The Effectiveness of the Combination of Problem-Based Learning Models and Hybrid Learning Models to Improve Problem Solving Skills

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Abstract: The research objective is to describe the effectiveness of the combination of the PBL (Problem-Based Learning) model and hybrid learning in improving problem-solving skills.. This research is a quasi-experimental design with a non-equivalent control group design. The research subjects were 40 students consisting of an experimental class and a control class in the fourth semester of the PGSD STKIP PGRI Bangkalan study program. The results showed that the N-Gain values for the experimental class and the control class were .89 and 1.43. The hypothesis test using SPSS shows that the Sig (2-*tailed*) value in the experimental class is .000 <0.05 with a t-count value of 6.389 <t-table 0.687, that is to say there is a significant difference, the combination of the PBL model and the hybrid learning model and the learning model direct. Based on the results of data analysis, it can be concluded that the combination of the PBL model and the hybrid learning model is effective in improving problem solving skills.

Keywords: Effectiveness; Hybrid learning; Problem Based learning; Skill

Introduction

After the Covid-19 pandemic, the use of information technology in the education system in higher education has become an alternative method of learning in the digital era. The government encourages tertiary institutions to develop online learning by offering collaborative online learning grants for study programs in tertiary institutions. STKIP PGRI Bangkalan developed a Learning Management System (LMS *)* as an online learning system that can be accessed on the https://elearning.stkippgri-bkl.ac.id/ page .

LMS is a web-based online learning platform. The LMS platform is easy to use and can be accessed anywhere and anytime by students, an obstacle often faced by students is the problem of internet network connection. (Fibriasari et al., 2023). LMS can increase student independence in learning and working (Marpaung et al., 2021). The implementation of blended learning has enhanced students' self-directed learning abilities, enabling them to refine their knowledge (Tong et al., 2022). LMS strengthens the face-to-face learning process through online classroom learning (Bradley, 2020). Students can study and work independently with fellow students or lecturers.

Online learning using LMS can be done synchronously and asynchronously. Synchronous online learning using zoom meetings, Google meet or other social media. LMS is generally used as asynchronous online learning. Lecturers have not utilized the LMS features optimally, the LMS is only used to post information and upload lecture materials and assignments. Therefore, lecturers must be able to optimally utilize LMS by combining learning models that provide opportunities for students to build knowledge and develop skills according to what is needed in this *era . society* 5.0.

The student-centered learning model is in accordance with the national education curriculum, one of which is the problem-based learning model (PBL). Model PBL dapat meningkatkan keterampilan berpikir tingkat tinggi (Anggraeni et al., 2023). In the PBL model students must be actively involved in the inquiry process, make decisions, use new information, relate prior knowledge and construct new knowledge (Astutiani & Hidayah, 2019). The PBL model encourages students to solve problems by gaining new knowledge and adapting existing knowledge. (Hanefar et al., 2021). Lecturers as facilitators in the learning process help students construct new knowledge (Sajidan et al., 2022). The PBL model provides an opportunity for students to recall the material they have learned and find solutions to solve problems (Nurtanto et al., 2018). The PBL model allows students to develop skills through direct involvement in solving problems effectively in accordance with real life situations (Jatmiko et al., 2018). Model PBL dapat meningkatkan keterampilan berpikir kritis, memecahkan permasalahan kompleks dalam kehidupan nyata (Jatmiko et al., 2018). The PBL model uses real problems in everyday life as material that students must learn to train and improve problem solving skills (Sari & Sugiyarto, 2015). improve student understanding, cooperation skills and efficiency in solving problems (Sulaiman, 2011). Case-based learning (real problems) can link theoretical and practical (Kramer et al., 2020). The PBL model can improve students' abilities to understand physical phenomena, share knowledge, conduct research and solve problems (Dwikoranto et al., 2021). Metode CPBL dapat meningkatkan keterampilan pengaturan diri mahasiswa dalam belajar dan bekerja (Hidajat, 2023).

In implementing the PBL model, lecturers combine online and face-to-face learning in class. Online learning can be done before and after face-to-face learning in class. Online learning can be done *synchronously* and *asynchronously,* it is called blended learning (Powell et al., 2015). The purpose of online classes is to provide information, prepare students for face-to-face learning and review or practice what they have learned, while face-to-face classes are for discussion, sharing information and getting feedback from groups and lecturers (Fibriasari et al., 2023).

Online class learning uses the LMS PBL model, namely the problem orientation phase, organizing student learning and guiding students to study and work, while face-to-face learning is presenting results and evaluating problem-solving processes. The problem orientation phase of the lecturer provides information about lectures, uploads material. The phase of organizing students is that the lecturer forms groups and posts assignments and timelines that must be done by students. The lecturer uploads a social media hot issue video as a problem then the lecturer asks students to see and identify the problem. The guiding phase of solving problems can be done synchronously and asynchronously. In synchronous the lecturer confirms to students about the material being studied and the tasks that must be completed during asynchronous learning (Lenggogeni, 2022). Lecturers use the Chatting Forum on the LMS as an online discussion space between students and students or students and lecturers. Online discussion activities are carried out asynchronously, meaning that discussions can be held at different places and times. Lecturers guide students directly at the same place and time using zoom meetings, Google meet or other social media. Students are guided by lecturers in carrying out discussions to solve problems and develop solutions that can be implemented by seeking appropriate information (Mardi et al., 2021). . Pendekatan pembelajaran online meningkatkan motivasi belajar mahasiswa (Wahyuni et al., 2020).

Face-to-face learning in class is the phase of presenting in front of the class. In this phase students present the tasks that have been done in groups. The lecturer acts as a facilitator of discussion activities. Lecturers can help students provide scaffolding both online and face to face. This activity provides an opportunity for students to express opinions, comments and suggestions between groups. Students are more confident in presenting their assignments in front of the class and expressing opinions, comments and suggestions, because students are already involved in online discussions. Students are guided by lecturers to carry out discussions to solve problems and develop solutions that can be implemented by seeking appropriate information(Dwikoranto et al., 2019). The PBL learning model can create a democratic, open and positive learning atmosphere to develop problem-solving skills (Mardi et al., 2021). Penerapan kombinasi pembelajaran tatap muka dan online berkontribusi pada dua dimensi motivasi - self-efficacy dan nilai pembelajaran fisika (Dorocki et al., 2022).

Problem solving is important in the learning process because it supports the development of skills in the 21st century (Radulović et al., 2023). Polya's problem solving steps include understanding the problem, planning a solution, solving the problem according to plan and checking again. Problem solving indicators Polya understands the problem, namely students can determine what is known and what is asked. The indicator for planning a settlement is to identify a strategy for solving a problem. The indicator of solving the problem is carrying out problem solving. The indicator re-checks the results obtained (Astutiani & Hidayah, 2019).

Method

This research is a quasi-experimental study with a non-equivalent control group research design (Sugiono, 2013) as follows on table 1. The research subjects were 40 students consisting of an experimental class and a control class in semester IV of the 2021 – 2022 academic year PGSD STKIP PGRI Bangkalan Study Program. Technical data collection, namely problem-solving skills tests and student response questionnaires to a combination of problem-based learning models and hybrid learning models.

Technical data analysis using descriptive statistics. Technical analysis of problem solving skills based on an increase in the score of problem solving skill indicators on the pretest and posttest using the N-Gain value and converted with the following criteria (Hage, 1999) on table 2. Learning is said to be effective if the N-Gain has increased significantly. Technical analysis of student responses uses Guttman data and the percentage of student responses is converted to criteria (Table 3).

Table 1. No-Equivalent Control Group Design

Pre Test	Treatment	Posttest
O_1	X	O_2
O_3		O_4

Table 2. N-Gain Scores and Criteria

N-Gain Score	Criteria
0.70 < N-Gain	Tall
0.30 ≤ N-Gain ≤ 0.70	Currently
N-Gain < 0.30	Low

Tabel 3. Response Criteria

Percentage	Criteria
81–100	Strongly agree
61–80	Agree
41–60	Simply Agree
21–40	Disagree
00 – 20	Strongly Disagree

Student responses are said to be positive if student responses are in the agree or strongly agree category.

Results and Discussion

The results of the descriptive statistical analysis of the experimental class and the control group's problem solving skills are shown in Figure 1. Figure 1 shows that the average score of problem solving skills in the experimental class increased from the control class. The difference in the average scores of the experimental class and the control class in the pre-test and post-test were 44.4 and 39.4. The experimental class uses the PBL model

and the hybrid learning model and the control class uses the direct learning model.
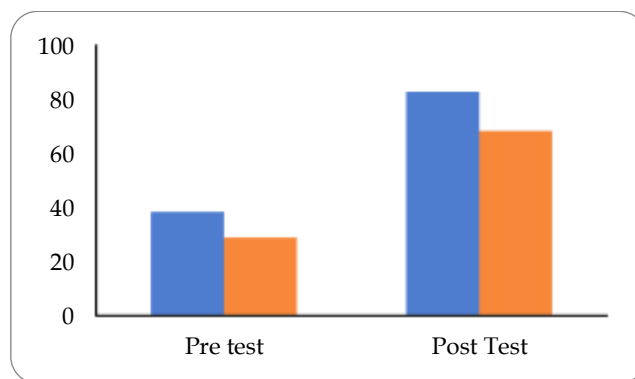
Figure 1. The average pre-test and post-test problem-solving skills of the experimental and control classes

The t-test was used to test the hypothesis that there were differences in treatment in the pre-test and post-test, because after the normality test using the Kolmogorov-Smirnov test the data were normally distributed. The results of the t-test using SPSS showed that the Sig (2- *tailed*) value in the experimental class was .000 <0.05 with a t-value of -20.697 <t-table 0.687. Ho is rejected and Ha is accepted, that is, it can be said that there is a significant difference, there is an effect of the combination of the PBL model and the hybrid learning model on problem solving skills.

The independent sample t-test was used to test the hypothesis that there were differences in the treatment of the experimental class and the control class. The results of the independent test using SPSS showed that the Sig (2- *tailed*) value in the experimental class was .000 <0.05 with a t-count value of 6.389 <t-table 0.687. Ho is rejected and Ha is accepted, that is, it can be said that there is a significant difference, there is a difference in the combination of the PBL model and the hybrid learning model and the direct learning model. The average scores of problem solving skills in the experimental class and control class were 82.80 and 68.30.

The results of the average N-Gain scores for the experimental class and the control class were 0.71 which were included in the high category and 0.55 which were included in the medium category. The combination of PBL and hybrid learning models is said to be effective if the results of problem solving skills have increased significantly.

Implementation of the problem-oriented PBL model phase, lecturers design online class learning using LMS. Students study and work independently without space and time limits by logging in using their respective accounts. Students can find learning achievements and information on assignments that must be done. In the

Higher Science Science course on energy and its changes in real and recent events, the lecturer asks students to watch videos about the application of energy and its changes in everyday life, then identify problems with the impact caused by energy and its changes. Students identify problems by associating their knowledge and new information obtained. Up-to-date and updated materials as problem topics to be resolved, helping students to obtain new appropriate information easily, quickly and accurately through online and print media. The PBL model allows students to develop skills through direct involvement with effective problem-solving techniques and in accordance with real-life situations (Zanudin, Pambudi, 2019).

The social constructivist theory explains how individuals give meaning and understand the world in which they exist One's experiences are interpreted differently based on their individual experiences, as individuals use personal experiences to construct interpretations and give meaning to them. Social constructivism relies on participants' understanding and perspectives of experiences, presenting participants' beliefs, feelings, and ideologies (Creswell & Poth, 2018).The PBL model requires students to be actively involved in the discovery process, make decisions and use new information by connecting with previous knowledge or constructing new knowledge (Sugeng & Suryani, 2019). In the phase of organizing students, the lecturer provides information about the rules of the assignment to be carried out and the deadline for group submissions at the LMS. Lecturers can set the time when tasks can be downloaded and the deadline for uploading them. If students make a late submission, students cannot collect assignments. Lecturers can also see the progress of students who have submitted and who have not uploaded the tasks. Therefore, the lecturer can give a warning (notification) to students (Zainudin & Pambudi 2021). Students determine solutions with their group mates and download student assignment sheets. Students coordinate with their group members to make a schedule for completing assignments.

In the mentoring phase of completing assignments, the lecturer guides students both face-to-face and online. The advantage of online learning is that students can express opinions, comments, ask questions between groups and lecturers can facilitate online discussion activities. Online interaction makes students more confident in giving comments and responses; therefore when students are in the meeting at the classroom, they already have an initial knowledge about the material to be discussed by the lecture. This activity gives students the opportunity to practice problem-solving skills. Problem solving skills and students' critical thinking skills in online learning through *Google Classroom* have

increased compared to the independent learning module approach (Sombria et al., 2023). Learning to use social media encourages students' scientific skills and improves problem-solving skills and forms a culture of healthy communication between lecturers and students (Lee et al., 2016). Learning to use problem solving-based modules is effective in improving students' analytical thinking skills in problem solving aspects including identifying problems, defining, presenting and evaluating (Karenina et al., 2020). Students can also provide guidance to lecturers directly face to face on campus. Learning using the PBL model can improve problem solving skills, because students are trained to solve scientific problems (Taufiq & Kaniawati, 2023). The PBL model students' attitudes towards learning is positive, because students can construct knowledge and lecturers act as facilitators in the learning process (Hanefar et al., 2021).

At face-to-face meetings in class, students present their work in front of the class. In this phase students are trained in communication skills, namely expressing opinions in front of the class. In this activity students are involved in inter-group discussions, the lecturer as a facilitator of discussion activities directs and provides confirmation and strengthens students' understanding of concepts. Discussion activities run interactively, because students are already involved in online discussions so that confidence increases during discussions in class. Online discussion activities reduce the embarrassment of students to ask questions and give opinions. The blended learning approach allows students to conduct experiments, analyze experimental data, and practice interpretation in preparation for subsequent learning. With better preparation, students are more confident in their knowledge and skills, and instructors have more time to provide support.

The problem understanding skill indicator has the highest score. This is because, among other things, students are used to determining what is known and what is asked in solving high school time questions and the theme of the problem is a phenomenon that is the latest issue, students often hear and read news both through print, online and TV media. The indicator of re-checking skills is the lowest because students are not consistent/harmonious between the problems found solutions and problem solving.

The results of student responses to the combination of the PBL model and the hybrid learning model showed that students stated that 90% of the combination of the PBL and hybrid learning models could explore student knowledge and skills. 80% of online learning using LMS students can increase knowledge of material concepts. This shows that student responses to the PBL and Hybrid learning models are positive. In general,

students are satisfied with the blended learning model, students are actively involved in learning activities (Fitriana, 2017). Student learning outcomes and responses have increased greatly and are very good for learning using the Online Laboratory-based Blended Learning method on the material of the anatomical structure of vertebrate animals (Sandika, 2017).

Conclusion

Research proves that the combination of PBL and hybrid learning models is effective in improving problem solving skills. This can be shown by the average N-Gain score of the experimental class and the control class, namely 0.71 included in the high category and 0.55 included in the medium category. The hypothesis test using SPSS showed a Sig (2- *tailed*) value in the experimental class .000 <0.05 with a t-count value of 6.389 <t-table 0.687, that is to say there is a significant difference, the combination of the PBL model and the hybrid learning model with the direct learning model.

Author Contributions
In writing the article the writer was guided by Dr. Didik Hermanto, M.Pd. and Rica Wijayanti, S. Si, M. Pd. as supervising lecturer. The author determines the background, methods, results and discussion, conclusions. Then, the supervising lecturer provides input and suggestions during the writing of the author's article to the author, so that this article can be resolved. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interests
Declare conflicts of interest

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