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The Effect of Problem-Based Blended Learning Models on Learning Outcomes and Achievement Motivation of Automotive Engineering Study Program Students

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This study aims to examine the effect of a problem-based blended learning (PBBL) model on learning outcomes in drawing automotive design and student achievement motivation. This study was conducted using quasi-experimental research with the subjects of the two offerings of student participants in the Automotive Design Course at the Faculty of Engineering, Universitas Negeri Malang (UM) in the odd semester 2018/2019 which was determined randomly. The blended learning model used is an e-learning application that has been implemented at UM through the SIPEJAR Program. Data collection on learning outcomes for drawing automotive design was done based on the overall results of the automotive design drawing assignments which are assessed based on the assessment sheet, and for achievement motivation data was done through a questionnaire. The research data were analysed using the t-test technique which was preceded by a prerequisite test for all research data which included a normality test and a homogeneity test. The results showed that the PBBL model had a positive and significant effect on learning outcomes in drawing automotive design and student achievement motivation where groups of students that taught using the PBBL model showed higher learning outcomes and achievement motivation than groups of students taught using conventional models.

Keywords: blended learning, problem-based, learning outcomes, automotive design, achievement motivation.

Introduction

Blended learning is a form of learning innovation that combines conventional learning models that emphasise face-to-face and IT-based learning in the form of e-learning (Rovai Jordan, 2004) or Web-based learning (Dzakiria, Mustafa, & Bakar, 2014); which is currently seen as a superior strategy to improve student academic performance (Marshall et al. 2018). Quantitatively, the percentage of e-learning portion in blended learning is in the range of 30-79% compared to face-to-face learning (Allen, Seaman, & Garrett, 2007). Compared to conventional learning models, blended learning has various advantages because of its characteristics which are: (1) it is able to combine various delivery methods, learning models, teaching styles, as well as various technology-based media; (2) able to combine direct learning (face-to-face), independent learning, and learning through online, (3) supported by an effective combination of ways of delivering, teaching, and teaching styles; and (4) able to portray the teacher as a facilitator and parents as a support in learning (Watson, 2008). These four characteristics give birth to five keys to the successful implementation of blended learning, namely (1) live events, namely face-to-face learning synchronously in the same time and place or at the same time but in different places; (2) self-paced learning, which allows students to learn anytime, anywhere online, (3) collaboration, the occurrence of teacher collaboration and student collaboration; (4) assessment, using a combination of online and offline assessment types both test and non-test in nature; and (5) performance support materials, the use of teaching materials in digital form that can be accessed by students both offline and online (Carman, 2005).

Various theoretical advantages of blended learning exist in improving the quality of processes and outcomes of learning that have been empirically tested in various domains of learning. Implementation of blended learning (a combination of classical learning, e-learning, and field study) in the Automotive Body Course shows that mastery learning and the average scores of students taught using blended learning are superior to the mastery learning and average scores of students taught face-to-face (Pradhana, Estriyanto, & Rohman, 2013). Similar research findings were reported by Sjukur (2012) and Syarif (2012) who stated that learning outcomes of Computer and Information Processing Skills in groups of vocational students taught using blended learning were superior to those who were conventionally taught. In fact, the implementation of blended learning can also increase learning motivation of vocational students when compared with conventional learning as reported by Sjukur (2012) and Syarif (2012).

One appropriate learning model that combined with blended learning produced quality processes and outcomes of learning in the field of automotive design is the problem-based learning (PBL) model. Problem-based learning is a learning model that challenges students to learn to solve real-world problems in collaboration (Dischino et al., 2011; & Hmelo-silver, 2014). The application of PBL involves students in building knowledge, defining problems, developing hypotheses, reasoning skills, collecting data and finding answers to the problems they face independently (Huang, Shen, & Lin, 2007; & Hmelo-silver, 2014). In short, PBL can be seen as an art of problem-solving (Ayşe & Arabacioğlu, 2011) where ill-structured problems taken from the real world become a focal point and stimulus for students (Kolmos, 2014).

The learning process in PBL consists of various steps that always begin with the presentation of problems, usually ill-structured problems, by the lecturer/instructor to students. Then followed by various steps of problem-solving up to the assessment of the solution carried out in active and independent learning by students under the guidance of the teacher. The experts formulated these various steps in different stages even though the essence is the same. The Maastricht Model (Matheson & Haas, 2010) presents seven steps, namely (1) clarifying the text and explaining unclear terms and concepts, (2) defining the key problem, (3) analysing the problem and suggesting possible solutions, (4) elaborating, testing, reviewing and refining, (5) formulating learning objectives, (6) self-study, and (7) integrating and testing new information. The learning process in PBL is shorter stated by Dischino et al. (2011) which only includes four steps, namely, (1) problem analysis, (2) self-directed learning, (3) brainstorming, and (4) solution testing. While Chhabra & Sharma (2013) proposed five steps in implementing PBL, namely (1) orienting students to the problems, (2) organising students for study, (3) assisting independent and group investigations, (4) developing and presenting reports, videos , models etc., and (5) analysing and evaluating the problem solving process.

The advantages of PBL models in learning automotive engineering have been revealed in various studies. Research conducted by Purnama, Mukhadis, & Nauri (2016) shows that the learning outcomes of Gasoline Motorcycle Technology Subjects of groups of students taught using the PBL model are better than the learning outcomes of groups of students taught using the conventional model. Similar findings were also found by Mardiah, Hamdani, & Komaro (2016) who stated that groups of students who were taught using the PBL model had better learning outcomes in Mechanical Mechanics and Mechanical Element Subjects than groups of students taught using the conventional model. In practicum learning, research findings of Nurtanto & Fawaid (2015) also show that the PBL model is able to improve the learning outcomes of Light Vehicle Engineering practicum for vocational students.

One of the subjects in the Automotive Engineering Education Study Program, Faculty of Engineering, UM, which is full of ill-structured problem loads from real life, is the Automotive Design Course. One of the learning outcomes of the course is that students have the skills to draw the design of automotive engine components and automotive body components to improve the quality of safety and comfort in the use of motorised vehicles. The Automotive Design Course has a very high level of creativity and innovation development for students in drawing automotive body components, especially those related to exterior design that can meet the novelty value in terms of styling and imaging in accordance with consumer demands by paying more attention to safety and comfort factors. That's why learning Automotive Design Courses is very appropriately implemented using the problem-based blended learning model (PBBL).

The PBBL model in the context of this research is a combination of e-learning and face-to-face learning where the learning process undertaken by lecturers and students is designed based on PBL syntax. While the blended learning model is made in the form of a Web Enhanced Course Model which is integrated with the e-learning system or SIPEJAR UM. Modules and assignments for students uploaded in the UM e-learning system are also arranged on a problem-based platform. Software taught to students to draw automotive designs is the 2012 Inventor Program.

In addition to the main learning outcomes in the form of the ability to draw automotive design, the students of Automotive Engineering Education Study Program are also required to have high achievement motivation to do and to produce the best results. Psychologically, achievement motivation is interpreted as the desire and impulse that exists in a person to engage in a task and do the task with the best results, which meets certain standards of excellence. In this context, Mcclelland (1987) states that achievement motivation is the desire that exists in a person that drives him/her to try to achieve a standard or measure of excellence. This is in line with the opinion of Santrock (2005) who states that achievement motivation is the desire and drive of someone to do something with the best results. In fact, achievement motivation can be considered as one's tendency to achieve success or achieve the desired end goal, one's involvement in the task, one's expectation to succeed in the task at hand, and the drive to face obstacles in doing various jobs quickly and accurately (Purwanto, 2016).

This study aims to examine the effect of problem-based blended learning models on students' learning outcomes of drawing automotive design and achievement motivation of Automotive Engineering Education Study Program. The test was carried out by testing the results of learning to draw automotive design and achievement motivation between groups of students taught using problem-based blended learning model and groups of students taught using conventional model.

1. Method Methodology

a. Research Design

This study is classified as a quasi-experimental study carried out using a post-test design as shown in Table 1.

Table 1. Research Design

Subject	Pretest	Treatment	Postcatest
EC	-	X_1	O_1 O_2
CC	-	X_2	O_1 O_2

EC = Experimental Class

CC = Control Class

X_1 = Problem-based blended learning model

X_2 = Conventional model

O_1 = Learning outcomes of drawing automotive design

O_2 = Achievement motivation

The variables in this study were classified into three, namely independent variables, dependent variables, and control variables. The independent variable was the use of learning models which are divided into two, namely, the problem-based blended learning (PBBL) model and the conventional model (face-to-face). The dependent variable was also divided into two, namely learning outcomes in drawing automotive design and student achievement motivation. While the control variables, the variables that are made the same during the study take place both in the experimental class and the control class, include curriculum and scope of learning material, allocation of face-to-face time in class, learning modules, types and specifications of desktop computers used in learning, and various types assignments given to students.

The PBBL model as a treatment in this study was carried out using an online learning model that has been owned by UM. The development of PBBL model was carried out by the research team under the guidance and assistance of media experts from the Department of Educational Technology of UM recommended by the Learning Innovation Development Team at the Education and Learning Development Institute of UM. The results of the blended learning model were uploaded on the UM e-learning web with the user name is ID number of lecturer and the password is dosen1_UM. In this blended learning model the ratio between online and offline learning is 7:8. This means that online learning was carried out for 7 meetings (46.67%) of the 15 planned meetings, while offline learning (face-to-face) is carried out for 8 meetings (53.33%). Overall the blended learning design in this study is shown in the following Table 2.

Table 2. Summary of Semester Instructional Plans in Automotive Design Courses

Meeting	Sub CLO*)	Content Description	Learning Experiences	
			Offline	Online-Asinkron
1	1.1 & 1.2	Sketch design: Dimention, draw, constraint, modify, navigate	√	
2	2.1 & 2.2	Part Design: Extrude, hole, Fillet, Chamber	√	

3	2.1 & 2.2	Part Design: Extrude , Loft, Coil	√	
4	2.3	Part Design: Work plane, Work Axis, Work ponit	√	
5	2.4	Part Design: Revolve, Sweep		√
6	2.5	Part Design: Rectangular pattern, Circular pattern, Mirror		√
7	3.1 & 3.2	Part Assembly: Mate, Angle, Tangent, Insert	√	
8	3.1 & 3.2	Part Assembly: Mate, Angle, Tangent, Insert		√
9	4.1 & 4.2	Presentation: Create View, Tweak Component, Animate	√	
10	4.1 & 4.2	Presentation: Create View, Tweak Component, Animate		√
11	5.1	Drawing Surface: Thicken/offset, Stitch, Sculpt, Extend, Replace Face, Patch, Trim	√	
12	6.1	Drawing Automotive Body	√	
13	6.1	Drawing Automotive Body		√
14	6.1	Drawing Automotive Body		√
15	6.1	Drawing Automotive Body		√
16		Final Test		

*) CLO = Course learning outcomes

Various learning resources uploaded on the UM Web E-Learning for learning materials of students in the experimental class include: (1) the module of Automotive Design Course developed based on problem-based learning; (2) material presentations in the form of power points; (3) assignments that must be done by students; and (4) learning videos. These various learning resources can be studied, downloaded, worked on, and discussed interactively online by experimental group students with lecturers. All student work results were also uploaded and recorded in the UM e-learning system. For the control group, all students learning processes were done face-to-face (offline) and the results of the work were collected in the form of soft copies but not uploaded to the UM e-learning system.

The experimental group learning strategy was designed based on the PBL syntax proposed by Chhabra & Sharma (2013) consisting of five steps, namely: (1) orienting students to the problems, (2) organising students for study, (3) assisting independent and group investigations, (4) developing and presenting reports, videos, models etc., and (5) analysing and evaluating the problem solving process, as synthesised in Table 3.

Table 3. Synthesis of PBL Strategies in Automotive Design Courses

No.	Syntax of PBL	Learning Activities
1.	Orienting students to the	The lecturer explains the problems/tasks that must be done by
	problems	students during the lecture.
2.	Organising students for study	In group students comprehensively understand the problem/task of
		making automotive design drawings that they receive, by reading
		modules prepared online and other relevant references, discussing,
		and asking lecturers if they don't understand.
3.	Assisting independent and	Lecturers provide group and individual consultations on the
	group investigation *)	implementation and results of market research/analysis on
		automotive design for urban communities conducted by students
		both online and offline. Each group member does:
		o market research/analysis,
		o make automotive body design plans based on research results,
		o make ideas/sketches, and
		o create a design concept per part and/or as a whole.
4.	Developing and presenting	Each student individually did:
	reports, videos, models etc.	o draw assignments given by lecturers or draw automotive body
		design based on planning, ideas, and concept designs that have
		been done in the previous stage,
		o make a short video about the drawing process, dan
		o presented a video and automotive body design drawings its

			produced. (All results were uploaded in the UM e-learning
			system).
5.	Analysing and evaluating the	Together with the students, the lecturer did:	
	problem solving process.	o analysis of the problem solving process carried out by each	
			student,
		o giving feedback on the problem solving process that has been	
			done by each student, both offline and online), and

o evaluating automotive body design drawings produced by each student.

* The stages of learning were carried out only at meetings 11-15.

a. Research Subjects

The subjects of this study were students of the Automotive Engineering Education Study Program of UM which participating in Automotive Design Courses in the odd semester of the academic year 2018/2019. There were three offerings of student, namely: offering 1 (29 students), offering 2 (27 students), and offering 3 (23 students). Of the three offerings, two offerings were randomly selected to be involved in the study, and two of the selected offerings were randomly assigned to determine the experimental class and the control class. In this way an offering of 3 (23 students) was obtained as an experimental class taught using the PBBL model and offering 2 (27 students) as a control class taught using the conventional model. To find out the homogeneity of the two offerings, a different test was performed on the achievement of Engineering Drawing Courses which are prerequisites for Automotive Design Courses. Based on the results of the t-test on the data of technical drawing achievement obtained from the lecturer, shown that the mean score of the experimental group is 85.39; mean score of control group is 83.18; score of t_{table} is 1.470, and p_{value} (sig.) is 0.148. Because of p_{value} (sig.) is more than 0.05, it means that both groups of students have no different prior ability in the form of achievement of engineering drawing. In other words, the initial conditions of the two groups students were homogeneous.

c. Data Collection

Data on drawing automotive design learning outcomes were obtained from scores of all automotive design drawing assignments produced by students whose assessments were based on the Automotive Design Drawing Evaluation Sheet which includes aspects of accuracy, drawing procedures, time used, aesthetics, and aerodynamic aspects. The last two aspects only apply to accessing exterior or automotive body design drawings. The judges were three automotive design expert lecturers consisting of a lecturer in Automotive Design Courses, and two other automotive design expert lecturers in the Study Program of Automotive Engineering Education, UM. Whereas student achievement motivation was measured using a questionnaire developed by researchers based on the achievement motivation theory proposed by Mcclelland (1987). Before being used, the instrument was validated by experts and field tested to determine its validity and reliability. Validation analysis of instruments based on trial data was done using the Product Moment Pearson formula (Sarjono & Julianita, 2011). Based on the provisions given by Sarjono & Julianita (2011) from the 35 items analysed which obtained 29 valid items. Six invalid items were discarded, so the instrument of achievement motivation used in this study consisted of 29 items. Whereas for instrument reliability is calculated based on the Cronbach Alpha formula (Sarjono & Julianita, 2011) with a result of 0.970. After being tested for requirements, which included normality and homogeneity, the research data was analysed using t-test techniques.

d. Data Analysis

The research data were analysed using t-test technique which was carried out using the SPSS Program 20. Before being analysed, all research data were tested for prerequisites which included tests of normality and tests of homogeneity (Sarjono & Julianita, 2011). The data normality test was carried out using the Kolmogorov-Smirnov Test, while the homogeneity test of the data was carried out using the Leven's Test in which the results are shown in Table 4 and Table 5.

Table 4. Data Normality Test Result p <0.05

Data Tested	p_{value} (Sig.)	Information
The learning outcomes	0.200	Normally distributed
Achievement motivation	0.091	Normally distributed

Based on Table 4, it is known that all variable scores tested have p_{value} (Sig.) > 0.05. This means that the scores of the students' learning outcomes of drawing car designs and achievement motivation in the PBBL model and the conventional model classes are normally distributed.

Table 5. Data Homogeneity Test Result p < 0.05

Data Tested	P_{value} (Sig.)	Information
The learning outcomes	0.288	Homogeneous
Achievement motivation	0.082	Homogeneous

The results of testing homogeneity of data as shown in Table 5 show that all research data have p_{value} (sig.) > 0.05, which means that the score of the students' learning outcomes and achievement motivation in both the blended learning and the conventional classes are homogeneous. Based on the two prerequisite test results, all research data have met the requirements to be analysed using the t-test technique.

Results

The research data in the form of students' learning outcomes of drawing automotive design and students' achievement motivation in the experimental class were taught using the PBBL model and the control class were taught using the conventional model as described in Table 6 and 7 below.

Table 6. Data Description of Students' Learning Outcomes of the PBBL Model and the Conventional Model Classes

	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
PBBL Model	23	18.00	78.00	96.00	1983.00	86.21	5.40	29.17
Conventional Model	27	15.00	76.00	91.00	2246.00	83.18	4.40	19.38

Table 7. Data Description of Students' Achievement Motivation of the PBBL Model and the Conventional Model Classes

	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation	Variance
PBBL Model	23	19.20	80.80	100.00	2018.00	87.73	4.48	20.13
Conventional Model	27	24.50	71.60	96.10	2265.20	83.89	6.59	43.48

Based on Table 6 and 7 it is known that the mean of students' learning outcomes of drawing automotive designs and achievement motivation of class taught using the PBBL model are higher than the class of students taught using the conventional model. The main results of this study obtained from data analysis using the t-test technique are shown in Tables 8 and 9 below.

Table 8. T-Test Result of Students' Learning Outcomes of the PBBL Model and the Conventional Model Classes

Independent Samples Test $p < 0.05$

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Learning Outcomes	Equal variances assumed	1.156	.288	2.187	48	.034	3.03221	1.38646	.24453	5.81988
	Equal variances not assumed			2.151	42.446	.037	3.03221	1.40949	.18863	5.87578

Based on Table 8 it is known that from testing the difference in learning outcomes obtained t_{table} is 2.187 and Sig. (2-tailed) is 0.034, which means the value of Sig. (2-tailed) 0.05 then H_0 rejected. The results indicate that there are significant differences in drawing automotive design learning outcomes between groups of students taught using the PBBL model and groups of students taught using conventional model. Referring to the data in Table 5 it means that the learning outcomes of drawing automotive design of students groups taught using the

PBBL model are superior to the learning outcomes of drawing automotive design of students groups who are taught using conventional model.

Table 9. T-Test Result of Students' Achievement Motivation of the PBBL Model and the Conventional Classes

Independent Samples Test p < 0.05

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Achievement Motivation	Equal variances assumed	3.151	.082	2.365	48	.022	3.843	1.625	.576	7.109
	Equal variances not assumed			2.437	45.915	.019	3.843	1.577	.669	7.017

From Table 9 it is also known that in testing the difference in achievement motivation the t_{table} is 2,365 and Sig. (2-tailed) is 0.022, which means the value of Sig. (2-tailed) < 0.05 then H_0 rejected. The results indicate that there are significant differences in achievement motivation between groups of students taught using the PBBL model and groups of students taught using conventional model. Referring to the data in Table 6 it means that the achievement motivation of groups of students taught using the PBBL model is higher than the achievement motivation of groups of students taught using conventional model.

2. Discussion

The results of this study indicate that there are significant differences in learning outcomes in drawing automotive design between groups of students taught using the PBBL model and groups of students taught using conventional model where the learning outcomes of groups of students taught using the PBBL model are superior to the learning outcomes of groups of students taught using conventional models. This finding is in line with the opinion of Marshall et al. (2018) who states that the blended learning model is a superior strategy to improve student academic performance. The superiority of the blended learning model also occurs because of the combination of various delivery methods and the use of various technology-based media, as well as the combination of direct learning (face-to-face) and independent learning via online (Watson, 2008). In this study, the combination of online learning (e-learning) and offline learning (face-to-face) occurred with a ratio of 7: 8 or the charge of e-learning in the blended learning model that was experimented in this study reached 46.67% which means that PBBL has fulfilled the requirements as a blended learning model as determined by Allen, Seaman, & Garrett (2007). By combining various delivery strategies and using more technology in the PBBL model, the learning activities of students are increased and have an impact on their high learning outcomes.

The advantages of the PBBL model in improving student learning outcomes compared to conventional models are also in line with various research results which state that the average scores of students taught using blended learning is superior to the average scores of students taught face-to-face or conventionally (Pradhana, Estriyanto, & Rohman, 2013). Other research results that are in line with the findings of this study were also reported by Sjukur (2012) and Syarif (2012) who stated that the learning outcomes of vocational student groups taught using blended learning were superior to those of conventionally taught groups (face-to-face). The superiority of the achievement of groups of students taught using the blended learning model compared to groups of students taught traditionally was also reported by Yapici & Akbayin (2012).

In the PBBL model, the excellence of student learning outcomes is not only influenced by the blended learning model but also by the PBL model which is used as the basis for organising learning activities. Separately with blended learning, PBL's superiority in improving student learning outcomes has also been revealed in various studies. Thus, the superiority of the PBBL model in improving student learning outcomes can also be harmonised with various experimental research findings that make PBL as the treatment. Therefore, the findings of this study which state that groups of students taught using the PBBL model have higher learning outcomes in drawing automotive designs compared to groups of students taught with conventional models are also in line with the research findings of Purnama, Mukhadis, & Nauri (2016). They state that the learning outcomes of the Gasoline Motorcycle Technology lessons that the groups of students are taught using the PBL model is higher than the learning outcomes of groups of students taught using conventional models. Likewise, research findings reported by Mardiah, Hamdani, & Komaro (2016) state that groups of students taught using the PBL model have better learning outcomes in Mechanical Mechanics and Mechanical Element lessons than groups of students taught using conventional models. Even in practicum learning, research findings of Nurtanto & Fawaid (2015) also show that the PBL model is able to improve the learning outcomes of Light Vehicle Engineering practicum for vocational students. The superiority of the PBL model compared to conventional models for improving student learning outcomes mainly lies in the involvement and activeness of students during the learning process. In other words, in the PBL model the learning centre is the student (student-centred learning), whereas in the conventional model the learning centre is the teacher (teacher-centred learning).

The results of this study also showed that the achievement motivation of students of the PBBL class was higher than the achievement motivation of students of the conventional class. These results are in accordance with the results of Sjukur (2012) and Syarif (2012) research which states that the implementation of blended learning can increase the motivation of learning of vocational students when compared to conventional learning (face-to-face). Students' learning motivation in the blended learning model is shown by the more active learning compared to traditional classes (Ravenscroft & Luhanga, 2018). The activeness of students of PBBL class occurs because they have the opportunity to interact with lecturers and with fellow students more than conventional class students. Besides active learning, the high achievement motivation of the students of the PBBL class model also occurs because of their tendency to do the best things from the class with the online students only or face-to-face only (conventional), where it shows the greatest chance of success for students of the blended learning class (Owston 2018) which has a positive impact on the formation of high achievement motivation in themselves. This is in line with the opinion of (Santrock, 2005) who states that achievement motivation is one's desire and drive to do something with good results. In fact, the findings of this study are also in accordance with the opinion of Chaplin (2011), who states that the high achievement motivation of students is reflected in their tendency to achieve success or achieve the desired end goal, their involvement in the task, their hopes to succeed in the task it receives, and their encouragement to face obstacles in doing various jobs quickly and precisely.

3. Conclusion

Based on the results of the research and discussion it can be concluded that (1) the learning outcomes of drawing automotive design of the groups of students taught using the PBBL model are superior to groups of students taught using the conventional model (face-to-face); and (2) the achievement motivation of the group of students taught using the PBBL model is superior to the group of students taught using the conventional model. In other words, the use of the PBBL model in learning of Automotive Design Course has a positive and significant effect on learning outcomes in drawing automotive design and achievement motivation of students of Automotive Engineering Study Program.

Based on these conclusions the following suggestions are made: (1) PBBL model integrated with UM e-learning system (SIPEJAR), as implemented in this study, can be used as an alternative innovative learning models in the Automotive Engineering Study Program and the like at UM in order to improve the quality of the process and the results of learning by design; (2) similar experimental research needs to be done by selectively selecting certain moderator variables, for example students' prior knowledge, student intelligence levels, and the like or by increasing the amount of e-learning rather than face-to-face learning in the experimented blended learning model; and (3) it is necessary to measure the attractiveness of the implementation of the blended learning model for students which can be used as one of the dependent variables in pseudo experimental research.

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