

The Effectiveness of Implementation of Character-Based Problem Solving Open-Ended Learning Method Towards Students' Learning Outcomes

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Abstract--the purpose of the study is to find out the differences in the students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method. This research is quasi-experimental study. The subject of the study is the students who take the Transportation Planning Course at Department of Building Construction Education of Faculty Engineering in State University of Malang. The sample of the research is 2 off/class. In order to get the same group, these two classes are adjusted especially for the students with cumulative achievement index from semester 1 to 4. The number of experimental class is 15 students and the number of control class is 15 students. T-test is used to test the hypothesis. Based on the data analysis, it can be concluded that there was a significant difference in the students' learning outcomes in the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method.

Keywords--problem-solving, character, learning outcomes

I. INTRODUCTION

Regarding the quality of education issues and the future life in the XXI century, the fundamental changes in higher education is needed to improve the quality of graduates. Subandi Sardjoko (2015) Director of National Planning and Development Education Agency (Bappenas), said the index of Indonesia's higher education level is 14.6 percent and it is considered low. The situation is different from Singapore and Malaysia which have a better education level index (28%) and (33%). Likewise, the competitiveness of Indonesian tertiary education graduates is still far below from other Asean countries. In conclusion, the quality of graduates are still low. On the other hand, the high level of corruption and power abuse by state officials and the private sector gives bad impacts to the university quality. It means that the university has failed to secure the character values of their graduates.

Based on the affective/mental capability that related to the character/behavior of the students in Indonesia, the quality of Indonesia graduates needs to be improved. We can see this fact from time to time through various mass media reports about some of the students' negative behavior. Several incidents of students' fights in Makassar which were followed by the destruction of campus infrastructures still occur frequently and continue to recur

until now. Physical violence during the campus orientation often occurs from year to year. For example is the death of the student of National Institute of Technology Malang at Ospek 2012. Plagiarism issues among students often occur (Rina et al, 2009; <http://edukasi.kompasiana.com>, 2013); In Malang City, the students' research and scientific works contain 90% of plagiarism (Jawa Post, 2015). It shows that the students' mentality need to be fixed. The hedonistic lifestyle, where the most of the students compete and dream to live in luxury life (<http://www.dakwatuna.com>, 2012). Spree and "hang out" at cafes, malls and plazas, this is part of their life agenda; our young people consume liquor, drug party, free sex and others (Praja and Damayantie, 2013). These data shows that the students' cognitive domain (brain intelligence) and affective domains (mental, character, attitude) need to be improved. This is in line with the current government's policy about mental revolution for improving and developing a civilized character.

In order to solve those problem above, universities must make educational breakthroughs. One of the good solution is using the innovative learning method to develop the cognitive capability and affective/mental ability systematically. Based on the background above, it is necessary to find a learning method for Transportation Planning course to improve the cognitive, psychomotor and affective capability simultaneously. The right learning strategy to solve the problem is by implementing the Character-based Problem Solving Open-Ended learning method which is developed by Wood (1975; 1997; 2000). Problem solving ability is high level of thinking skill that really needed for engineering students. The result of Kuncoro's (2012) study concluded that the Character-based Problem Solving Open Ended learning method could improve the students' learning outcomes in Engineering Mechanics.

The meaning of Problem solving open ended learning model (open problem solving) is in line with constructivist's view, it stated that the problem solving open ended model uses real-world cases and as a medium in developing critical thinking and problem solving skill for the students. Furthermore, new knowledge is obtained in a meaningful context. The students are involved actively in solving problems/challenges and building their own understanding. If there are no challenges in learning

and training situations, it means no problems. Analytical problem solving tends to explore cognitive skill, while the Problem Solving Open-Ended involves significant social and affective dimensions (Newell and Simon (1972).

In the field work, college graduates are not enough to have only adequate cognitive capability, but they must also be provided with high affective (mental attitude) ability. Good cognitive capability without good affective capability does not guarantee one's success in life. Many college alumni who are smart to become state officials are dragged into cases of corruption/power abuse, because they do not have adequate affective/character capability (Dharmawan, 2014). The best way for affective/mental attitude development is to integrate the content elements of mental/character in cognitive tasks, increase student activities, giving individual and group assignments, discussion to enable the students to make presentations (Watz, M. 2011; White & Warfa, 2011 ; Mantonye, et.al, 2013). Thus, it can develop the cognitive ability, and mental/character ability simultaneously in the curriculum and learning.

The empirical test needs to be conducted for the implementation of Character-based Problem Solving Open Ended learning method and conventional learning method. The purpose of the empirical test is to find out the reliability of implementation of Character-based Problem Solving Open Ended learning method and conventional learning method. If the use of the Character-based Problem Solving Open Ended learning method is better than conventional learning method, the model is worth to use in learning. But if conventional learning model is better than Problem Solving Open Ended Character-based learning model, then the other learning methods need to be developed. Based on the background of the problems above, the purpose of this study is to find out the differences in the students' learning outcomes between the use of Character-based Problem Solving Open Ended learning method and conventional learning method at Transportation Planning course.

This research is experimental quasi study. The subject of the study is the students who take the Transportation Planning Course at Department of Building Construction Education of Faculty Engineering in State University of Malang. The experimental design is presented in Table 1 as follows:

Table 1. Experimental Design

Group	Dependent Variable	Posttest
(R) Eksperimental	X1	Y
(R) Control	X2	Y

In this design, there are experimental group and control group. X1 treatment is given for the experimental group and X2 treatment is given for the control group. In the last step, the posttest is conducted for both groups.

Notes:

- R = Subject Grouping
- X1 = Character-based Problem Solving Open Ended Learning Method
- X2 = Conventional Learning Method

Y = Post test

Based on the field trial design above, the hypothesis is described as follows: Different learning structures (X1, X2,) have different effects on learning outcomes. The subject of study for the field test is the students at semester 5 Department of Building Construction Education of Faculty Engineering in State University of Malang. These subjects are taken from the students who take Transportation Planning course in the 2017/2018. The sample of the research is 2 off/class. In order to get the same group, these two classes are adjusted especially for the students with cumulative achievement index from semester 1 to 4. The number of experimental class is 15 students and the number of control class is 15 students.

The independent variable (effect) is a character-based Problem Solving Open Ended learning method and conventional learning method. Dependent variables are learning outcomes from the cognitive domain's learning outcomes and affective domain's learning outcomes (characters). The test of cognitive's learning outcomes is conducted at the seventh meeting or after the learning treatment ends. The essay test is given to measure the students' learning outcomes. The test of affective's learning outcomes is conducted at third meeting until the seventh meeting. The observation technique is conducted to measure the affective's learning outcomes. In this study there are 7 (seven) components of the character that need to be studied, namely (1) honesty, (2) independence, (3) discipline, (4) curiosity (5) creative, (6) hard work, and (7) reading habit. The t-test is used to test the hypothesis.

II. THE RESULT OF THE STUDY

1. The Differences of Learning Outcomes Based on the Learning Method

Based on the data analysis, the statistical description of the quality of learning outcomes is presented in Table 2 as follows:

Table 2. Statistical Description of Learning Outcomes

Method	N	Mean	Deviation Std	Error Mean Std
Conventional	15	6.88	0.047	0.012
<i>Problem solving open ended</i>	15	7.84	0.041	0.108

Based on the Table 2 above, the mean of conventional learning method was 6.88 and the mean of problem solving open ended learning method was 7.84. So, there was a difference of the mean of learning outcomes between Conventional learning method and Character-based Problem Solving Open Ended learning method. In order to determine whether these differences cannot be ignored or occur by chance, further test was necessary to be conducted.

The null hypothesis: there was no differences in the students' learning outcomes between the Character-based Problem Solving Open Ended learning method and conventional learning method. Analysis technique of Independent Sample t-test was used to test the hypothesis.

The description of analysis data of t-test is presented in Table 3 as follows:

Table 3. Analysis Description of t-test in learning outcomes

		Equal variances assumed	Equal variances not assumed
		Learning Outcome	
Levene's Test for Equality of Variances	F	3,683	
	Sig.	,065	
T		-6,781	-6,781
	Df	28	21,539
Sig. (2-tailed)		,000	,000
	Mean Difference	-	-
Std. Error Difference		10,31429	10,31429
	95% Confidence Interval of the Difference	13,43021	13,47286
		-7,19836	-7,15571
			-7,15571

Table 3 showed that t_{count} with *equal variance t assumed* was -6,781 (minus sign in significant test is ignored) with probability 0.000. Because the probability was <0.05, H_0 was rejected and H_1 was accepted. So the difference in the quality of students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method in learning process did not occur by chance. This means that there was a significant difference of students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method. It was proven by the results of group learning of Character-based Problem Solving Open-Ended learning method was higher than the group learning of conventional learning method.

2. The Differences of Character Based on the Learning

Based on the data analysis, the statistical description of character quality can be presented in Table 4 as follows:

Table 4. Statistical Description of Learning Outcomes

Method	N	Mean	Deviation Std	Error Mean Std
Problem solving open ended	15	7.93	5.18	1.33
Conventional	15	6.90	2.80	0.72

From Table 4, the mean of character of conventional method was 6.90 and the mean of Character-based Problem Solving Open-Ended model was 7.93. So, it can be concluded that there was a difference of mean between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method. In order to determine whether these differences cannot be ignored or occur by chance, further test was necessary to be conducted.

The null hypothesis: there was no differences in the students' learning outcomes between Character-based

Problem Solving Open Ended learning method and conventional learning method. Analysis technique of Independent Sample t-test was used to test the hypothesis. The description of analysis data of t-test is presented in Table 5 as follows:

Table 5. Analysis Description of t-test of Character

		Equal variances assumed	Equal variances not assumed
		Character	
Levene's Test for Equality of Variances	F	0,311	
	Sig.	0,582	
t-test for Equality of Means	T	-59,050	-59,050
	Df	28	27,640
Sig. (2-tailed)		,000	,000
	Mean Difference	-,96185	-,96185
Std. Error Difference		,01629	,01629
	95% Confidence Interval of the Difference	-,99522	-,99524
		-,92849	-,92847

Table 5 showed that t_{count} with *equal variance t assumed* was -59,050 (minus sign in significant test is ignored) with probability 0.000. Because the probability is <0.05, H_0 was rejected and H_1 was accepted. So the difference in the quality of students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method in learning process did not occur by chance. This means that there was a significant difference of the students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method. It was proven by the results of group learning of Character-based Problem Solving Open-Ended learning method was higher than the group learning of conventional learning method.

III. DISCUSSIONS

The Difference of Learning Outcomes Based on the Learning Method

The Transportation Planning course is not merely in the form of knowledge transfer, but it is expected that the students are able to apply the knowledge they have acquired. Therefore, they can solve the field problems that they face, especially in the work world. Thus, in learning, the students not only learn concepts/formulas and rules, but also learn how to use these concepts/formulas to

discuss the problems in their practices and exam. This is very important because one of the effective methods in engineering learning is by doing practices and exam (Bhattacharya & Mandke, 1997). Thus, the learning activities are not only focused on getting how much knowledge we get, but also how to use all the knowledge to deal with new situations or solve specific problems that are related to the area we have studied.

Based on the result, it showed that the mean of the students' learning outcomes in Character-based Problem Solving Open-Ended learning method was 7.84. It was higher than the students' learning outcomes in conventional learning method (6.8). It was proven by the results of group learning of Character-based Problem Solving Open-Ended learning method was higher than the group learning of conventional learning method. Meanwhile, the result of t-test with equal variance t assumed was -59,050 (minus sign in significant test is ignored) with probability 0.000. Because the probability was <0.05 , H_0 was rejected and H_1 was accepted. So the difference in the quality of students' learning outcomes between the use of Character-based Problem Solving Open-Ended model and Conventional model in learning did not occur by chance. This means that there was a significant different of students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method.

The advantage of Character-based Problem Solving Open-Ended learning method is based on constructivist understanding which gives more convenience for the students. So they are able to construct their own knowledge after having real activities that can be observed with their five senses and real activities that they can think of (Jonassen, 1997 and 2000). This is in line with Kuncoro's (2012) opinion that problem solving open ended learning method can improve the ability in understanding and solving problems in science, technology, and engineering field. While Cheung, et. Al (2003) said that character-based problem solving open ended learning method can improve the students' ability significantly in generating a number of ideas in design problems, discussing the problems of indetified ideas, and generating deeper ideas.

The Difference of Character Based on the Learning Method

Based on the results of the data analysis, it showed that the mean of the character of the conventional learning method was 6.90 and the mean of the character of Character-based Problem Solving Open-Ended learning method was 7.93. From the description of the data, there was a difference in the mean between the use of conventional learning method and character-based problem solving open-ended learning method. While the t_{count} value was -59,050 with probability 0,000 . Because the probability was <0.05 , H_0 was rejected and H_1 was accepted. So the difference in the quality of students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method in learning process did not occur by chance. This means that there was a significant

different of the students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method.

The improvement of the students' character is in line with Jonassen and Tessmer' (1996) opinion. He stated that problem solving can improve the students' individual self-confidence, motivation and other attitude aspects such as effort, confidence, anxiety, perseverance, and knowledge during the process of problem solving. Furthermore, the implementation of problem solving open ended learning method can encourage the students to take risks, increase curiosity, and increase perseverance (Costa & Kallick, 2000). Aspects of perseverance, motivation, confidence, curiosity, and risk-taking are important components in character development such as honesty, discipline, curiosity, creativity, hard work and reading habit.

(Gray, 2009; Benninga, Berkowitz, Kuenh, and Smith, 2003) revealed that the teaching characters education at school is as important as teaching academic problems. Between academic education and character education must be applied together in school. In addition, Narvaez, and Lapsley (2007) said the character education must be an integral part of education systems. The character values need to be developed by the students because it is a life reflection for Indonesian nation.

The development of character values for the students can be done through the daily learning process in the classroom, practicum rooms, laboratories, workshops and others. In order to achieve good results in implementing character building, the teacher must be able to implement the innovative learning strategies by integrating character elements in learning tasks. By the implementation of character-based problem solving open ended learning method, the learning paradigm can be directed towards the current learning paradigm. The components of the current learning paradigm are; (1) a learning which is directed to encourage the students to find out from various sources of observation without knowing anything before, (2) a learning which is directed to be able to formulate problems (ask), not just solve the problems (answer), (3) a learning which is directed to train analytical thinking (decision making) rather than mechanistic thinking (routine), (4) a learning which is emphasized the importance of cooperation and collaboration in solving problems, and (5) a learning which is not enough to give only knowledge through core subjects, but must be followed by the character values development that is supported by the a ability to utilize information and communicate.

The strategy of character implementation in the education system is a unity in the learning process that must conduted by each education institution (Battistich, 2002). Learning activities in the character development framework means the students can use active learning approaches such as contextual learning approaches, cooperative learning, problem-based learning, project-based learning, service learning, work-based learning, and ICARE (Intoduction, Connection, Application, Reflection, Extension) and also can be used for character education (Larson, 2009; Zuhdi et al., 2010; Kemdiknas, 2010; Samani, dan Hariyanto. 2011.).

IV. CONCLUSIONS

Conclusions can be drawn from the hypothesis test's and research discussion results were (1) there was a significant difference in students' learning outcomes between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method. It was proven by the results of group learning of Character-based Problem Solving Open-Ended learning method was higher than the group learning of conventional learning method, and (2) there is a significant difference in students' character between the use of Character-based Problem Solving Open-Ended learning method and Conventional learning method. It was proven by the results of group learning of Character-based Problem Solving Open-Ended learning method was higher than the group learning of conventional learning method.

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