Development of Learning Tools Based on Problem Based Learning for Electrical Motorcycle Maintenance Course: Cognitive Ability

Sukardi, Andeka, Rizky Ema Wulansari, Tee Tze Kiong, Dedy Irfan

Abstract: This study was designed to evaluate the effectiveness of learning tools based on Problem-Based Learning for the ElectricalMotorcycle Maintenance course in SMKs. This research applieda quantitative research approach and a quasi-experimental research design. The method consists of four stages namely: define, development, design and disseminate. The results of this research wereas follow: (1) An Instructional Design had been developed for motorcycle electrical System at Vocational High School. (2) The effectiveness was 86.26%. Based on the finding, it can be concluded that the tested program is effective to be used. On the other hand, results obtained from this research also proved that PBL-based Learning Devices is giving positive effectson improving student learning outcomes.

Keywords: Problem Based Learning, Cognitive Ability, Electrical Motorcycle Maintenance

I. INTRODUCTION

There are six main components needed to be thoroughly considered in the learning process, namely the purpose of learning, teacher and students, learning tools, learning media, teaching methods, and evaluation [1].Due to the componentswork in a system, the components must be interconnected to assurethat the teaching and learning process will achieve its goal effectively. The six components play a very important role in the implementation of learning [4]. As stated by [6], during the preparation stage, a teacher is expected to prepare learning material, teaching aids/ labs, questions and instructions for students. The teacher also needs to encourage active learning, examine student prior knowledge, and diagnose students' strengths and weaknesses. All these will support the implementation ofa learning process. Learning tools also play an important role in the implementation of learning [12].

[7] says that learning models are used to accomplish learning goals. Teachers need time and effort to prepare the learning tools. [14] stated that learning models consist of syllabus, learning process planning (contains identification of core competencies (KI), basic competencies (KD), indicators of achievement of competencies, learning objectives, teaching materials, time allocation, learning methods, learning activities, assessment learning outcomes, and learning resources), teaching materials, student worksheets (LKPD), and assessment instruments.

Electrical Motorcycle Maintenance is one of the courses of Engineering and Motorcycle Business three years program. The findings of observation explained that the Electrical Motorcycle Maintenance course is difficult for students to master. One of the main reasons is due to the implementation of the course, lack of strategic lesson planning and learning model that can be applied by teachers. The lack of teaching materials and the quality of learning tools always related to the comprehension of students [8].In this case, it is proposed that a learning tool needs to be developed and implemented.

Basic competencies are crucial to producing good quality and competent students. Hence, students are still struggling with this matter. Students should be guided by a variety of learning tools by the teacher to achieve learning outcomes. Teachers should also apply different methods in teaching that can attract and increase the learning motivation among students.

Problem Based Learning (PBL) as one of the effective learning models should be implemented on Electrical Motorcycle Maintenance (PKSM). It is confirmed that PBL has many advantages especially on the development of students' thinking and problem-solving skill. This is supported by[17] that PBL is one of the learning models that encourage the development of thinking skills (reasoning, communication and connections/networks) for students.

PBL Model helps students improve their learning skills too in a way of openness, reflective, critical and active mindset [20]. This model guides students on solving a problem in the learning process systematically compared to other models or approaches. Research conducted by [9] affirmed that PBL is more effective than the demonstration method.

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According to [3], PBLhelps students to develop thinking skills and problem-solving skills too. Through the process of PBL, it is expected that students can practice critical thinking, increase creativity and ability to solve problems [23]. Therefore, students are more confident and competitive in class. PBL can improve students' thinking skills in solving problems. This is aligning with the PKSM course's main goal which emphasizes the ability to thinking skills and problem-solving.

II. METHOD

This study used a quantitative research approach with a quasi-experimental research design. In this study, researchers adopted the (4D) procedure from Thiagarajan [21]; [22]. According to [21], there are 4 stages, namely: Define, Design, Development and Disseminate. This study was conducted at the Vocational School of Humanities,Kerinci. The test was used as the research instrument to collect data.

A. Sample

Samples of this study were students from class XI in Electrical Motorcycle Engineering at the Vocational School of Humanities, Kerinci.

B. Instrument

The test was developed based on the Electrical Motorcycle Engineering course KD and indicators.

III. RESULTS AND DISCUSSION

Pretest data were obtained before treatment was given to the students. On the other hand, posttest data were collected after treatment was implemented to class Vocational School of Humanities, Kerinci.

The normality test of Kolmogorov-Smirnov (Table 1) and Levene test of homogeneity (Table 2) were carried out to fulfill the requirement of the test of assumption. Both tests showed that the data were normalized and homogenous.

Based on the results of pretest and posttest data analysis at a significance level of 0.05, the value of pretest data normality is 0.597 which can be seen in p-value. Because the value of normality is greater than the significance value (0.597> 0.05), the data is declared to be normally distributed. Furthermore, for the posttest value obtained a value of 0.093 which can be seen in p-value, because the value of normality is greater than the value of significance (0.093> 0.05), the data is declared normal distribution and can be continued with the homogeneity test.

Table 1: Normality Data of Pretest-Posttest

One-Sample Kolmogorov-Smirnov Test			
		Pretest	Posttest
N		26	26
Normal Parameters[a,b]	Mean	70.0000	87.0769
	Std. Deviation	10.76290	7.18289
Most Extreme Differences	Absolute	.151	.243
	Positive	.151	.243
	Negative	-.113	-.180

Kolmogorov-Smirnov Z	.768	1.238
Asymp. Sig. (2-tailed)	.597	.093

Based on SPSS output (Table 2), the significance value of pretest and posttest data was 0.235> 0.05, meaning that the pretest and posttest data had the same/ homogeneous variance and could be continued with gains score testing.

Table 2: Homogeneity Test of Pretest-Posttest

Test of Homogeneity of Variances			
Levene Statistic	df1	df2	Sig.
1.530	3	22	.235

Pretest and posttest were then compared and analyzed to identify the effectiveness of the treatment (Table 3). Based on the description of the data in Table 3, the pretest data obtained were: the mean of 70, the median of 68, the standard deviation of 10.76, the minimum value of 49 and the maximum value of 94. The mean for the posttest was 87.07, the median was 84, the standard deviation 7.18, a minimum value of 76 and a maximum value of 100.

Table 3: Data Description of Pretest-Posttest

		Pretest	Posttest
N	Valid	26	26
	Missing	0	0
Mean		70.0000	87.0769
Std. Error of Mean		2.11078	1.40868
Median		68.0000	84.0000
Mode		62.00a	84.00
Std. Deviation		10.76290	7.18289
Variance		115.840	51.594
Range		45.00	24.00
Minimum		49.00	76.00
Maximum		94.00	100.00
Sum		1820.00	2264.00

Based on the gained test scores(Table 4), it can be concluded that 23 studentsobtained significantly increased scores, while the three students get a decreased value. The decreased value happened mostly due tothe existence of internal factors and external factors that affect student learning outcomes such as personal problems experienced by students or pressure from the environment and several other problems faced by students who cannot fully be controlled by researchers.

Table 4: Gained Score

	Pre test	Post test	Max Score	Posttest-Pretest	Max-Pretest
	70.00	87.08	100.00	17.08	30.00

It can be concluded that the developed learning tool of PBL gives a positive effect. After the PBL device is declared practical, the activity is focused on evaluating whether the PBL tool can be used for effective purposes in learning activities.

The aspect of effectiveness observed is the learning outcomes of students. This can be seen by observing the learning process and giving the final test questions to the students after using a problem-based learning tool. If the PBL tool to be developed has not met the criteria of valid, practical, and effective, then revisions to the criteria are still considered to be lacking. The results of this revision will later serve as a benchmark in improving the PBL tools developed. Based on the effectiveness testing of problem-based learning devices obtained the t-count value of 7.091 with t-table 2.063, because t-count> t-table (7.091> 2.063), so it can be concluded that the proposed hypothesis is accepted. This is reinforced by a significance value of 0,000 (0,000 < 0,05), meaning that there are significant differences in student learning outcomes at the pretest and posttest. So that it can be concluded that the provision of treatment in the form of the application of problem-based learning devices in the subjects of Maintenance of Motorbike Electricity Class XI Motorcycle Engineering at the Vocational High School was successfully implemented. So, it can be concluded that this problem-based learning tool is an effective learning device used in the Electric Motor Maintenance subjects. So that it can be seen from the cognitive learning outcomes of students who take lessons using this problem-based learning tool that shows that problem-based learning tools are developed effectively to improve students' cognitive learning outcomes.

According to the previous research conducted by [10] which states that problem-based learning tools are effective in improving student learning outcomes because these problem-based learning devices can support student learning in applying knowledge or concepts to real objects, students can absorb information maximally in direct practice of learning [5] and the existence of student problem-based learning tools are more participatory because students are easy to understand the concepts of learning [19]. As well as research conducted by [11] who said that problem-based learning tools effectively improve student learning outcomes, because learning by using a problem-based learning tool can make students learn more deeply than learning without problem-based learning tools.

IV. CONCLUSION

The problem-based learning tool produced on the Motorbike Electrical Maintenance subjects is a learning device consisting of lesson plans, teaching materials, LKPD and assessment instruments. Learning devices that are generated integrated support learning activities that are following the PBL syntax. The lesson plan is used as a guide for teachers to direct the learning process following the PBL syntax. Teaching materials are used by students for learning resources that help smooth the learning process. LKPD contains activities and tasks that will be carried out by students according to the PBL syntax-directed by the teacher, and assessment instruments in the form of pretest and posttest questions are used to see the effectiveness of the learning device.

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