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# Problem-Based Blended Learning: The Impacts on Students' Collaborative Skills

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**ABSTRACT**
This research was conducted in order to test the effectiveness of Problem-Based Blended Learning in improving students' collaboration skills. The purpose of this study is to describe the significance of learning differences between students who are taught by using Problem-Based Blended Learning model (BL-PBL), PBL model, conventional models, and the effectiveness of these learning models. The type of this research was quasi-experimental research, by conducting pre-test and post-test control group design. The subjects of this study were the eleventh grade students of SMAN 1 Sleman, while the number of the students in experimental classes was 33 students, and 35 students belong to the control classes (with a total number of 101 students). Experimental class I was taught by using Problem-Based Blended Learning, while experimental II was taught by using PBL learning model, and the control class was taught conventionally. The data of students' collaboration skills were obtained from the result of the questionnaire sheets during pre-test and post-test and by using observation sheets (filled out by observers) in each learning process. The data were analyzed by using N-Gain, and the effectiveness of students' collaboration skills showed by the value of the effect size calculated by using Partial Eta Squared. The results of this study indicate that the value of the effect size on the BL-PBL model was 0.773, and categorized as high (compared to other models). In addition, the N-gain value also showed that BL-PBL learning was in the high category (0.4). Hence, it can be concluded that BL-PBL learning is more effective in increasing students' collaboration skills rather than PBL and conventional models.

***Keywords:*** *Blended Learning, Collaboration Skills, PBL.*

 

## 1. INTRODUCTION

Collaboration skill is one of the skills that becomes the biggest challenge in the 21st Century, especially in the learning process [1]; while these skills can be developed in the learning process, either at school or outside school [2-4]. Globalization has made an education shift towards the use of technology, as well as the learning processes. The conditions that unite the space and time has forced teachers and students to change the learning process and learning experience. This becomes the turning point for the teachers, especially in selecting the learning methods that are integrated with the technology. Nevertheless, cooperation between teachers and students is the main key to achieve a successful learning. Collaboration skills can facilitate students and teachers in achieving the main goals [5-6]. Collaborative skills consist of two or more persons that work together to achieve the goals, by conducting face-to-face interaction (directly) or by utilizing the technology (online) in order to solve a problem and draw a conclusion [7]. Collaborative skills can combine some strategies in order to solve a problem and achieve the goal [8-9].

Collaboration skills can be nurtured if someone knows that they have the same goals with other members in a group and able to achieve the goal together [10]. Collaboration skills consist of several strategies that build a positive energy, creativity and positive emotions [11-12]. Collaboration skills consist of several cycles, such as planning, reviewing, practicing, giving feedback, and presenting [13] in order to help students collaborate with other group members and solve the problem. In addition, collaboration skills also provide opportunities for students to manage their emotions, especially when there are any different perspectives among them, and to make them learn how to defend an idea. [14].

The design of the assessment on collaboration skills consists of two components, such as: the teacher creates working conditions that attract the students to collaborate with other members, and students can share each task to the other members [15-17]. However, the collaborative skills that need to be improved are not only the collaborations with peers or teachers, but also when giving each other assistance, ideas, and respecting the different perspectives in order to achieve the main goal [18-19].

Collaboration skills can be built with the cooperative between students and teachers in in the learning process, such as: students provide same motivation in solving problem and the teacher can monitor their activities [20]. These skills become very important when students are in an environment that makes them feel like a true social creatures in daily life, especially in achieving goals and solving the problem [21].

The success of the learning process also depends on the collaboration skills between teachers and students during the learning process [22]. Learning by using Problem-Based Blended Learning model that integrate with technology can direct students in group learning to solve problems, find information, as well as increasing someone's confidence in discussing his/her ideas [23].

Collaboration skills consist of four aspects, such as; (1) ability to work actively and effectively, (2) ability to share the job desk to each member in the group, (3) ability to compromise with others, and (4) ability to adapt with the various roles. Furthermore, these four aspects were classified into six indicators in the questionnaires and observation sheets, in order to measure students' collaboration skills. The skills indicator used in this study is the result of synthesis from [24-26] consists of; (1) contribution to the group, (2) cooperate with anyone, (3) responsibility in finishing the tasks, (4) the attitude forms by finishing the task, (5) the ability to respect others, (6) and care to other friends and adaptation to the various roles.

PBL has been successfully applied to various learning topics and domains in education [27]. The most important thing in PBL is it can facilitate students in the process of delivering material from the teacher [28]. PBL activities that are focused on the inquiry process can help students to collaborate with each other, especially in understanding the context of the lesson [29]. PBL can direct students to learn from the context of problems in daily life on order to be able to develop their problem solving skills [30]. One of the Physics materials that is still difficult for students is Static Fluid material, such as understanding the concept of hydrostatic pressure, comparing hydrostatic pressure on different liquids, the concept of pascal, and the concept of Archimedes [31]. Some of these difficulties are related to the implementation of the theory about the events in daily life that requires several practices. In addition, another students' problem is they understand the concept, but they are not able to solve the problems in different contexts [32].

This study aims to explain the significant differences between learning by using BL-PBL, PBL, and conventional models, and also to measure the effectiveness of each learning model in improving students' collaborative skills. However, in the learning process in schools, teachers have never used BL-PBL model in the learning process. Hence, students' collaborative skills are still lack, showed by the group presentation process which revealed that there are still many students who do not pay attention, talk with other friends, and are not delighted in learning. This condition reinforces the researcher to conduct this research, and also for those schools that implement Curriculum 2013. Students must have the ability to collaborate with their friends or teachers in order to be able to deliver their opinions or ideas, especially in solving a problem. This research combines online and face-to-face systems to help students understand the material, even before entering the class. In addition, students can also access material directly (online), and can prepare a preliminary knowledge about what should be done during face-to-face classes. The assignments given for each group is also done online, where each students' role will be different in order to make them active and responsible in group. Students can

make optimal collaboration skills in the discussion process. In discussion forum, their communication skills are increasingly trained in conveying knowledge and results of investigations during presentations in front of the class. Communication becomes an important skill that must be possessed by students.

## 2. RESEARCH METHOD

### *2. 1 Types of Research*

This research implemented a quasi-experimental research by conducting pre-test and post-test control group designs. The research subjects consisted of experimental class 1, experimental class 2, and control class. Experimental class 1 was taught by using Problem-Based Blended Learning model; while experimental class 2 is taught by using PBL model; and control class is taught conventionally.

This research was conducted in the eleventh grade students who belong to the science major in SMAN 1 Sleman, that consisted of 101 students. The experimental class consisted of 33 students and the control classed consist of 35 students. The samples were determined by implementing random sampling technique, since researchers cannot randomly choose their own students. The students in each class were taught by using different model, but with same material (Static Fluid material). A questionnaire was used in the pre-test and post-test in order to measure students' collaborative skills.

In addition, the observation sheets were used to measure students' collaborative skills, especially in the classroom (face to face). Indicators of the collaborative skills used in this study consisted of four aspects, such as (1) the ability to work actively and effectively, (2) responsibility with the team to complete the task, (3) the ability to compromise with others, and (4) the ability to adapt to various roles, stated in the nineteen statements on the questionnaire, and seven statements contained on the observation sheet. The results of the questionnaire were validated by using content validity and evaluated by expert judgment using Cronbach's alpha coefficient (0.87), categorized as high.

### *2. 2 Data Analysis*

The data were analyzed by using descriptive and inferential analysis. Descriptive analysis was used to explain the average score, the maximum score, the minimum score of each class, both in the pre-test and post-test. Meanwhile, the N-gain value of each class was categorized according to the standard gain [33]. In addition, inferential analysis was used to see the effectiveness of PBL model-based blended learning in improving students' collaboration skills by using Paired Sample Test (t-Test) with a significance of 5%, showed by the results of Test Within subjects which were declared significant if the value is <0.05, and used general linear model in order to know the effect size of the learning model on collaborative skills.

## 3. RESULTS AND DISCUSSION

The results of the statistical description of students' collaboration skills for the experimental and control classes are presented in Table 1.

**Table 1. Students' Collaborative Skills based on Pre-test and Post-test Results**

| Class | *Pre-test* | | | *Post-test* | | |
|---|---|---|---|---|---|---|
| | Min. | Maks. | Average | Min. | Maks. | Average |
| Eksperiment 1 | 53 | 78 | 56 | 71 | 90 | 71 |
| Eksperiment 2 | 35 | 76 | 56 | 51 | 89 | 66 |
| Control | 39 | 55 | 48 | 38 | 60 | 57 |

Based on the results of Table 1, it can be seen that the average score of the post-test in experimental class 1 is higher than the other classes. It indicates that after implementing Problem Based Blended Learning, students in the experimental class 1 can improve their collaboration skills based on the results of questionnaire on the the pre-test and post-test. In addition, it is showed by the increase of N-gain presented in Table 2.

**Table 2. Results of N-gain Collaborative Skills**

| Class | Gain | Category |
|---|---|---|
| Eksperiment 1 | 0.4 | Medium |
| Eksperiment 2 | 0.2 | Low |
| Control | 0.2 | Low |

The results of Table 2 show that the highest N-gain value was obtained by experimental class 1 that are taught by using Problem-Based Blended Learning (0.4), and categorized as medium. In the experimental class 1, the students were classified in a small group, where a group consisted of three persons. In addition, before the class, the students had divided the tasks, such as chairman, secretary and presenter. Hence, in face-to-face learning, each student had already understood their own jobdesk. In addition, students had been able to see the LKPD before entering the class, and they can read in advance about what practicum conducted in the classroom. In other words, students were being more ready to learn.

Meanwhile, the experimental classes and the control class obtained same N-gain value, while it is categorized as low, since the group in experimental class 2 are considered as large groups. Large groups consist of five to six persons, and causes not all students were involved in the practicum process. There are several students who are passive and only watch their friends in the investigation process. Meanwhile, in the control class, the teacher used conventional model where students create groups consisted of five to six persons and had presentations. This situation made only half of the students are active in the presentation and discussion. Only a few students who looked enthusiastic and some students were bored and not motivated in learning.

The results of the pre-test and post-test scores of collaboration skills were also analyzed using the Paired Sample t-Test, which is presented in Table 3.

**Table 3.** Paired Sample Test t-Test Collaboration Skills

| Class | Sig. (2 tailed) |
|---|---|
| PreEks1-PostEks1 | 0,00 |
| PreEks2-PostEks2 | 0,00 |
| PreControl – PostControl | 0,00 |

Based on Table 3, the significant value of the three classes show that the results are smaller than 0.05. This shows that there are significant differences in the average pre-test and post-test collaboration skills in the three classes. In addition, it can also be seen in the table of Test of Within - Subject Effects results presented in Table 4.

**Table 4.** Test of Within-Subject Effects

| Source | | F | Sig. |
|---|---|---|---|
| **time * Group** | Sphericity Assumed | 20,950 | ,000 |
| | Greenhouse-Geisser | 20,950 | ,000 |
| | Huynh-Feldt | 20,950 | ,000 |
| | Lower-bound | 20,950 | ,000 |

The results of the Test of Within-Subject Effects table seen in the time line * group and Greenhouse-Geisser sub-rows show F = 20,950 with a significance value of 0.000 indicating that there is an interaction between pre-post test in each class (experimental 1, experimental 2, and control class). The comparison of effect size values between experimental classes and control class can be seen in Figure 1.

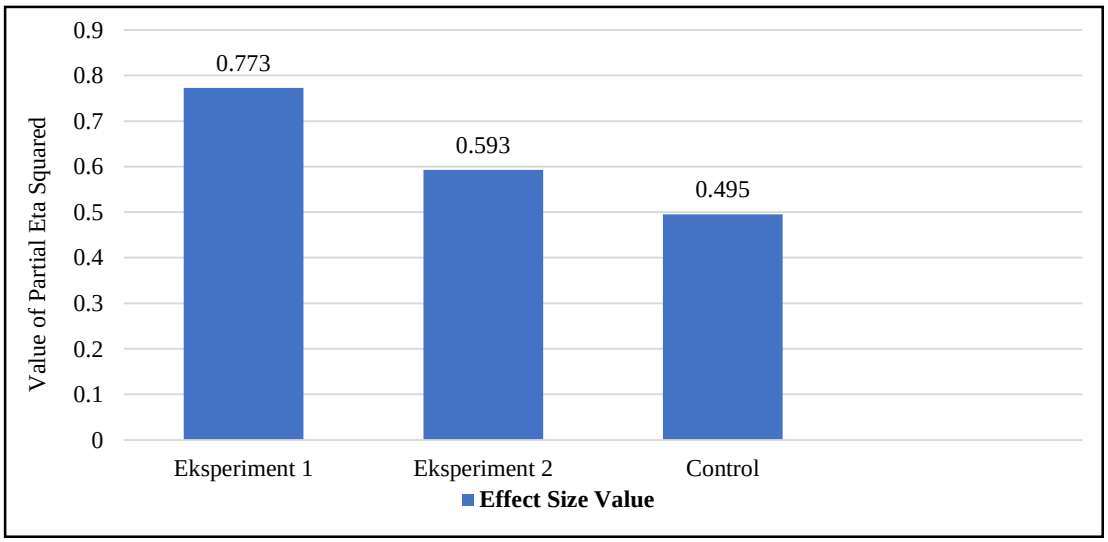


**Figure 1.** Comparison of Effect Size Value in experiment and control class

Figure 1 shows the increase of the collaborative skills from each class. Problem-Based Blended Learning class shows the highest increase compared to other classes. The graph shows that there are any significant differences between the three classes. In Problem-Based Blended Learning and PBL classes, the difference is not really significant, because the experimental class can finish all stages in Problem-Based Blended Learning model. In other words, for all stages in the Problem-Based Blended Learning model, everything can be done face-to-face. Meanwhile, in experimental class 2 who are taught by using PBL model, the students could not finish their works in one meeting, based on all stages of the PBL model, since the students did not know what will be learned, so discussion and practicum process take a long time. However, a very significant difference is seen in conventional class, since the teacher only gave assignment or ask the the students to do a presentation. Thus, students' collaborative skills are not too distracted and students tend to be bored and passive during the learning process.

In order to see the effectiveness of students' collaboration skills, it can be seen in the multivariate test table presented in Table 5.

**Table 5.** Multivariate Test

| *Wilk's Lambda* | F | Sig. | Partial Eta Squared |
|---|---|---|---|
| *Blended Learning* – PBL | 334,410[a] | ,000 | ,773 |
| PBL | 142,555[a] | ,000 | ,593 |
| Convensional | 95,932[a] | ,000 | ,495 |

Based on the results of the multivariate test table, it shows that the value of the effect size expressed in the Partial Eta Squared value. Problem-Based Blended Learning has the highest effectiveness, showed by the amount (0.773), and it is he highest value compared to other classes. It shows that Problem-Based Blended Learning is much more effective in improving students' collaborative skills.

Students in each class experience an increase in their collaborative skills but different for each aspect. The average scores obtained from the post-test showed that the experimental class that were taught by using Problem-Based Blended Learning obtained the highest score, but not too significantly different from the experimental class 2 that were taught by using PBL model, since both classes use the same learning model. It is ln line with previous research conducted by Redhana [34] and Mayasari, Kadarohman, Rusdiana & Kurniawati [35] that revealed that Problem-Based Blended Learning can increase students skills in the 21st Century, and one of thems is collaborative skills, since students can link the theory with practice. It can also improve collaborative skills among the students in the learning process. Meanwhile, the conventional class experienced an insignificant increase like the experimental class, since conventional classes only use presentations (power point) to deliver the results of their discussions, that makes the presentation is less interesting and the students did not pay attention. In addition, learning by using blended learning can encourage students to become independent learners, and change the learning patterns into student centers. In other words, collaborative skills between each student can be built more effectively [36]. Observation results for each aspect of collaborative skills obtained from observers are presented in Figure 2.

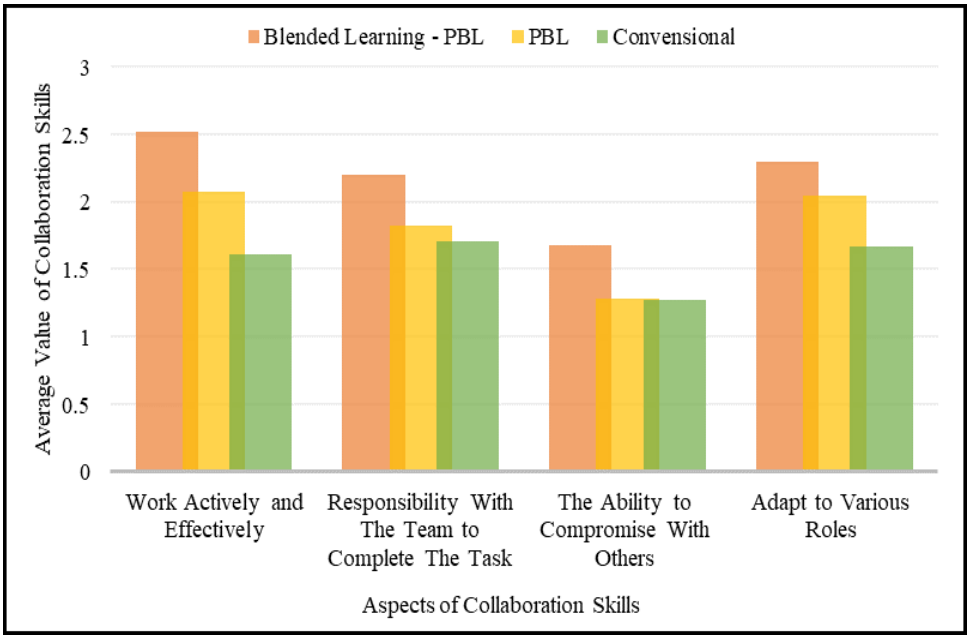


**Figure 2.** Enhancing Collaboration Skills Aspects

Figure 2 shows the results of the increase in students' collaborative skills for each class. The first experimental class that were taught by using Problem-Based Blended Learning obtained the highest score in working actively and effectively, such as in active contribution and collaboration aspects, compared to other aspects. Hence, the students that were taught using Problem-Based Blended Learning obtain an increase in their collaborative skills, both online and face-to-face learning. This is in line with previous research conducted by Lestariningsih and Wijayatiningsih [37], stated that blended learning with PBL models can create cooperation between teachers and students. This is also supported by communication through the online devices that causes social interaction.

For experimental class 2 that were taught by using PBL model, it was found that the aspects of adapting to various roles reached the highest score, since PBL model directs students to collaborate with each other in solving problems [38]. Even though face-to-face learning took a shortage of time, the presentation and discussion stages were not conducted for each meeting.

Meanwhile, in the control class, the results on the responsibility of finishing the task aspect reached the highest score, since students are divided into large groups. It was showed by students' good presentations. However, in the process, only few students were enthusiastic in listening to the presentations, while some students were passive and did not pay attention to the presentations.

However, in this study, the increases were not found in every aspects, since there must be a consistent attitude from the teacher and students to collaborate with each other in the learning process. In addition, each student has different habits in learning and not all of them think that collaborative learning is easy, and they need time to learn a different method. Nevertheless, it can be seen that Problem-Based Blended Learning can improve students' collaboration skills more effectively than other classes. This shows that learning that combines online and offline systems and integrated with PBL models has a great impact on improving students' collaboration skills.

## 4. CONCLUSION

Based on the results of the effect sizes, it can be concluded that Problem-Based Blended Learning is more effective in improving students' collaboration skills rather than PBL models and conventional learning. In addition, it can be seen from the significant difference from the average scores of pre-test and post test and the N-gain value. However, there are some suggestions for further research, such as (1) group learning can be more effective when groups are formed in small groups, where students can clearly divide the task for each member, in order to make each student responsible; (2) The material used in the learning process must be considered and suitable with the students' learning needs and the variables that are measured; and (3) Cooperation between teachers and students is the key to reach the success in the learning process that has been designed.

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