation. Online learning provides an alternative approach to strive students to obtain independent material (Sasongko and Fatirul, 2019). A teacher is

needed to utilize technology in the learning process, one of which is innovation in terms of time, place, and the learning process expected to improve students' understanding, namely increasing online learning hours (Arham & Dwiningsih, 2016).

To enhance creative thinking, self-study, and students learning activity according to individual experience, students must connect between utilization and the digital tools they use to get results and understand from one chapter to another. The highest of independent studies is the ability of students to adapt learning experiences in meeting individual needs, and this finding suggests self-regulation of learning skills. Recent findings demonstrate cognitive and social-emotional proficiency and technical proficiency, i.e. the ability to effectively use new technologies (Blau et al., 2020).

The reality of education quality issues includes learning motivation from each student, and the achievement of learning outcomes obtained by students is meagre (Sugito, 2017). Teacher readiness can support students to have better abilities in observing, questioning, learning to reason, and communicating the material, they have obtained (Subandowo, 2015). Best Possible Self (BPS) intervention can increase academic competence, and BPS intervention increases positive expectations, strengthens aspirations, motivates goals, and supports academic commitment (Altintas et al., 2020).

The reality of the quality of education, which is relatively low, is also felt in the learning outcomes of chemistry subjects in school. This can be seen as one of them in SMKN 1 Kamal that in KKM Chemical subjects in SMKN 1 Kamal the 2018/2019 school year is 70 and the completion of student learning is only 30% in semester 1. This is very far from the completion of the recommended curriculum. Models in learning are external factors that can cause an impact on students' learning achievement. The learning model should adapt to the characteristics of the student itself and the chemistry subjects. What is often done is the use of conventional learning models that make children bored and not passionate. Improving the quality of education must also be balanced with teachers' quality, including the ability to provide teaching materials in the learning process, namely by applying information technology (IT). If it is not done, then teachers will be left behind in era 4.0 and will impact the quality of graduates. Teachers will give their knowledge to students following the current

situation, where students who get an education today are Generation Z. The habits of this generation include many of them using mobile phones, Twitter, and other social media to get information through video streams, news, or short news messages. The transformation of education from traditional methods into education integrates technology and information. The education applied in learning was the Problem Based Learning (PBL) model, i.e. teachers guide students to overcome obstacles and difficulties in learning, gradually clarify problems, and help students to learn positively and proactively so that students are not dependent, students create knowledge for themselves, create and develop their understanding sustainably and creatively (Nguyen, 2019).

In addition, some schools apply blended learning by providing technical and pedagogical training to facilitate the transformation of face-to-face learning by combining the best elements of direct and online learning (Porter &Graham, 2016). Blended-based Problem Based Learning (PBL) is a chemical learning model that combines direct or face-to-face learning, online or offline learning, and the use of computers and the internet. In this case, it uses technology through various online learning, including Google Classroom and virtual face-to-face using Zoom and Google Meet. Blended-based PBL learning is based on existing principles in chemistry learning, following a theory of constructive learning. Blended-based PBL model imbued with constructive principles is learning that is not just the transfer of knowledge, but learning is the process of preparing knowledge that students go through with various experiences encountered (Sasmito et al., 2017). Control in this learning is the knowledge of previous students who use the face-to-face learning process with problem-based learning (PBL), without using the internet.

Problem-based learning associates new problems that exist in real life. This simplifies thinking skills by performing work actions and doing many experimental exercises (Septiani et al., 2020). Furthermore, according to (Arrosagaray et al., 2019) i.e. learning activities enhanced with technology, have enormous potential to increase student engagement, motivation, active learning attitude, and retention in education, In this way the initial motivation of students will be enhanced by learning experimenting with the use of ICT so that students are satisfied with this blended

learning. According to (Kintu et al., 2017), blended learning is intended to increase students' knowledge levels in order to create analytical skills that can help produce skilled students who can become innovative graduates who adequately meet the demands of work through creativity and innovation. Meanwhile, according to (Semler, 2005) *“Blended learning combines the best aspects of online learning, structured face-to-face activities, and real-world practice. An online learning system, classroom training, and on-the-job experience have major drawbacks by themselves. The blended learning approach uses the strengths of each to counter the others weaknesses.”*

With the existence of collaboration between teachers and students and between students and students, the learning process using blended learning is a model that is very preferred by students, which will improve their learning skills (Fatirul, 2020). In general, the steps of the blended learning-PBL learning model are that the teacher uploads learning materials and homework to the LMS Google Classroom, informs students to learn the uploaded material, examines and checks the student's presence, explains the teaching material by explaining the learning objectives in the teaching material so that it is clear the goals to be achieved, motivate and guide students to gain more information and provide answers to questions that students find difficult to understand, appreciate students' success in doing homework, provide assessments in the form of quizzes and essays prepared through Google Classes, and discuss problems in online, offline, face-to-face learning in person and face-to-face virtually. Furthermore, motivation may be an essential factor for educators to promote learning (Rufii & Rochmawati, 2019). In essence, student learning outcomes can basically be seen from behavioral changes, namely, cognitive, emotional, and psychomotor (Andriyati et al., 2020).

Based on the description above, this study is intended to find out the difference in the influence of the use of blended-based Problem Based Learning (PBL) and Problem Based Learning (PBL) on the learning outcomes of students of class X SMK Negeri in Bangkalan, to find out the difference between the influence of high learning motivation and low learning motivation on the chemistry learning outcomes of students of class X SMK Negeri in Bangkalan, and to know the influence of interaction

between blended-based Problem Based Learning (PBL) model and learning motivation on the chemistry learning outcomes of class X SMK Negeri in Bangkalan.

Research Method

The study used an experimental method in which two independent variables were manipulated and a random subject was assigned as a sample in an experiment, this was done to measure the variable. The experiment in this study was a post-test experiment. The design of this study was conducted so that the study could show a causal relationship using the treatment of control groups and experimental groups. The research design refers to the factorial analysis of 2×2 , consisting of variables: (1) free variables consisting of blended-based Problem Based Learning (PBL) and Problem Based Learning (PBL), (2) the moderator variable is learning motivation, and (3) the bound variable is the result of chemical learning.

The population of this study was 120 students of class X SMKN 1 Kamal and SMKN 3 Bangkalan, and the number of research samples was as many as 60 people. It was obtained by random sampling techniques that had similarities in initial ability. This study used two methods in the learning process; the first category was chemical learning that used blended-based PBL learning. In this case, learning using the internet and online and face-to-face, and the second group was chemical learning using the PBL model, which was face-to-face without the need for the internet. The learning steps used were the same in both classes, but the learning scenarios used were different.

The instrument or tool used was a test of learning results. The test of learning results was to find out the learning ability of students at the beginning and the end of learning. The test used in this study was conducted twice, namely the initial test to find out students' initial ability, the test conducted at the beginning of face-to-face, and questions raised from previous basic abilities. The second was the last test after the learning model was applied. This final test aimed to obtain data on students' learning outcomes after being given different treatments.

The method of data collection in this study used two activities, namely: (1) experimental preparation activities, in this preparatory activity researcher performed chemical preparation, then compiled learning devices, compiled research instruments

ranging from compiling motivational tests, initial tests, and final tests, and the next was a trial, and (2) the activity of conducting experiments, the first activity that researcher did to carry out this experiment was to conduct preliminary tests to find out the initial ability of students, to be used as samples. At the last meeting, students were given a test post to determine their success in blended-based PBL or PBL classes.

Data analysis in this study used two-way variant analysis (ANOVA). Analysis of these two-way variants to test the comparative hypothesis of two or more groups. The first was the hypothesis testing requirement. In data hypothesis testing, used SPSS and first must complete the normality test and homogeneity test. In the normality test, it was determined whether the sample came from a normally distributed population. The normality test used Kolmogorov-Smirnoff in SPSS and used a significance level of 0.05. This homogeneity test was done to test whether the experimental group and control group had the same variant (homogeneous) or heterogeneous. In SPSS, the Levene test was used for homogeneity tests. The second was hypothesis testing. Hypothesis testing used influence tests between subjects in SPSS. Using SPSS, variance analysis could be performed to test hypotheses 1, 2, and 3 in the study using a two-way variance test (ANOVA).

Results and Discussion

The results of this study contained the presentation of data and hypothesis testing of all statistical calculation results presented in the form of SPSS output.

Table 1 Descriptive Statistics

Descriptive Statistics			
	Learning Outcomes	Learning Motivation	Valid N (listwise)
N	60	60	60
Range	55	37	
Minimum	40	63	
Maximum	95	100	
Mean	76,5	88,93	
Std. Deviation	14,68	7,811	
Variance	215,508	61,012	

Table 1 showed descriptive data on the table which was interpreted as processed data was 60, the minimum value of student learning outcomes was 40, the maximum score was 95, the average was 76.50, and the standard deviation was 14,680. If looked at the data displayed, the student's academic achievement was higher than the ideal average, so it can be said that the student's academic achievement was classified as very high.

Learning Outcomes

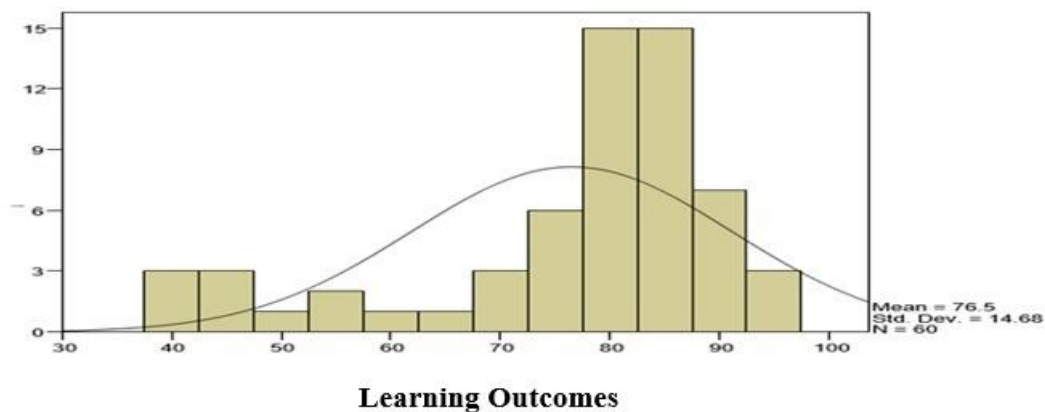


Figure 1. Histogram Results

Table 2 Categories of Student Learning Motivation Levels

Maxl = 100		
Minl = 20		
Ml = 60		
Sdi = 13,3		
Interval		Note
Ml s.d Ml + 3*SDI	60 s.d 100	High
Ml - 3*SDI s.d Ml-1	0 s.d 59	Low

Mean value of student learning outcomes is 88,93

From the table above, 60 processed data and obtained student learning results with PBL treatment had a minimum value of 40 and a maximum of 90 while the mean was 72.33 with a standard deviation of 16,439. When compared to the learning outcomes of students who used the blended-based PBL model a minimum score was 45, a maximum score was 95, an average score was 80.67, and a standard deviation was

11,502. When this acquisition was compared to the learning outcomes of the PBL learning method (average range was 66.2 - 78.47), it showed that the average learning outcome of students blended-based PBL model was in a position that exceeded the average range of PBL students. This meant that by using the blended-based PBL model the average value of student learning outcomes of this model was much higher compared to the PBL learning model, as shown in Table 3

Table 3 Learning outcomes data description of PBL and Blended-based PBL

Descriptives					
Learning Outcomes	Model		Statistics	Std. Error	
Learning Outcomes	PBL	Mean	72,33	3,001	
		95% Confidence Interval for Mean	66,2		
		Lower Bound	78,47		
		Upper Bound	73,15		
		5% Trimmed Mean	80		
		Median	270,23		
		Variance	16,439		
		Std. Deviation	40		
		Minimum	90		
		Maximum	50		
		Range	19		
		Interquartile Range	-1,05		0,427
		Skewness	-0,312		0,833
		Kurtosis			
		Blended PBL	Mean	80,67	2,1
95% Confidence Interval for Mean	76,37				
Lower Bound	84,96				
Upper Bound	81,67				
5% Trimmed Mean	85				
Median	132,299				
Variance	11,502				
Std. Deviation	45				
Minimum	95				
Maximum	50				
Range	8				
Interquartile Range	-1,522	0,427			
Skewness	2,62	0,833			
Kurtosis					

Tabel 4. Hypothesis test with Tests of between-subjects Effects

Tests of Between-Subjects Effects

Dependent Variable: Learning Outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3428,776	3	1142,92	6,892	,000
Intercept	331927,460	1	331927,46	2001,668	,000
Model	1413,593	1	1413,593	8,525	,005
T_Motivasi	1709,733	1	1709,733	10,310	,002
Model * T_Motivasi	702,136	1	702,136	4,234	,044
Error	9286,224	56	165,825		
Total	363850,000	60			
Corrected Total	12715,000	59			

a. R Squared = ,270 (Adjusted R Squared = ,231)

Table 4 showed that if the probability (significance) was greater than or equal to 0.05, then H_0 was acceptable; if the probability (significance) was less than 0.05, H_0 was rejected, or H_a was accepted. The results of the statistical test were listed in Table 7:

1. The value of F on the third row was 8.525, and its significance was 0.005. This meant that H_0 was rejected or H_a was accepted which indicated that learning outcomes between classes that used blended-based PBL and PBL learning differed.
2. The fourth row obtained an F value of 10,310 and a significant value of 0.002. This meant that H_0 was rejected or H_a was accepted which showed a difference in learning outcomes between students who had low learning motivation and students who had high learning motivation.
3. On the fifth row, the value of F was 4.234 and the effective value was 0.044. This meant that H_0 was rejected or accepted, which showed an interaction between the learning model and the student's learning motivation towards the student's learning outcomes. It was said that learning models and learning motivation were essential to improving students' learning outcomes.

Discussion

By using diverse learning methods, we can interact in the learning process, so communication occurs between teachers and students and between students. The number of interactions that occur depends on the application of learning models applied to students. Changes in the PBL learning model are learning methods, where teachers use lecture methods to carry out learning activities and then combine them with discussion methods. In other words, where a teacher first conveys the subject matter by presentation orally to the student, then the student is assigned to have a scientific conversation.

Based on the findings above, it can be seen that the value F is obtained at 8.525, and the significance is 0.005. This means that H_a is accepted, so there is a difference in

learning outcomes between chemistry subjects that use blended learning-PBL and PBL. Learning with this blended-based PBL model was developed in the field of medicine. PBL is a learning that is done so that learning runs more effectively, productively, and meaningfully. Realistic PBL can be applied without having to use a new curriculum. PBL strategy is to transfer knowledge to students from chapter one to another, one context to the next. Transfer in this case is an activity with thinking skills and provides reasons for new things by associating with the initial knowledge that has been rhymed before. Transfer in this case can be done by giving the task about the material that is being summarized and associated with the next discussion.

This result is in accordance with those stated by Arends (2004) that the syntax of the Problem-based Learning model has 5 (five) phases, namely: give orientation about their problems to students, organize students to research, assist in independent investigations and groups, develop and present problem-solving results, and analyze and evaluate the process of addressing the problem.

In this research, giving orientation about the problem to students means that students in this phase explain the meaning of learning so that a positive attitude towards learning is formed and describes something that students are expected to do. Here the teacher must explain the purpose of the learning by the plan of learning implementation, explain the problems or questions that are investigated; during the learning investigation, the teacher will be encouraged to ask questions and seek information during the syntax of the teacher's analysis and explanation, students will be encouraged to express their ideas openly and freely, all shiva is allowed to contribute to the investigation and express his ideas. Organizing students to research means that students are obliged to develop skills to collaborate between students and cooperate to complete tasks and their reporting. Assisting In independent and group investigations means that the core of PBL is how students can conduct investigations conducted independently or in groups and mainly involve collecting data, experiments, hypotheses, and explanations and providing solutions. In this phase, developing and presenting problem-solving results is to create written reports, such as video recordings showing problematic situations and proposed solutions, models that include physical representations of a problem and its solutions, and computer

programs and multimedia presentations. Analyzing and evaluating the process of overcoming problems, in this phase, the teacher asks students to re-synchronize the mind during learning, the teacher reflects and evaluates the problem-solving process carried out.

Further, in line with this, Jannah (2019) suggests six stages in designing and organizing blended learning to get optimal results, namely: set the kind and ingredients of teaching, set the blended learning design used, set an online learning format, test the design made, hold blended learning well, and prepare the criteria for the evaluation of blended learning implementation.

In this research, setting the kind and ingredients of teaching means that teachers, in this case, must understand very well what relevant teaching materials are applied online and face-to-face. Teaching materials that will be uploaded online are urgent only so that it spurs students to know about the internet world – setting the blended learning design used means that the learning plan really should be well designed with the goal of the learning plan being relevant and facilitating face-to-face learning or face-to-face distance. It does not even make it harder for students. The facilities designed must be based on how the teaching material is presented and accessed, determine which teaching materials are mandatory and which are supporting to enrich their knowledge, determine which tasks should be done with the group and which should be done individually, and strive for provisions that support the smooth learning of blended learning. Setting an online learning format means that whether teaching materials are available in PDF format or video also needs a hosting notification used by teachers, such as yahoo, google, Facebook, and others. Testing the design means that this is done to determine whether the learning system is running well and whether it complicates students or not, even if it makes learning easier. Holding blended learning well means that previously there has been socialization from teachers about this system, ranging from introducing related components, ways of access, and others. Preparing the criteria for the evaluation of blended learning implementation means that How easily students can access all the information provided, how the quality of the content used and the instructions whether it is in accordance with the purpose of learning, the better the presentation of teaching

materials, the better and how much expenditure is spent on this learning. Learning must provide ease in communicating and collaborating or called group discussions provided in the form of applications on the internet such as Google Classroom, email, G-Meet, Zoom, Whatsapp, and others (Thai et al., 2017). Problem Based learning model based blended, this is chosen because it is expected to increase the creativity of students in solving problems in learning that contain skills in collaborating and communicating so that it is expected that students' learning outcomes seen from the stages in solving problems will increase in accordance with expectations and can develop new ideas and questions in the language material. Collaboration and communication in groups will motivate students to learn actively and responsibly in learning activities themselves.

Further, research has proven that online learning activities can be efficient and interesting (Jong et. al., 2014). Synchronous online communication is used in the cases described. Asynchronous communication is more flexible, asynchronous communication in the form of feedback through discussion forums is highly valued for bringing structure to open projects. Both in synchronous and asynchronous online communication, the rules of interaction and communication are more critical than in face-to-face, blended learning sessions, which is an essential medium for the future. The combination of face-to-face and online activities is fascinating. Integrated learning can even make it easier to realize collaborative learning between professionals. Ikuo Shimizu Hideyuki at. al. (2019) states that the effectiveness of PBL can be strengthened by combining it with e-learning. In addition, students' learning motivation and self-efficacy increase. Thus, the more students become independent learners, the higher their acceptance of technology in blended PBL. By adding e-learning elements in the PBL, we can stimulate knowledge development student-centred, thereby supporting self-efficacy and self-learning without compromising tutor authority. Ron Oliver (2011) states that the study's findings seem to provide strong support for the premise that problem-based teaching approaches delivered using mixed learning involving web-based tools and hands-on instruction can provide strong support for students. Most students show a positive level of satisfaction with the learning approach and show that it supports their learning. The form and type of problem were found to affect student

satisfaction levels with more practical and relevant problems that were preferred over those considered theoretical and less applied.

This clarity has proven that by designing blended learning that uses problem-based learning strategies and improving student learning achievement, with this development strategy, the level of creativity, communication, and collaboration of students is more comfortable and increases self-learning for their respective students.

The learning model aims to equip students with knowledge that can be flexibly applied (transferred) from one problem to another and from one context to another. Defining transfer is the ability to think and argue about a new situation through preliminary knowledge. It can connote positively if learning or problem solving is improved through preliminary knowledge. It can connote negative if initial knowledge interferes with the learning process. Transfer can also occur in a context by assigning a task closely related to the subject matter or a particular situation and is then used in another context.

If PBL learning is applied with high motivation, it will be able to improve learning outcomes. This is reinforced by the opinion of M. Nur, (2000: 27) that in order for learning to occur, the learner must take action on the new information and connect the new information with the initial knowledge that is with the coding process strategy that is often called the repeat strategy. From the discussion above it can be concluded that in order for learning to occur that can improve learning outcomes, there needs to be a realistic approach to the learning model used. The results showed that the contextual learning process had shown satisfactory results.

Conclusion

Research using different learning models can improve students' learning outcomes. The study compared blended learning with PBL learning strategies that use face-to-face strategy. Learning models that incorporate blended-based PBL strategies show that students have higher learning outcomes than face-to-face PBL learning strategies. In the learning implementation process, it is essential to note the variables that support the improvement of learning outcomes.

Therefore, blended-based PBL and PBL learning models with learning motivation can result in positive interaction in improving students' learning outcomes. Furthermore, the best research tool is to ask teachers to provide topics through the application of PBL strategies in the learning process, as PBL strategies can stimulate students' spatial memory and information options for each student by combining some of the knowledge previously possessed and associating it with early knowledge to produce achievements. In addition, the strategy is implemented by applying the blended-based PBL model, so that students can have the opportunity to interact with many learning resources (between students and students, teachers with students, students and others who are required to learn, collaborate and convey each other and all other learning resources). Advanced research needs to work to combine variables such as teaching approaches with student characteristics or using student learning styles to express their effect on improving student learning outcomes.

REFERENCES

- Altintas, E., Karaca, Y., Moustafa, A., & El Haj, M. (2020). Effect of Best Possible Self Intervention on Situational Motivation and Commitment in Academic Context. *Learning and Motivation*, 69, 101599.
- Andriyati, S., Kuswarini, P., & Surahman, E. (2020). Perbedaan Hasil Belajar Siswa Yang Menggunakan Model Pembelajaran Project Based Learning Dan Problem Based Learning. *Geoducation*, 1(1).
- Arham, U. U., & Dwiningsih, K. (2016). Keefektifan Multimedia Interaktif Berbasis Blended Learning untuk Meningkatkan Hasil Belajar Siswa. *Kwangsan*, 4(2).
- Arrosagaray, M., González-Peiteado, M., Pino-Juste, M., & Rodríguez-López, B. (2019).
- Blau, I., Shamir-Inbal, T., & Avdiel, O. (2020). How does the pedagogical design of a technology-enhanced collaborative academic course promote digital literacies, self-regulation, and perceived learning of students? *The Internet and Higher Education*, 45, 100722. <https://doi.org/10.1016/j.iheduc.2019.100722>
- Fatirul, A. N. (2012). Pengaruh Strategi Pembelajaran (Problem-Based Learning Berbantuan dan Tanpa Berbantuan Internet) dan Gaya Kognitif Terhadap Prestasi Belajar. (Disertasi). *Disertasi Dan Tesis Program Pascasarjana UM*.

Fatirul, A. N. (2020). Online Application Development in Blended Learning to Increase Ease of Collaboration and Communication, and Students' Freedom of Thought Ability. *Online Learning*, 3(5).

Fatirul, A. N., ST, M. P., Walujo, D. A., & ST, M. (2020). Desain Blended Learning: Desain Pembelajaran Online Hasil Penelitian. *Scopindo Media Pustaka*.

Ismail, J. (2019). Meningkatkan Motivasi Belajar Bahasa Indonesia Melalui Interaksi Edukatif Siswa Kelas Viii Smp Negeri 5 Kota Ternate. *E-Jurnal Mitra Pendidikan*, 3(8), 1105–1120.

Jannah, M. (2019). Pengaruh Penerapan Model Blended Learning Terhadap Tingkat Pemahaman Siswa Smp Pada Mata Pelajaran Ips Kelas Vii Tahun 2019.

Kintu, M. J., Zhu, C., & Kagambe, E. (2017). Blended learning effectiveness: The relationship between student characteristics, design features and outcomes. *International Journal of Educational Technology in Higher Education*, 14(1), 7. <https://doi.org/10.1186/s41239-017-0043-4>

Kopeyev, Z., Mubarakov, A., Kultan, J., Aimicheva, G., & Tuyakov, Y. (2020). Using a Personalized Learning Style and Google Classroom Technology to Bridge the Knowledge Gap on Computer Science. *International Journal of Emerging Technologies in Learning (IJET)*, 15(02), 218–229.

Nguyen, G. N. (2019). Teaching the Law of Cosines in Advanced 10th Grade Geometry Textbook by Way of Problem-Based Learning in Vietnam. *International Journal of Learning, Teaching and Educational Research*, 18(11), 397–413.

Porter, W. W., & Graham, C. R. (2016). Institutional drivers and barriers to faculty adoption of blended learning in higher education. *British Journal of Educational Technology*, 47(4), 748–762.

Rufii, R., & Rochmawati, D. (2019). Evaluation of universal design for constructivist-based statistics learning module for students' increased motivation. *Journal of Education and Learning (EduLearn)*, 13(3), 431–440. <https://doi.org/10.11591/edulearn.v13i3.9174>

Sasmito, A., Suciati, S., & Mariadi, M. (2017). Profile of Communication Skills in Biology For XI Grade Students of "Y" Senior High School in Madiun Regency. *Unnes Science Education Journal*, 6(2).

Sasongko, D. B., & Fatirul, N. (2019). Pengembangan E-Learning Dengan Video Conference Untuk Pendukung Pembelajaran Informatika Terapan Di Politeknik Kelautan Dan Perikanan Sidoarjo. *Jurnal Education And Development*, 7(2), 236–236.

Semler, S. (2005). Use blended learning to increase learner engagement and reduce training costs. On-Line) Dalam [Http://Www. Learnings. Com/Content/Lsnews/Blended_learning1. Html](http://www.learnings.com/content/lsnews/blended_learning1.html). Diunduh, 11.

Septiani, U. U., Degeng, I. N. S., & Sitompul, N. C. (2020). Development of Problem Based Learning Book for Indonesian Language and Literature Subject at Junior High School". *Jurnal Dimensi Pendidikan Dan Pembelajaran*, 8(2), 91-102. <https://doi.org/10.24269/dpp.v8i2.2194>

Siregar, S. (2013). Meningkatkan Pemahaman dan Hasil Belajar Siswa Pada Mata Pelajaran Matematika dengan Menggunakan Software Graphmatica. *Edumatica: Jurnal Pendidikan Matematika*, 3(01).

Subandowo, S. (2015). *Kebijakan Pendidikan Teori & Praktik*. Wineka Media.

Sugito, Sugito. (2017). *Kapita Selekta teknologi pendidikan dan problematika pendidikan*. Adi Buana University Press.

Sugiyono, P. (2011). *Metodologi penelitian kuantitatif kualitatif dan R&D*. Alfabeta, Bandung.

Sugiyono, P. D. (2009). *Metode Penelitian Kuantitatif Kualitatif Dan R &D*, Alfabeta. Denzin, NK, & Lincoln, S. Yvonna.

Thai, N. T. T., De Wever, B., & Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback. *Computers & Education*, 107, 113-126.