

# Impact of Problem Based Learning-Blended Learning on Students' Creativity and Learning Interest

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Received: September 18, 2023

Revised: November 12, 2023

Accepted: January 25, 2024

Published: January 31, 2024

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DOI: [10.29303/jppipa.v10i1.5366](https://doi.org/10.29303/jppipa.v10i1.5366)

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**Abstract:** The research aims to find out whether there is an increase in creative thinking and interest in learning Biology using the Problem Based Learning model based on Blended Learning (PBL-BL). This type of research is Quasi Experimental with a None Equivalent (Pretest and Posttest) Control Group Design. The population was 116 students in class XI MIPA SMA Negeri 4 Bengkulu City, three sample classes, two experimental classes and one control class. The data collection method uses the Torrance creative thinking test and questionnaires to measure students' interest in learning Biology. Data were analyzed using the One Way Anova test. The results of the research show that there is an increase in students' creative thinking power and interest in learning by implementing the Problem Based Learning model based on Blended Learning (PBL-BL) in Biology learning.

**Keywords:** Blended learning; Creative thinking; Problem based learning

## Introduction

In the era of the industrial revolution 4.0, it has changed the way of thinking about education, not just a way of teaching, but far necessary is change in the perspective of the concept of education itself (Lase, 2019). In this era, Critical thinking is important in the education system (Ernawati et al., 2019). Indonesia's creative thinking index is still low both at the international level (115th level out of 139 countries evaluated) and ASEAN (level 115). 6 of 6 ASEAN countries (Saputri et al., 2020). These skills are very important in solving problems of everyday life, create new ideas and products (Ndiung et al., 2019). Creative thinking needs to develop and taught to the student so that they can be independent and solve the problem (Mustofa et al., 2020). Biology learning in schools, not to mention providing opportunities to develop creative thinking skills, is only at the stage of material development and memory to obtain high cognitive academic scores (Astuti et al., 2020).

Creative thinking is defined as the thinking that enables students to apply their imagination to building ideas, questions, and hypotheses, experimenting with alternatives or solutions and evaluating their own and their peers' ideas, final products, and processes (Fatmawati et al., 2019). The creative thinking ability and interest of the students in the learning process are low (Traut-Mattausch et al., 2015). This can be seen by the lack of questions from the students to the teacher during class or teaching (Fatmawati et al., 2019). The motivation from the teachers, the school, and the family environment, thinking ability, and curiosity of the students can grow and develop well. Interests have a good effect on academic learning, domains of knowledge, and certain fields of study for individuals (Rothstein et al., 2011). One model that is suitable for increasing students' creative thinking and interest is the Problem-based learning model based on blended learning (PBL-BL) (Wijayati et al., 2019). Project-based learning is a student-centered form of instruction that is based on three constructivist principles: learning is

## How to Cite:

Irwandi, Hartati, Y., Hidayat, T., & Fitriani, A. (2024). Impact of Problem Based Learning-Blended Learning on Students' Creativity and Learning Interest. *Jurnal Penelitian Pendidikan IPA*, 10(1), 37-46. <https://doi.org/10.29303/jppipa.v10i1.5366>

context-specific, learners are involved actively in the learning process and they achieve their goals through social interactions and the sharing of knowledge and understanding (Aksela et al., 2018). Blended learning is learning that combines learning delivery strategies using face-to-face activities, offline and online computer-based learning (internet and mobile learning) (Khine et al., 2003). The principle of PBL-BL is relevant to the principle of Biology learning, namely following the theory of constructive learning. Learning is not only a transfer of knowledge but the process of compiling knowledge that is carried out by students through various experiences encountered (Husamah, 2015). There are seven steps to implement project-based learning, namely: formulating learning outcomes, understanding concepts, practicing skills, designing projects, making project proposals, implementing projects, and presenting project reports presentation of the project report. The study showed that the implementation of seven steps of PBL was practice and effective to enhance student's productive competencies (Jalinus et al., 2017).

#### *Literature Review*

This review informs research about blended learning in the learning process that effect on students' learning interest and creative thinking skills. It also explains how the role of technology to support learning.

#### *Technology and Education System*

The Internet provides many conveniences for the world of teaching. There are various choices of applications that can be used to facilitate the teaching process. The choices of available applications are very diverse, ranging from free ones (under open-source projects) to commercial ones (under certain vendors) (Heron et al., 2013). Technological developments, especially information technology that is increasing rapidly affecting the implementation of education. Information technology can also help solve the educational problems we are facing when information technology is developed or adopted and packaged by the principles of learning technology. The development of information and communication technology affects digital learning, with the development of computer-based learning (OECD, 2016). The development of science and technology increasingly encourages reform efforts in the use of technological results in the learning process. By utilizing information and communication technology (ICT), media can become multimedia, namely media that can combine sound, images, and video in one medium (Kashada et al., 2018). The use of information technology in this case e-learning is needed not only by skilled educators in utilizing technology and technology for the manufacture of teaching materials

but a design is needed to carry out learning effectively. There is also the role of the computer as an additional role in learning; its use includes the presentation of information on the content of the subject matter, exercises, or both (Arkoful et al., 2014).

So far, students are only introduced to conventional learning methods, while times have drastically changed where computers, laptops, and even smartphones are rampant and today's children are also familiar with smartphones with sophisticated technology and it's time for learning methods to keep up with the times (Razzaq et al., 2018). One of technology which used for the education system is Edmodo. Edmodo is a social media platform that is often described as Facebook for schools and can do more as needed. Edmodo is an interesting application for teachers and students with social elements similar to Facebook, but in fact, there is greater value in this social network-based educational application. Edmodo is social network-based learning that is safe and free in making it easier for teachers to create and managing virtual classes so that students can connect with classmates and teachers anytime and anywhere (Rifai, 2017).

Edmodo is an educational site that allows students to access uploaded learning content (learning materials, learning links and videos, assignments, and grade notifications) by teachers, and makes it easier for teachers and students to communicate in an online classroom environment (Rifai, 2017). Previous research stated that Edmodo can cause students to participate more in learning, Edmodo is a tool that needs to be introduced to students because it is more productive and allows students to easily interact in the world of education (Siahaan, 2020). It can be concluded that Edmodo is a social network for learning based on the Learning Management System (LMS). Edmodo provides facilities for teachers and students, a safe place for teachers and students to communicate, collaborate, share learning content and applications, do homework, discuss in virtual classes, online tests, and deliver grades.

The purpose of using Edmodo media in learning can be explained as follows: improving the quality of learning and teaching culture of teachers and students, expanding learning opportunities and developing new products

#### *Creative Thinking*

Creative thinking ability is a person's ability to be able to think logically, critically, innovatively, and systematically, in dealing with various problems creative thinking skills are very important for everyone because in all disciplines and the world of work one can analyze and synthesize various concepts and be able to

see the relationship between these concepts to be used to solve problems (Maharani, 2014).

People who have creative thinking skills are not only able to deal with non-routine problems but are also able to see various alternatives to problem-solving. This means that a person is not able to deal with non-routine problems, and is also unable to see various alternatives to problem-solving, then that person is not creative (Bishara, 2016). Creative thinking is a combination of logical thinking and divergent thinking based on intuition but still in awareness. When one applies creative thinking in a problem-solving practice, intuitive divergent thinking generates many ideas. This will be useful in finding a solution. This understanding explains that creative thinking pays attention to logical or intuitive thinking to generate ideas (Siswono, 2010).

Creative thinking involves the ability to find something new or original. It involves skills that have flexibility, originality, fluency, elaboration, brainstorming, modification, fantasizing, associative thinking, attribute lists, and metaphorical thinking. The purpose of creative thinking is to stimulate curiosity and stimulate divergent thinking. These reasons encourage the assumption to group creative thinking in the category of higher-order thinking skills. Creative thinking is defined as the scope of the ability to see new relationships between techniques and fields of application and to make associations between ideas that may not be related (Birgili, 2015).

### Blended Learning

In the learning process, students use technology resources as a driver to improve the quality of learning and the demands of the industrial revolution era. The use of technology in the learning process has now been done by many educators. So this learning process is called blended learning. Initially, the term Blended learning was used to describe learning that tried to combine face-to-face learning with online learning. The concept of blended learning began to develop with the presence of several experts who developed and defined the Blended learning model. Blended learning is an effective combination of various learning models and learning styles that can be applied to an interactive online learning environment (e-learning) and conventional (face-to-face) (Sima et al., 2020).

At first, the learning process was only done face-to-face, the rapid progress of technology and information so that learning switched to using pure electronics (blended-learning pure) in the online form (Coman et al., 2020). The use of online learning in education continues to increase. Teachers and students can access electronic documents to enrich the study to make students more actively participate because online learning provides

an interactive learning environment (Darling-Hammond et al., 2020). However, face-to-face learning is still carried out so that a combination of traditional and online learning models occurs, an explanation of the concept of blended learning is explained in the image (Figure 1) (Heinze et al., 2010).

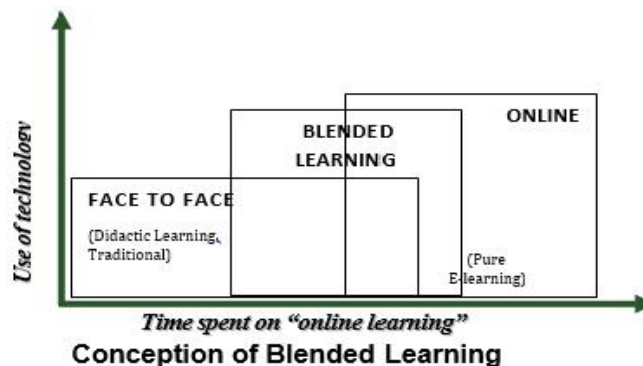


Figure 1. Conception of blended learning

### Problem-Based Learning-Blended Learning

Blended learning is a present and future learning that needs to be mastered by teaching staff, therefore it is necessary to mix face-to-face learning with online learning activities (Dwiyogo, 2018). According to Rusman (2016) in the learning process using e-learning collaboratively in the problem-solving process. Problem-solving learning activities are a type of thinking ability. Thinking is a high-level cognitive activity that involves the assimilation and accommodation of various knowledge and cognitive structures or cognitive schemas that students have to solve problems (Thobroni, 2015). By utilizing problems as triggers for learning and interactive, the potential of technology may be fully utilized, but on the other hand, e-learning still has limitations.

Some of the basic principles of PBL-Blended are: (1) using the power of real problems to generate motivation; (2) conditioning the environment concerning global information; (3) encouraging the process of utilizing and developing e-learning; (4) emphasizes problem-solving and decision making rather than learning materials; (5) provide a system in collaboration; (6) optimistic in using a flexible structure; and (7) developing evaluation and criticism of information sources.

### Students' Learning Interest

Interest is a feeling of liking or interest of students in learning so that it encourages them to learn and master knowledge and experience by being shown through participation and activeness in seeking knowledge. Therefore, interest in learning will encourage students to study better with an interest or liking for the lesson so that they have the initiative to continue learning and feel very useful for them. Students

who have an interest in certain subjects tend to pay greater attention to these subjects (Lin et al., 2017).

Interest is a condition that refers to a person's psychological interest to attend to something. Someone who has an interest will be shown through participating in the learning process. That is, if teachers want to be successful in teaching and learning processes, they must provide a stimulus to students so that they have an interest and motivation in participating in the learning process. Based on the understanding of interest that has been stated above, it can be concluded that interest is a feeling or feeling that a person has to learn and master knowledge and experience by being shown through participation and activity in seeking knowledge and experience (Filgona et al., 2020).

**Method**

The type of research conducted in this research is quasi-experimental research. The purpose of quasi-experimental research is to obtain information that is an approximation to the information that can be obtained by the actual experiment, in conditions where it is not possible to control as tightly as desired by the true experimenter existing conditions. This design is called a quasi-experimental research design (Howard, 2014). The research design used the Nonequivalent (Pretest and Posttest) Control Group Design. Researchers will give a pretest to the experimental class 1, experiment 2, and control class. The pretest was given to determine the scientific literacy ability and student interest in learning before being given treatment. The results of the pretest between the experimental classes 1, experiment 2, and the control class are expected to have no difference, therefore the three classes must be homogeneous

After it was known that the experimental class 1, experiment 2, and control class were homogeneous, it was continued by providing treatment with a problem-based learning model based on blended learning in experimental class 1, namely in class XI MIPA 1, problem-based learning in experimental class 2, namely in class XI MIPA 2 and discovery learning models in the control class, namely class XI MIPA 3. After all, classes were given treatment, each student, both experimental class 1, 2, and control class, was given a final test/posttest to determine the difference in scientific literacy ability and student interest in learning after being given treatment.

**Table 1.** Pretest-posttest non-equivalent Control Group Design

Group	Pretest	Treatment	Posttest
E1	O1	X1	O2
E2	O1	X2	O2
C	O1	X0	O2

Description:

- E1 : Experiment Class 1
- E2 : Experiment Class 2
- C : Class Control
- O1 : Pretest
- O2 : Posttest:
- X1 : Problem based learning model based on Blended learning
- X2 : Problem based learning Model
- X0 : Discovery Learning Model

Methods of data collection using tests and questionnaires. The design used in this study was a pretest-posttest, which was divided into three groups, namely the PBL-BL learning model group, the PBL learning model group, and the discovery learning model group. For the treatment group, namely the class that applies learning with the PBL-BL model, PBL and for the control group, discovery learning is applied. It can be seen in Table 1. The group is given a pretest and posttest in the form of knowledge about the topic that has been determined and a questionnaire of interest in learning, then analyzed using the test One-way ANOVA. Before the ANOVA test, the prerequisite tests were carried out, namely the normality test and the homogeneity test, if there was a difference between the 3 treatments, then it was analyzed by the Post Hoc Tukey test.

The population in this study were all students of class XI MIPA at SMAN 4 Bengkulu City for the academic year 2019/2020 with a total of 116 people consisting of 4 classes with the distribution of students. Group sampling was done utilizing a simple random sampling technique, namely random sampling so that each population has the same opportunity to be selected as the research sample. Sampling with this technique is done by drawing lots. The steps for the draw are as follows:

- 1) The researcher prepared lottery paper as much as the class XI population in the school, namely 4 sheets of lottery paper. The lottery paper reads class XI MIPA 1, XI MIPA 2, XI MIPA 3 and XI MIPA 4.
- 2) Researchers draw by doing two draws. The first draw resulted in class XI MIPA 1 as the experimental class 1 and the second draw appeared class XI MIPA 2 as the experimental class 2 and the third draw class XI MIPA 3 as the control class.

**Result and Discussion**

*Results*

*Creative Thinking Ability Data*

Table 2 shows that there are differences in the average pretest, posttest, and gain values in the experimental class and the control class. The

experimental class has an average score greater than the control class. Meanwhile, based on the gain value, experimental class 1 showed an increase in creative thinking skills which were classified as high, while the experimental class 2 and control class were classified as low. Before the hypothesis is tested, first the prerequisite tests are the normality test and the homogeneity test. The results of the data normality test are presented in Table 3.

**Table 2.** Pretest, Posttest, and Gain on Creative Thinking Ability

Class	Pretest	Posttest	Gain	Category
Experiment 1	16.07	25.63	0.75	High
Experiment 1	16.52	25.00	0.10	Low
Control	15.96	22.93	0.08	Low

**Table 3.** Results of Normality Test Analysis on Creative Thinking Ability

Group	One Sample Kolmogorov Smirnov		
	Statistic	df	Sig
Experiment Class 1	.117	27	.200
Experiment Class 1	.124	27	.200
Control Class	.155	27	.096

Based on the analysis of the normality test in table 3, it can be seen that the experimental class obtained a significance value = 0.200 greater than 0.05 (coefficient) and the control class obtained a significance value = 0.096 greater than 0.05 (coefficient). This means that both groups of data (experimental class and control class) come from a normally distributed population. The results of the homogeneity of variance test for the two groups of data are presented in Table 4.

**Table 4.** Results of Homogeneity Test Analysis on Creative Thinking Ability

Variant Homogeneity Test			
Leven's Statistics	Df1	Df2	Sig
.743	2	83	.479

Based on the results of the homogeneity test, the significance value = 0.479 is greater than 0.05 (coefficient). So, it can be concluded that the creative thinking ability data is homogeneous. The creative thinking ability score data proved to be normal and homogeneous, then tested using the T-test. The independent sample T-test was used to determine the significance of the specific increase between the three groups which were partially analyzed. The results of the T-test can be seen in Table 5.

**Table 5.** Results of Independent Sample T-Test Analysis on Creative Thinking Ability

Creative Thinking Value	t-test for Equality of Means			
		t	df	Sig.(2-tailed)
	Equal variances assumed	-3.303	84	.001
Equal variances not assumed	-3.236	53.414	.002	

There is a significant increase in students' creative thinking skills between the experimental group 1, experiment 2, and the control group. This is evidenced by the results of the T-test analysis with a significant value (2 tailed) = 0.001 less than 0.05 (coefficient). Based on the test results, it can be concluded that there is an increase in students' creative thinking skills who are taught using the PBL-BL model, PBL, and conventional strategies.

*Student Learning Interest Data*

Table 6 shows that there are differences in the average pretest, posttest, and gain values in the experimental class and the control class. The experimental class has an average score greater than the control class. Meanwhile, based on the gain value, experimental class 1 increased student interest in the high category, experimental class 2 was in the medium category and the control class was in a low category. Before the hypothesis is tested, first the prerequisite tests are the normality test and the homogeneity test. The results of the data normality test are presented in Table 7.

**Table 6.** Pretest, Posttest, and Gain on Students' Interest in Learning

Class	Pretest	Posttest	Gain	Category
Experiment 1	78.08	89.67	0.83	High
Experiment 2	81.1	82.81	0.36	Medium
Control	79.5	77.14	0.15	Low

**Table 7.** The Results of the Normality Test for Students' Interest in Learning

Group	One Sample Kolmogorov Smirnov		
	Statistics	df	sig
Experiment class 1	.182	21	.068
Experiment class 1	.118	21	.200
Control Class	.159	21	.174

Based on the analysis of the normality test in table 7, it can be seen that the experimental class 1 obtained a significance value = 0.068 greater than 0.05 (coefficient), the experimental class 2 obtained a significance value = 0.200 greater than 0.05 (coefficient) and the control class obtained a value significance = 0.174 greater than 0.05 (coefficient). This means that the three groups of data

(experimental class 1, experiment 2, and control class) come from a normally distributed population. The results of the homogeneity of variance test for the two groups of data are presented in table 8.

**Table 8.** Results of Homogeneity Test Analysis on Students' Learning Interest

Variant Homogeneity Test			
Leven's Statistics	df	df	Sig
2.181		7	.12

Based on the results of the homogeneity test, the significance value = 0.120 is greater than 0.05 (coefficient). So, it can be concluded that the data of student interest in learning is homogeneous. The student learning interest score data proved normal and homogeneous, then tested using the T- test. The independent sample T-test was used to determine the significance of the specific increase between the three groups which were partially analyzed. The results of the T-test can be seen in table 9.

**Table 9.** Results of Independent Sample T-Test Analysis on Students' Interest in Learning

t-test for equality of means				
		t	df	Sig.(2 tailed)
Interest in learning Value	Equal variances assumed	3.290	44	.002
	Equal variances not assumed	3.177	33.605	.003

Table 9 shows that there is an increase in students' interest in learning between the experimental group 1, experiment 2, and the control group. This is evidenced by the results of the T-test analysis with a significant value (2 tailed) = 0.002 less than 0.05 (coefficient). Based on the test results, it can be concluded that there is an increase in student interest in learning that is taught using the PBL-BL model, PBL, and conventional strategies.

*Discussion*

Based on the data obtained that interest in learning Biology class XI MIPA 1 is categorized as interested, this is influenced by the problem-based learning model based on Blended Learning (PBL-BL). The problem-based learning model is a learner-centered pedagogical approach that provides opportunities for students to engage in goal-directed investigations (Ali, 2019). The problem-based learning model stimulates students to be aware and determine the problem- solving skills they need, be able to use knowledge operationally, and do group work in the context of real-life problems. In addition, the problem-based learning model can support

students' interest and awareness in the learning process (Yuan et al., 2020).

Applying the blended learning model can increase students' interest in learning. The blended learning model is a learning model that combines face-to-face learning with offline and online computer-based learning (internet and mobile learning) (Hawi et al., 2019). The teacher's online learning process uses the Edmodo application. Edmodo app is a social media platform similar to Facebook. Edmodo is a free site that provides microblogging for a special use in the field of education (Gay et al., 2017). In short, Edmodo is a motivational platform that encourages students to study outside of school time (Gay et al., 2017). The Edmodo network offers three types of accounts (for teachers, students, and parents) and each group uses the network to meet its needs in an area of interest (Alqahtani, 2019).

The Edmodo application has a different design that attracts students to learn because teachers can easily create an integrated learning environment and experience. Edmodo provides a safe and easy way for teachers and students to connect, collaborate, share learning content, access assignments, grades, school announcements and also provide effective feedback and motivate students (Siahaan, 2020). Previous studies have stated that the Edmodo application can cause students to participate more in learning, Edmodo is a tool that needs to be introduced to students because it is more productive and allows students to easily interact in the world of education (Gay et al., 2017). In line with the results of research that the web-centric course-based e-learning model with the Edmodo application media can increase student interest in learning, this can be seen from the average interest obtained by 76% and is included in the high category (Yustinaningrum, 2018).

The application of Edmodo also affects student motivation, this can be seen from the results of the student motivation questionnaire (Alqahtani, 2019). The results show that students who use Edmodo have better results in terms of learning approaches. Students who adopt Edmodo, compared to other students, also have greater motivation and a more positive attitude. Teaching through Edmodo can increase students' attention and give them a more positive attitude towards online learning (Inayati et al., 2019).

The subject of discussion in the learning process using a blended learning-based problem-based learning model is the endocrine system. The problems raised must be contextual and comprehensive so that students are expected to be more enthusiastic and interested in the issues that exist around their environment. For example, about diabetes mellitus. Based on the results in the field, students enthusiastically answered the teacher's questions through apperception activities,

discussions and were active in problem-solving activities both offline and online.

Based on the results of the data in the field that students' interest in learning the Edmodo application is quite high. So a teacher needs to introduce the Edmodo application widely. In addition, further studies on the use of the Edmodo application for students and teachers are still needed. Interest in learning Biology class XI MIPA 2 is categorized as very interested this is because in the learning process by applying a problem-based learning model involves real problems, contextual problems as the application of concepts. Therefore, students are more motivated and interested in solving problems. The concepts offered must be contextual so that students develop their concepts more quickly. If students understand the content of the problem, students are eager to solve the problem. The problem-based learning model is a way to take advantage of problems so that students are more experienced and work hard to face problems to generate interest in learning (Lasut et al., 2017).

The problem-based learning model facilitates students to increase their interest in scientific issues in the problem-solving process. Students who have an interest in the learning process using the problem-based learning model can find information on their own, can identify and formulate problems and work effectively in groups and build networks. Based on the results of research in class XI MIPA 2 that overall students focus on solving problems in groups and at the end of the learning process students can evaluate and provide conclusions. High student interest in learning will make students enthusiastic in learning so that they can create a conducive and interactive atmosphere.

Interest in learning Biology class XI MIPA 3 is categorized as very interested this is because the application of the discovery learning model can increase students' interest in learning. The discovery learning model is more effective than the conventional model. This is supported by the results of the questionnaire. The results of the questionnaire that more than 75% of the questionnaire items received a positive response of 67.65%. That is, discovery learning can increase student interest (Yustinaningrum, 2018).

The discovery learning model can optimize the indicators that exist in students' interest in learning. Such as the orientation phase which is intended to foster a responsive learning atmosphere that can bring joy to students before starting learning (Nurhayani et al., 2020).

The process of learning science lessons, activities based on investigations using the discovery learning method, can be used to attract students' attention and activate them to participate more in class. The learning

process is more given special analytical assignments both individually and in groups so that it requires the participation of all students in the learning process (Nilson, 2018). The discovery learning model can stimulate thinking power and provide opportunities for students to take part in learning activities so that students are more enthusiastic, enthusiastic and have an individual appeal to carry out investigations. These activities can arouse students' interest in learning because they are tailored to the interests and needs of students. Students show enthusiasm in the learning process by responding and completing LDS on time. The questions in the LDS support the stages of the discovery learning model.

The interpretation of the results of the data analysis test explains that there are differences in the interest in learning of Biology students in the material on the Endocrine system using Problem Based Learning (PBL) and Problem Based Learning based on Blended Learning (PBL-BL). This is caused by several factors below.

The first factor is because the problem-based learning model based on blended learning gives students more time to understand the learning material. So that students actively participate in finding various information by utilizing internet media. The second factor is the problem-based learning model based on blended learning that can develop students' interest in learning about the Edmodo application which will affect their knowledge so that it can lead to positive perceptions.

The next factor is that the problem-based learning model based on blended learning gives a feeling of pleasure towards learning. Feelings of pleasure will certainly affect the ease of students understanding the material being studied and students are easy to think in solving a problem. The problem-based learning model provides opportunities for students to be more interested in problem-solving. This is proven by creative thinking skills also increased, so it is expected that students will experience an increase in high-level cognitive skills such as problem-solving skills, reflective analysis, and meta-cognition.

## Conclusion

Based on the results of data analysis and discussions that have been carried out by the author, it can be concluded that there are differences in students' interest in learning Biology using the Problem Based Learning (PBL) model, Blended Learning-based Problem Based Learning (PBL-BL) and Discovery Learning (DL) in Biology learning class XI MIPA SMA Negeri 4 Bengkulu City.

## Author Contributions

All authors contributed to writing this article.

### Funding

No external funding.

### Conflicts of Interest

No conflict interest.

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