The Effects of Problem-Based Learning with Mind Mapping to Enhance Students' Creative Thinking Skills and Learning Outcomes

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Abstract
The quality of Indonesia's education need to obtain a very serious attention because its level tends to be decreasing. An effort to be done is by applying the learning innovation on education. Based on the observation to be conducted at Methodist Junior High Schools, the learning of Biology had not still applied the variation of learning models yet. This study aimed to give a wide description about the effects of Problem-Based Learning (PBL) with mind mapping on students' creative thinking skills and learning outcomes. This study was a quasi-experimental design with the pre- and post-test design. The population of this study were the whole students of Methodist Junior High Schools all over Medan, that were the seventh graders with an accreditation of A, namely SMP Methodist 1 Medan, SMP Methodist 5 Medan and SMP Methodist 6 Medan Academic Year 2016/2017 in total of 3 classes each. The sample withdrawal was conducted using purposive sampling technique. The data analysis which was used by an independent t-test and Pearson test. The result showed that there were the effects of Problem-Based Learning with mind mapping on students' learning outcomes where $p = 0,000 < 0,05$, there were the effects of PBL with mind mapping on students' creative thinking skills where $p = 0,000 < 0,05$, there were the relationships between students' creative thinking skills and learning outcomes taught by PBL with mind mapping where $p = 0,000 < 0,05$. The teachers were suggested to be able to design and plan either the learning instruments or strategies, learning models, methods or media that can involve students more actively in the process of teaching and learning.
Keywords: Problem-Based Learning, Mind Mapping, Creative Thinking Skills, Learning Outcomes

1. Introduction
The application of varied learning models can help teachers on the process of teaching and learning. The learning target to be applied will be achieved if teachers are capable to select some appropriate learning models containing of teaching materials, students' competences and infrastructures available that teachers need to do as a way/purpose and their own scope (Engkoswara, 1998).

The learning success of Biology in the level of Junior High School as known as Sekolah Menengah Pertama (SMP) has been expected more to all the parties especially the science teachers. According to Sabri (2010), a teacher is a main role model in the process of teaching and learning. On the way of teaching and learning needs to involve several kinds of activity that should be done, if expecting an optimal result for sure.

One of the best ways to be used to obtain an optimal result that we want is giving a pressure on the learning process. This will be conducted by selecting one of the most appropriate learning models. A way to deliver a more effective learning materials is by using a structured learning strategy or model. This structured model can be a Problem-Based Learning, as one of the learning models which is based on many problems that requires authentic investigation, that is an investigation which requires a real solution of the real problems (Arend, 2008).

Based on a research from Raimi (2004) on the title of "Problem-based learning strategy and student's quantitative ability in the learning of Biology". After being analyzed using a multiple analysis showed that an experimental group has obtained the highest score: 57,54, while if being compared to control group has obtained 45,62 and student's quantitative ability of experimental group has obtained 52,14, if being compared to control group has only obtained 50,62. This was proven from the research findings that the application of problem-based learning could give science students a good pair of scales to learn much more about scientific knowledge.

The study from Matt & Rick (2001) entitled "The relationships of social end economical backgrounds on students' critical and creative thinking skills had found that the contribution of critical thinking: 24%, perseverence: 5%, abstraction: 8%, originality: 2%, elaboration: 1%, and creative thinking: 60%. This study was conducted on the participating groups.

One of the best ways to urge and motivate students to learn meaningfully is by applying a mind mapping, either as media or evaluation devices. Mind mapping develops the divergent and creative thoughts as well. Mind mapping that we commonly called concept mapping is a great tool of organizational thinking in which the easiest way to place information into brains and take that information if necessary (Busan, 2008).

The study from Husli (2007) about the use of mind maps-note taking on seventh students' learning outcomes of Biology on the topic of Classification of Living Things, showed that mind maps-note taking would give a balanced benefit on the improvement of students' learning outcomes of Biology. The study from Barak

and Shakhman aimed to explore science teaching based on the changes of practice and instructional concept of science teachers. Data was collected from a semi-structured interview to the 11 experienced-science teachers. It showed that science teachers had still applied a conventional and traditional teaching method in the classroom, so the result of science teaching based on the the changes of practice and instructional concept was not satisfactory yet.

Based on the result of observation at Methodist Junior High Schools, that the learning of Biology had not been optimally applying the variation of learning models. Of those issues, it required to realize that the influence in selecting learning models was an important external factor to enhance students' creative thinking skills and learning outcomes all at once. From those backgrounds aforementioned, the aim of this study was to find out the effects of problem-based learning with mind mapping on students' creative thinking skills and learning outcomes at Methodist Junior High Schools all over Medan.

2. Research Method

This study was conducted at Methodist Junior High Schools all over Medan, with an accreditation of A. The population of this study were the whole students of seventh grade at SMP Methodist 1 Medan, SMP Methodist 5 Medan and SMP Methodist 6 Medan on the first semester of academic year 2016/2017 in January to May 2017. The samples of this study were 2 classes, one class was taught using Problem-Based Learning with mind mapping and another class was taught using Problem-Based Learning without mind mapping by purposive sampling technique.

This study used a quasi-experimental design with a pre- and post-test design. The collected data include the scores of pre- and post-test learning outcomes on the topic of ecosystem, with 30 multiple choices in 4 options (a, b, c, d) that had been through the process of validity and reliability test, 20 creative thinking tests in the form of checklist that had been through the process of validity and reliability test and being conducted at the end of study. The data analysis used an independent t-test and Pearson test.

3. Result and Discussion

Before being under treatment, at the beginning of sessions all the students were given a pretest to find out their initial abilities about the topic of ecosystem. The description of students initial abilities between two classes, shown in Table 1 and Table 2.

Table 1. The Tabulation of Students' Pretest Data Treated by PBL with Mind Mapping in Every School

The Description of Data in Experimental Class I

	N	Mean	Std. Deviation	Min	Max
Pretest_Methodist_1	30	48,3330	15,23168	13,33	73,33
Pretest_Methodist_5	30	52,2217	13,68313	16,67	70,00
Pretest_Methodist_6	30	46,5553	9,92174	26,67	63,33

Table 2. The Tabulation of Students' Pretest Data Treated by PBL without Mind Mapping in Every School

The Description of Data in Experimental Class II

	N	Mean	Std. Deviation	Min	Max
Pretest_Methodist_1	30	54,5557	14,47643	26,67	76,67
Pretest_Methodist_5	30	49,3340	11,42788	20,00	70,00
Pretest_Methodist_6	30	45,8890	12,70546	16,67	73,33

Subsequently both classes were given different treatments, Experimental Class I was taught using Problem-Based Learning with Mind Mapping and Experimental Class II was taught using Problem-Based Learning without Mind Mapping. At the end of sessions given a post-test to find out the students' learning outcomes. The description of post-test results in both classes can be seen in Table 3 and Table 4.

Table 3. Description of Students' Post-test Data of Experimental Class I in Every School

The Description of Data in Experimental Class I

	N	Mean	Std. Deviation	Min	Max
Postest_Methodist_1	30	85,1110	8,10571	70,00	79,67
Postest_Methodist_5	30	89,2220	4,84961	80,00	96,67
Postest_Methodist_6	30	86,5553	5,63910	76,67	96,67

Table 4. Description of Students' Post-test Data of Experimental Class II in Every School

The Description of Data in Experimental Class II

	N	Mean	Std. Deviation	Min	Max
Postest_Methodist_1	30	75,5553	4,49203	70,00	83,33
Postest_Methodist_5	30	75,8893	4,34880	70,00	83,33
Postest_Methodist_6	30	77,7783	5,62831	70,00	90,00

Based on the results of pretest and post-test could be found out the level of students' comprehension about the topic of ecosystem by counting its normalised gain. The description of data gain in both classes was given in Table 5 and Table 6.

Table 5. Description of Students' Data Gain of Experimental Class I

The Description of Data in Experimental Class I

	N	Mean	Std. Deviation	Min	Max
Postest_Methodist_1	30	0,69	0,20	0,11	0,95
Postest_Methodist_5	30	0,76	0,12	0,50	0,95
Postest_Methodist_6	30	0,74	0,12	0,45	0,94

Table 6. Description of Students' Data Gain of Experimental Class II

The Description of Data in Experimental Class II

	N	Mean	Std. Deviation	Min	Max
Postest_Methodist_1	30	0,41	0,22	-0,14	0,77
Postest_Methodist_5	30	0,50	0,13	0,20	0,76
Postest_Methodist_6	30	0,57	0,16	0,18	0,80

The result of data in creative thinking skills was obtained by giving students the creative thinking's questionairre sheets at the end of sessions. Based on the result of student creative thinking's questionairre can be figured out that creative thinking skills about the topic of ecosystem after being under treatment were obtained the result of students' creative thinking skills in experimental class I at SMP Methodist 1 was 72,00 with a deviation standard of 7,66, at SMP Methodist 5 was 74,00 with a deviation standard of 6,54, at SMP Methodist 6 was 69,00 with a deviation standard of 5,85. Meanwhile in the experimental class was obtained the average post-test at SMP Methodist 1 was 72,70 with a deviation standard of 8,60, at SMP Methodist 5 was 73,00 with a deviation standard of 6,27, at SMP Methodist 6 was 74,00 with a deviation standard of 6,85.

Based on the result of students' creative thinking skills can be found out the percentage of the achievement levels of students' creative thinking. The description of students' creative thinking data can be seen in Table 7 and Table 8.

Table 7. Percentage of Students' Creative Thinking Criterion in Every School

School	Value	Experimental Class I (*Problem-Based Learning* with *mind mapping*)		Experimental Class II (*Problem-Based Learning* without *mind mapping*)		Category
		F	%	F	%	
SMP Methodist 1	N < 30	0	0,00	0	0,00	High
	N≤ N ≤ 70	13	43,33	13	43,33	Moderate
	N > 70	17	56,67	17	56,67	High
	Total	30	100,00	30	100,00	
SMP Methodist 5	N < 30	0	0,00	0	0,00	Low
	N≤ N ≤ 70	8	26,67	11	36,67	Moderate
	N > 70	22	73,33	19	63,33	High
	Total	30	100,00	30	100,00	
SMP Methodist 6	N < 30	0	0,00	0	0,00	Low
	N≤ N ≤ 70	16	53,33	14	46,67	Moderate
	N > 70	14	46,67	16	53,33	High
	Total	30	100,00	30	100,00	

Table 8. Percentage of Students' Creative Thinking Criterion in the whole samples

Value	Experimental Class I (*Problem-Based Learning* with *mind mapping*)		Experimental Class II (*Problem-Based Learning* without *mind mapping*)		Category
	F	%	F	%	
N < 30	0	0,00	0	0,00	Low
N≤ N ≤ 70	41	45,56	38	42,22	Moderate
N > 70	49	54,44	52	57,78	High
Total	90	100,00	90	100,00	

After conducting the prerequisite test of data analysis, showed that the data was distributing normally and homogenously so that it could be conducted a hypotheses testing. The data testing used SPSS 17.0 For Windows to three high schools, namely SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively. From the result of testing on the data of whole samples used an Independent Sample Test, showed that Sig. < α (0,00 < 0,05.), can be concluded that students' learning outcomes taught by applying Problem-Based Learning with mind mapping would give higher effects rather than students' learning outcomes taught by applying Problem-Based Learning without mind mapping in three high schools, SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively.

From the result of testing to the data of whole samples by an Independent Sample Test showed that Sig. < α (0,00 < 0,05.), can be concluded that students' creative thinking skills taught by applying Problem-Based Learning with mind mapping would give higher effects rather than students' creative thinking skills taught by applying Problem-Based Learning without mind mapping in three high schools, SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively.

From the result of testing to the data of whole samples by a Correlation Test showed that Sig. < α (0,000 < 0,05.), can be concluded that there were relationships between students' creative thinking skills and learning outcomes taught by applying Problem-Based Learning with mind mapping in three high schools, SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively (macro analysis).

3.1. The Effects of Problem-Based Learning with Mind Mapping on Students' Learning Outcomes

Totally students who have learned by applying Problem-Based Learning with mind mapping would give the higher learning outcome gains rather than students who have learned by applying Problem-Based Learning without mind mapping, that were the average gain of learning outcomes at SMP Methodist 1 was 0,69 with a deviation standard of 0,20, at SMP Methodist 5 was 0,76 with a deviation standard of 0,12 and at SMP Methodist 6 was 0,74 with a deviation standard of 0,12.

Meanwhile students who have learned by applying Problem Based Learning without mind mapping was obtained the average gain of students' learning outcomes at SMP Methodist 1 was 0,41 with a deviation standard of 0,22, at SMP Methodist 5 was 0,50 with a deviation standard of 0,13, at SMP Methodist 6 was 0,57 with a deviation standard of 0,16. Based on the result of micro hypotheses testing in every school, through the data tests by using SPSS 17 for Windows found out that students who have learned by applying Problem-Based Learning with mind mapping had significant effects on the improvement of students' learning outcomes. From the result of testing at SMP Methodist 1 showed Sig. < α (0,00 < 0,05.), at SMP Methodist 5 showed Sig. < α (0,00 < 0,05) and at SMP Methodist 6 showed Sig. < α (0,00 < 0,05) by an Independent Sample Test, it can be concluded that the third hypotheses were accepted. It means that students' learning outcomes taught by applying Problem-Based Learning with mind mapping were higher than students' learning outcomes taught by applying Problem Based Learning without mind mapping. In this case, Problem-Based Learning with mind mapping would give the significant effects on students' learning outcomes at SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively. In addition, from the result of testing to the whole samples in micro showed Sig. < α (0,00 < 0,05.) by an Independent Sample Test, it can be concluded that the third hypotheses were accepted. It means that students' learning outcomes taught by applying Problem Based Learning with mind mapping were higher than students' learning outcomes taught by applying Problem-Based Learning without mind mapping. In this case, Problem-Based Learning with mind mapping would give the significant effects on students' learning outcomes of all samples in three high schools, namely SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan. Thus, it could be seen that the use of Problem-Based Learning with mind mapping was effective on students' learning outcomes.

Biology has its special characteristic that differs to other sciences. One of the specialties is to intend the comprehension and problem-solving that students have overcome and also the comprehension on the patterns and concepts which lead to a better achievement. Thus, one of the conditions in order students to be successfully

passing through the learning process is a lot of efforts to optimizing the comprehension, recall and also connecting one learning material to others (Arend, 2008).

One of the best ways to be done in an effort to enhance students' learning outcomes and comprehension is by applying a Problem-based learning with mind mapping, by the means of other relevant learning materials, so that students can easily understand and recognize whichever materials that should be connected to subsequent learning materials and also to accomplish problems that students have faced in the learning process (Widura, 2008).

3.2. The Effects of Problem-Based Learning (PBL) with Mind Mapping to Enhance Students' Creative Thinking Skills

From the result of testing to the data of whole samples using SPSS 17.0 for Windows was if Sig. (1-tailed) < α means that Ha was accepted, but if Sig. (1-tailed) > α means that Ha was rejected. From the result of testing to the data of whole samples showed Sig. < α (0,00 < 0,05.) by an Independent Sample Test, it can be concluded that the fourth hypotheses was accepted. It means that students' creative thinking skills taught by applying Problem-Based Learning with mind mapping were higher than students' creative thinking skills taught by applying Problem Based Learning without mind mapping. In this case, Problem-Based Learning with mind mapping would give the significant effects on students' creative thinking skills in three high schools, SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively.

Biology lesson is one of the other lessons taught either in Junior High School or in Senior High School as well. The emphasis on Biology lesson has prioritised students' abilities in observing, describing, analysing and reckoning nature tendency so that it becomes a systematic knowledge structures.

Students who have higher creative thinking skills can learn in full concern and innovation, to building a perception with a higher passion and always be curious and attempting to discover new things towards many problematics occur.

3.3. Relationships Between Students' Creative Thinking Skills and Learning Outcomes Taught by Problem-Based Learning with Mind Mapping

From the result of testing to the data of whole samples showed Sig. < α (0,000 < 0,05.) by a Correlations Test in macro or testing to the whole samples, it can be concluded that the fifth hypotheses was accepted. It means that there were relationships between students' creative thinking skills and learning outcomes taught by Problem-Based Learning with mind mapping in three high schools, SMP Methodist 1, SMP Methodist 5 and SMP Methodist 6 Medan, consecutively.

Thinking creative is to think consistently and continuously in generating something creative/original in accordance with necessity.

Students who have creative thinking skills possibly mean that they have an ability to seek for solution or problem-solving to their own problems so that they get used to develop their own reasoning in understanding learning materials that a teacher has offered, eventually those materials can be understood more easily to obtain optimum learning outcomes.

4. Conclusion

Based on the results and discussions aforementioned above, it could be concluded that there were significant effects by appling Problem-Based Learning with mind mapping on students' creative thinking skills and learning outcomes taught by Problem Based Learning as well.

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