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Problem-Based Online Learning Assissted by Whatsapp to Facilitate The Scientific Learning of 2013 Curriculum

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Abstract

Scientific learning is difficult to be applied in an ideal way because of the lack of learning time. One of the solutions to overcome it is by using blended learning that integrated into problem-based learning. This study aims to comprehend the effectivity of problem-based online learning (PBOL) to improve learning outcomes, and its efficiency to reduce the time of face to face learning. The used media was WhatsApp because of its simplicity, and the students have been familiar with it. The seventy students of the 10th grade of SMAN 1 Kelua were being sampled in this study based on a saturation sampling technique and divided into three classes. This was a quasi-experimental study with single factor multiple-treatment design. The premier data of this study were learning outcomes and the total time of learning in the class. The data of learning outcomes were obtained by test and be analyzed by one-way ANOVA to detect the effect of PBOL on the learning outcomes. The data of learning time were gained by observation and documentation and be analyzed in a descriptive way to know the efficiency of PBOL. The analyzed result showed sig. value is 0.04, that is means PBOL, and PBL produces learning outcomes which have significantly different from conventional learning. On the other side, even the learning outcomes of PBOL is equal as learning outcomes of PBL, and it's learning time is fewer than the PBL's. From both of the facts, we can conclude that the PBOL assisted by WhatsApp is effective in enhancing learning outcomes and more efficient to be used.

Keywords: *Blended learning; problem-based online learning; WhatsApp*

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INTRODUCTION

The 2013 curriculum is the Indonesian government's answer to face the challenge of the 21st century. By this curriculum, the government intended to establish great human resources with great characters. The wished character not only a clever student but also well

mannered. All at once, it intends to develop students' curiosity as based on creativity and innovation. Therefore, the 2013 curriculum focus on the enhancement of balanced competencies between attitude, skill, and knowledge. It can be achieved by making students the subject of learning on the student-centered learning method.

The 2013 curriculum accommodates the scientific approach in its process. The suggested learning model in K13 are inquiry learning, discovery learning, problem-based learning, and project-based learning (Fitriyani, Supeno, & Maryani, 2019; Sambite, Mujasam, Widyaningsih, & Yusuf, 2019; Suriasa, 2019; Zaky, Darmadi, Jarnawi, & Musdalifa, 2019). Every learning model is built to accommodate the scientific approach, which are observing, asking, testing, reasoning, and communicating. The observing phase has a goal to create students' motivation and curiosity toward learning topics. An object from the real-world or video can be used as an observed object. The asking phase intends to focus the information or data that must be found. The students will formulate the problem, select the inquiry goal, make the hypotheses, and determine the variable of investigation. In the testing phase, students conduct the investigation based on the plan before. The goal is to find the wanted data. After the data were gained, students need to reason it to discover a conclusion. Then, the gained conclusion needs to communicate with the other groups.

Some researchers have researched to comprehend the problems of scientific learning (Aryani, 2014; Dewantari, 2015; Nuruzzaman, 2013; Paut, 2016; C. E. Wijayanti, Degeng, & Sumarni, 2016). Those researches stated the scientific learning could not be applied in an ideal way because there is a time limit while teaching in the class (Aryani, 2014; Nuruzzaman, 2013; C. E. Wijayanti et al., 2016). In this case, teachers need more time when delivering learning because of learning matter in K13 have a large scope, and it is hard to teach all of it just in one meeting (Paut, 2016). Dewantari (2015) explain more detail that the limitation of time made teachers seldom to involve a whole class to reflect activities, give enrichment task, and make learning summaries. On the other side, pushing scientific learning to become just one meeting is not solute. Based on Nuruzzaman (2013), the learning will be dominated by the teacher if all of the learning activities be loaded to one meeting. Besides that, the implementation of scientific learning activities (observing, asking, testing, reasoning, and communicating) will just become a formality task.

The discovered problems in the previous researches are also founded in the SMA Negeri 1 Kelua. The teachers proposed difficulty with time management if all of the learning subjects should be taught by a scientific approach. This is because of the scientific learning needs two or three meetings in the class to complete one topic investigation. One of the phases that required a lot of time is the testing phase. Besides that, the bigger the class, the harder its management. In the end, there are many subject topics delivered by not using a scientific approach to chase the completeness of subject matter.

The 2013 curriculum has given solutions about the limitation of learning time in the school. The solution is by applying learning that utilizes technology (Hartini, Misbah, Dewantara, Oktovian, & Aisyah, 2017; Mahyuddin, Wati, & Misbah, 2017; Sari, Supahar, & Ralmugiz, 2018). Technology has been utilized in education, as well as media communication between students and teachers, as media simulation to produce a model of the real world, or as media to assess students (Misbah, Pratama, Hartini, & Dewantara, 2018; Zainuddin,

Hasanah, Salam, Misbah, & Mahtari, 2019). The among that utilization of technology, one that can be used to enhance learning efficiency and effectivity is blended learning, which is a combination of online learning and face to face learning.

Blended learning has some characteristics that can be used to solve the limitation of learning time. Blended learning can be utilized as discussion media, share learning material, or perform independent tasks by the internet (Dewantara, Misbah, & Wati, 2020; Rohman & Ain, 2019). By blended learning, the learning not only can be conducted in the classroom but also can be continued while students and teachers have been at home. Airlanda (2016) develop a learning module that combined with blended learning to share learning material. He stated that blended learning could make students easier to access the information that can be delivered in the classroom because of time restriction.

Blended learning can be constructed by using a platform of application available on the internet. Barokati & Annas (2013) utilize the web as media for students and lecturers to meet and discuss in an online environment. In their given learning in one semester, the meeting by web was held in the early weeks of the lecture. Then the rest of the lecture was continued by face to face learning in the classroom. On another side, Purnomo, Ratnawati, & Aristin (2016) designed blended learning by utilizing WhatsApp application as a platform to share documents and deliver subject material to students. This research revealed that access to students to the lesson matter becomes more effective and efficient. Also, Wijayanti, Maharta, & Suana (2017) constructed blended learning by using Schoology application that based on the learning management system (LMS) as media for discussing, give lessons and quiz. This kind of application made the possibility for a teacher to perform learning, give a task, and evaluate students. Those researches implicate that the availability of hardware, software, and internet connection are a prerequisite to implementing blended learning.

Students' necessity and resources available in SMAN 1 Kelua need to analyze first to construct blended learning. This analysis was done to determine devices that will be used in the process of online teaching and learning. SMAN 1 Kelua is located in the northern area of South Borneo Province, which is in the Tabalong Regency. This area has an internet connection, but its bandwidth is limited, and its network not be spread evenly. Besides that, average students in this school have access to a smartphone, even it's their parent’s phone, or it's theirs. Blended learning that will be applied is an online discussion and share learning material such as videos and documents. Based on those necessities, the software that fits to facilitate blended learning in that school is WhatsApp. WhatsApp in kind of application that easy to use in android phones. This application also can run in a narrow bandwidth. It supports sharing files, pictures, videos, and can be used as media for online discussion (Mwakapina, Mhandeni, & Nyinondi, 2016). Then the last reason for the utilization of WhatsApp is because students of SMAN 1 Kelua have been familiar to with operating it. This is can minimalize technical trouble such as operational of application.

The used learning model in this research is problem-based learning. This learning uses real-world problems as anchor problems that need to investigate by students in the learning process (Arends & Kilcher, 2010). The PBL will be integrated into blended learning by WhatsApp in the early and the end of the PBL phase, which makes it become problem-based online learning (PBOL).

By vanishing some syntax that should be done in the class, the teacher supposed to be unimpeded to manage learning time.

This research aims to comprehend the effectiveness of PBOL in enhance students' learning outcomes and its efficiency to reduce learning time in the classroom. The analysis of learning enhancement is done by comparing the learning outcomes of students in the PBOL group to the learning outcome of the students in the conventional talk learning group. While the analysis of time efficiency is done by comparing the learning time of the PBOL group to the learning time of PBL conventional. The students' interaction in the online discussion was analyzed by constructivism theory to evaluate the given blended learning.

METHOD

This was quantitative research by a quasi-experimental type. The population was entire students of 10^{th} class, which amount to 70 students. The used sampling technique was saturated sampling. Seventy students were divided into three classes, that are X MIA 1 (24 students), X MIA 2 (23 students), and X MIA 3 (23 students). The used experimental design was a single factor multiple-treatment design by two experimental groups and one control group (Table 1). The design was used because of the given treatment were more than one. The first experimental group was given problem-based online learning (X_{a1}), the second experimental group was given conventional PBL that pure face to face (X_{a2}), and the control group was given conventional lecture learning (X_b). This design was chosen to comprehend the PBOL effectivity to of enchacing learning outcomes and its efficiency to reduce learning time in face to face learning. The effectiveness to enhance learning outcomes can be analyzed by comparing the test results (T) of each group. On the other side, the efficiency to reduce learning time can be seen descriptively by comparing the learning time of the PBOL group and the PBL conventional group.

Table 1 Experimental Design

Groups	Pretest	Treatment	Posttest
Exp. 1	T	X_{a1}	T
Exp. 2	T	X_{a2}	T
Control	T	X_b	T

The given learning model as a treatment to the experimental class is problem-based learning. PBL is learning using real-world problems as a learning anchor to conduct a scientific investigation. The learning model is one of the scientific learning models suggested by the 2013 curriculum. PBL has five stages that can be seen in Table 2 below. The given learning topic is Newton's law of motion. Therefore, the investigated problems were related to forces on the static body, the inertia of a body, balancing forces, a relation of forces and mass to acceleration, and action-reaction forces that work to different bodies.

Table 2 Stages of PBOL

Phase	Activities
Orienting the problem	Online
Planning investigation	Face to face
Doing the investigation	Face to face
Developing and presenting result	Face to face
Reflecting and evaluating problem-solving process	Online

The first and last stages were conducted online in the WhatsApp group. The orienting problem stage was related to the present problem that will be solved by students. The teacher gave videos or a linked site for projecting the students to the studied topics. In this stage, the teacher also gave some simple questions as an initial task for students that should be collected in the next face to face meeting. In the next meeting, the teacher did not need to explain the investigated problem because it has been

done in the WhatsApp group. The activities in the classroom can be focused on determining the hypotheses and variable investigation, data collection and process, and present the group discussion result. Then, the last stage is done again online on the WhatsApp group. The teacher gave reflectional questions about the problem-solving process that has been conducted. From that process, the PBOL in this research needs two online meetings and one face to face meeting. The second experimental group took the same PBL scenario as the first group, but all of its learning process were conducted in the classroom. On the other side, the control class took conventional lecture learning, which has teacher-centered characteristics.

There were two looked data in this research that were students' learning outcomes and learning time. The learning outcomes data were gained by the test that consists of essay questions. The indicator of those questions are: (1) Describe forces that act on a body; (2) Explain the causes of physics phenomenon that relate to inertia concept; (3) Predict the phenomenon that will happen if a force acts on a body; (4) Explain daily life phenomenon when a force acts on a body; (5) Explain the motion of a body that related to action-reaction forces concept; and (6) Predict the motion of a body that related to action-reaction forces concept. The learning outcomes test result of every group will be analyzed to determine the significance of the given treatments toward students' learning outcomes.

The data of learning time were gained by observation toward the amount of learning time in the classroom. The analyses toward this data were done in a descriptive way to comprehend the learning time that has been reduced by PBOL to gain the learning goals. The data of students' learning outcomes were analyzed by one-way ANOVA that give prerequisite for normality and homogeneity of students' learning outcomes data. The hypotheses in this research are:

H_0 = there is no significant difference in students' learning outcomes score between the group that has been taught by PBOL, PBL conventional, and conventional lecture.

H_1 = there is a significant difference in students' learning outcomes score between the group that has been taught by PBOL, PBL conventional, and conventional lecture.

The tested criterion is H_0 will be rejected if the significance value (probability) is less than 0.05.

RESULT AND DISCUSSION

The pretest-posttest result of every group is shown in Table 3 below.

Table 3 Pretest and posttest result description

	Exp 1		Exp 2		Control	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Max	57.00	90.00	77.00	87.00	60.00	80.00
Min	23.00	43.00	23.00	43.00	20.00	37.00
Average	40.16	70.43	45.14	67.64	37.54	59.00
Normality test of posttest score	0.565		0.223		0.124	
Homogeneity test of posttest score			0.502			

ANOVA test was used to determine the differences in the posttest score of every group above. The used sig. value in the test was 0.05. The calculation result by SPSS produced the sig value as amount 0.04. This value is less than 0.05

and it made H_0 is rejected. The conclusion is it is significantly different from students' learning outcomes scores between the three classes. The post-hoc test was done to comprehend those differences and the result showed in Table 4 below.

Table 4 Post-hoc of the posttest score

Group (I)	Group (J)	Average dif. (I-J)	Sig.
Exp 1	Exp 2	2.273	1.000
	Control	11.348	0.004
Exp 2	Exo 1	-2.273	1.000
	Control	8.635	0.038

The posttest score of groups has taken problem-based online learning (experimental 1), and conventional problem-based learning (experimental 2) is different in a significant way toward the conventional lecture group. The suggested scientific learning by the 2013 curriculum is indeed more effective in enhancing students' learning outcomes. Student-centered learning allows students to construct knowledge based on their preconceptions. At the beginning of learning, students were given a stimulus about the daily life context of force and motion. Students were asked to suggest opinions about those phenomena. For example, there is a static body in the ground, and students should give an opinion if there are any forces act on it. Another example, a body is pushed, and then it moves to accelerate. In this case, students were asked to determine which are true about acceleration can produce forces, forces can produce an acceleration, or mass can produce the acceleration.

The role of the teacher in the early stages is leading students to give an original answer based on their understanding. According to Dinata & Suparwoto (2018), this phase is important for students to realize what are their conceptions about forces and motion. That preconception will be strengthened or be reconstructed by the learning process later. The conducted investigation in the laboratory will lead students to some concepts such as inertia of a body is affected by mass, balancing forces make a body at static circumstance or move with constant velocity, forces cause motion and acceleration, action-reaction forces have the same magnitude, it acts on different bodies, and action-reaction forces cannot cancel each other. However, those concepts will not just be accepted by students as part of their knowledge. The stage of reflection and evaluation of the problem-solving process is needed to allow students to realize the differences in their response if they were asked again with questions that they have answered in the first stage. Then, students who have experienced conceptual change will answer the question differently.

Carriger's reseaech (2015) exposed conceptual enhancement on students who have taken problem-based learning. Loyens, Jones, Mikkers, & van Gog (2015) also noted the same result, that problem-based learning could support students in understanding concepts, comprehend principles that bridging to another concept, and relating it to other concepts and principles. Therefore, it can enhance conceptual development and remediate misconceptions. Through experiences and comprehension that have achieved, students become more motivated in learning, work harder, and more skilled to find information effectively and efficiently. Based on Wenger (2011) those aspects are one of the efforts to become a long-life learner.

The efficiency of learning time was analyzed from the number of needed learning hours between problem-based online learning and conventional problem-based learning group. For three topics of investigation, the PBOL needs 9 (nine) learning hours (Jam Pelajaran) and 6 (six) online discussion activities. On the other side, the conventional PBL model needs an amount of learning hour

two times greater than PBOL to deliver the same topics learning. From the learning outcomes aspect, PBOL and conventional PBL models produce equal to output (Table 4). But from the time aspect, the PBOL needs fewer learning hours than PBL. The conclusion can be made from both facts that PBOL more efficient than conventional PBL. The implementation detail about problem-based online learning and conventional problem-based learning can be seen in Table 5 below.

Table 5 Differences of PBOL and PBL treatment

Topics	PBOL	PBL
Newton's first law	Orienting problem (online) Investigation, discussion, presentation (face to face 3 JP) Reflection and evaluation (online)	Orienting problem, investigation (3 JP) Discussion, presentation, reflection dan evaluation (3 JP)
Newton's second law	Orienting problem (online) Investigation, discussion, presentation (face to face 3 JP) Reflection and evaluation (online)	Orienting problem, investigation (3 JP) Discussion, presentation, reflection dan evaluation (3 JP)
Newton's third law	Orienting problem (online) Investigation, discussion, presentation (face to face 3 JP) Reflection and evaluation (online)	Orienting problem, investigation (3 JP) Discussion, presentation, reflection dan evaluation (3 JP)

The WhatsApp group can be used to create a discussion group, send a picture, and also share video and audio clips (Mwakapina et al., 2016). These functionalities can be utilized to reach students at the beginning of learning treatment. The teacher could make a class group and share file to focusing students on a problem. In this research, the video about Newton's laws phenomenon and student worksheet were sent by WhatsApp (Figure 1). Then students were asked to answer questions in the student's worksheet, and it should be collected in the next face to face meeting.

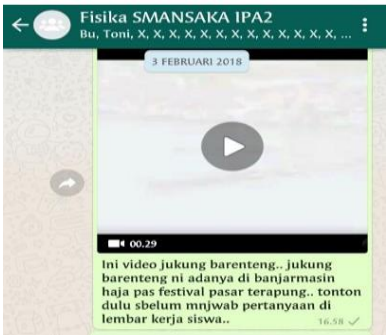

Figure 1 Orienting the problem of Newton's third law

The utilization of WhatsApp has an impact on students' engagement in the learning process. Figure 2 shows an online discussion session conducted in the reflection and evaluation problem-solving process stage. In the Figure 2, it can be seen some students are trying to expose their opinion. Something is interesting about it, some passive students in the classroom can become more active in an online discussion. Susilo (2014) stated the same matter, which is an enhancement of students' engagement in discussion activities. Some factors lead to that condition, such as the construction of a discussion environment, students' personality, and students' habit when using WhatsApp.

The learning condition on WhatsApp discussion would not make students feel intimidated if it compared to give an opinion in the classroom. When giving opinion in the online classroom, the intimidation would not be felt because "chatting" activity is their habit in daily life. It is different from giving an opinion in the classroom, when it happens, all of the eyes in the class

will be focused on the talking student. That situation will make students who aren't used to talk in front of the public hold their thought when delivering an opinion. Besides that, the online discussion gives the same opportunity to all students to expose their thinking. But in the classroom, it is different because only students who dare to raise hand up or pointed by the teacher that can deliver judgment.

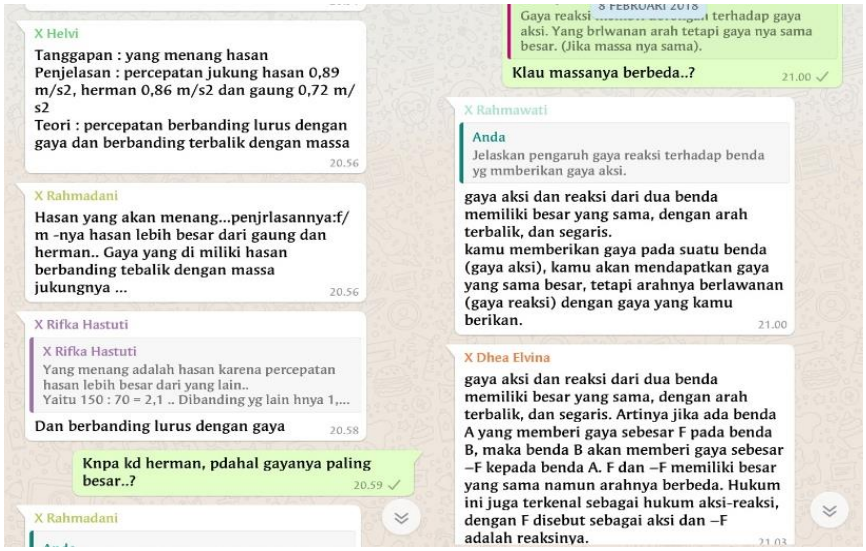

Figure 2 Online discussion on the reflection and evaluation stages

The integration of WhatsApp to PBOL produces a better learning reflection process than conventional PBL (Barhoumi, 2020). Figure 3 below presents students chatting when they reflected their reply if they answer the same questions at the orienting problem stage. In the PBOL, students can reflect their occurred conceptual change more personal by an individual chat with the teacher. It cannot happen at conventional PBL because many students didn't have the opportunity to "realize" their concepts. The reflectional questions on conventional PBL often are taken by superior students, while the other students stay passive and agree with the delivered opinion by an excellent student.

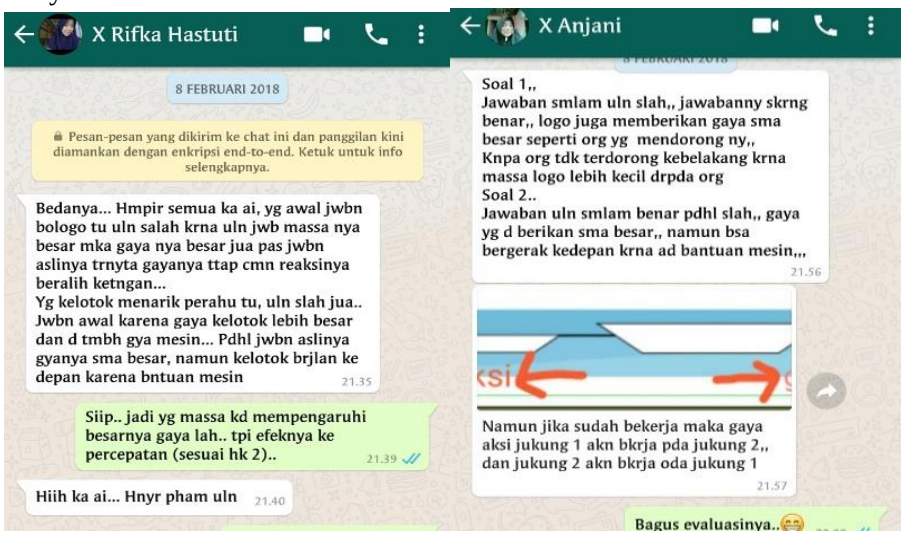

Figure 3 Concept reflection after the learning

The better reflection process will produce better conceptual change. The constructivism theory explains that a student learns by assimilation and accommodation process to construct a better mental model (de Ribaupierre, 2015). Through the assimilation process, a piece of new information will be added to student's preconceptions to become a more complex concept. On the other side, in the accommodation process, the held concept of a student will be reconstructed to fit with the newly gotten information. Picture 3 above shows each student realized they are mistaken in the beginning of learning. The information that they got in the investigation, discussion, and presentation confirmed that their early concept was a mistake. By their awareness, each student stated they have a new point of view based on the newly received information. In other words, the accommodation process has occurred on the students' conceptual structure about Newton's third law.

The online discussion also makes students think deeper when answer questions (Susilo, 2014). It is because each student will think when typing their answer in the section comment. Students need to check if their answer has been correct or still need to be fixed. It will make students think deeper and can minimize the spontaneous answers that usually occur in the face to face learning.

CONCLUSION

Problem-based online learning and conventional problem-based learning can produce better learning outcomes than conventional lecture learning. On the other side, the needed learning time of PBOL is fewer than PBL's. PBOL can be a solution of time limitation of learning in the classroom because of the learning output is equal to PBL but its learning time is more efficient. Therefore, this research can be used by other teachers as a reference to integrated technology in scientific learning. This research has limitations because it was done only in SMAN 1 Kelua. The result may be different if it is applied to another school. For future research, this research will be conducted on larger samples to gain a more comprehensive result.

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