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Problem-based Learning Method with the Teaching Factory Concept for Improving Student Learning Scores in the Steering, Brake, And Suspension System Course

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Quality learning processes are needed to improve student competence. This study aims to reveal the improvement of student learning scores through problem-based learning with the concept of factory teaching in the steering, brake, and suspension subjects in the automotive department, engineering faculty, Universitas Negeri Padang. Practical problems in the company are used as studies in learning in schools. To find out the success of this method, we used a sample of 32 students as a control class and 32 students as an experimental class. From the evaluation, it shows that learning scores of the experimental class students are higher than the control class students.

Keywords: Problem-based learning, teaching factory, student course score, steering, brake system

1. Introduction

In the future, Indonesian society must move from a consumptive country to a productive country. Today's young generation is the foundation for changing economic conditions in the future. Students are intellectual candidates who will take part in changing economic patterns. Ernawati [1] explained that economic conditions in the future are influenced by the conditions and efforts of today's students, so that entrepreneurial mindset is needed for every student. Furthermore, students not only think of being involved as civil servants, but also becoming entrepreneurs.

Previous research revealed that the quality of education has implications for the entrepreneurial mindset and is influenced by: theoretically-oriented learning patterns and practical problems [2], learning processes in both companies and lecture benches [3], and through student-centred teaching and learning in schools and companies [4]. Furthermore, [5] describes that the educational paradigm must follow developments in the company through the teaching factory. This is in line with the company's technological development paradigm [6], as a tool in developing students' mindset with a system of establishing a business [7].

As it is essential for students to have an entrepreneurial mindset, it is necessary to have a learning process that integrates learning at school with the company (teaching factory). This learning system invites students to recognise all the operations and systems that apply in the company and to solve the problems (as the concept of problem-based learning) in accordance with the subjects that they study in schools [8-11]. Familiarity with this company will instill the attitude to create their own business abilities while studying at school.

Steering, brake, and suspension (SBS) are the subjects that provide a learning experience for students regarding the steering, braking and suspension systems of vehicles. This course has a wide application and supports the improvement of vehicles, as the control system in the SBS that have been equipped with electronic control systems. This is what prompted us to conduct research on the method of problem-based learning with the concept of factory-based teaching to foster to improve the learning score of automotive students.

2. Problem-based learning for teaching factory concept

Teaching factory is a learning method that combines learning in the classroom with the company [12]. In the learning process, students are guided to know the activities in the company, then the instructor (teacher) arranges learning materials that are appropriate to the activities or processes in the company activity. This concept is carried out by dividing the hours of learning in the classroom with learning that takes essential problems in industry [5,13].

Several theories developed by [14] the teaching factory got inspiration from problem-based learning methods and experiential learning. This learning method emphasises the concept of technology that has been developed in the company along with the development of today's technology. In teaching factory learning methods there are elements of interaction, exploration, field experience and problem solving between educators and students, between students and the company and between the company and educators, as shown in Figure 1.

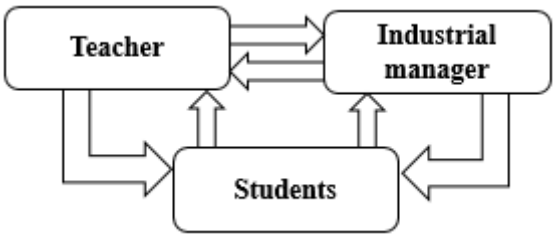

Figure 1. Interaction concept between students, teacher, and industrial manager

This process of interaction will be designed to bring students closer to people who have successfully established businesses. Finding problems in the company as an effort to provide insight to students in recognising problems, defining problems and solving problems. Teaching factory adheres to two systems of knowledge transfer, where problems in the company become the basis for finding synergy models between companies and the learning process in the classroom. The success of this learning system is mutually beneficial cooperation between students and companies, between students and teachers, and lecturers with the company.

3. Entrepreneurial mindset

Entrepreneurial mindset is a mindset that is oriented towards entrepreneurial activities in the company [13]. Entrepreneurship is related to business activities and innovation in a business.

While the concept of entrepreneurial mindset is also related to the characteristics of a person with the ability to meet challenges, initiative, ability to identify and ability to create new products or business methods [12, 14].

Entrepreneurship is more closely related to defining problems, exploring problems, finding solutions to problems in a business (company) which then creates creative solutions, effective actions and is a method of finding the latest problems from the company. In a business activity, entrepreneurial mindset learning is the process of learning about business concepts, learning about how to set up a business and learning to be a person who is able to manage a business. In this study, the team limited the learning process to change the student mindset from government staff oriented to oriented entrepreneurs. [14] defined three things that affect the entrepreneurial spirit of a student, first from the family environment, second from business encouragement from the school environment and third, working life or environmental conditions where students interact. Students who like to be in a company will slowly think about how to set up a business, or how to create a business.

4. The problem-based learning system with teaching factory concept

SBS courses are courses related to the system of controlling and stopping automotive vehicles. Learning outcomes in this course are students' knowing and being able to improve the KRS system on automotive vehicles. So, this system is very suitable if it is connected with a learning system that collaborates with the problems that occur in the company. More broadly, finding problems in the control and stopping system of vehicles in the company will also encourage students to learn how the company finds a solution. Guidance from lecturers greatly determines how intense communication between students and companies can realise entrepreneurial mindset in students.

In the learning process in the classroom, students and lecturers explore the problems that have been obtained by students to formulate solutions to existing problems. After the formulation of the problems in the company is completed, students are encouraged to return to the company and explain the problem-solving methods that have been discussed. On solving problems in the company, discussions conducted between students and the company will increase students'

insight in solving problems. It is probable that the method used by the company is better or slower in finding problems. Input for this will be used as a reference for students in solving problems in the field and will be discussed in the classroom.

This pattern will trigger students to be closer to the company, this closeness will accompany students' perceptions to think of a business, plan a business and try to realise the business. Realising that not all car owners who have electronic control systems in SBS voluntarily service in official workshops, and citing expensive costs, students can make opportunities, this is a new business as a forerunner in pioneering a larger business. The complete learning methods planned in this study are described in Figure 2.

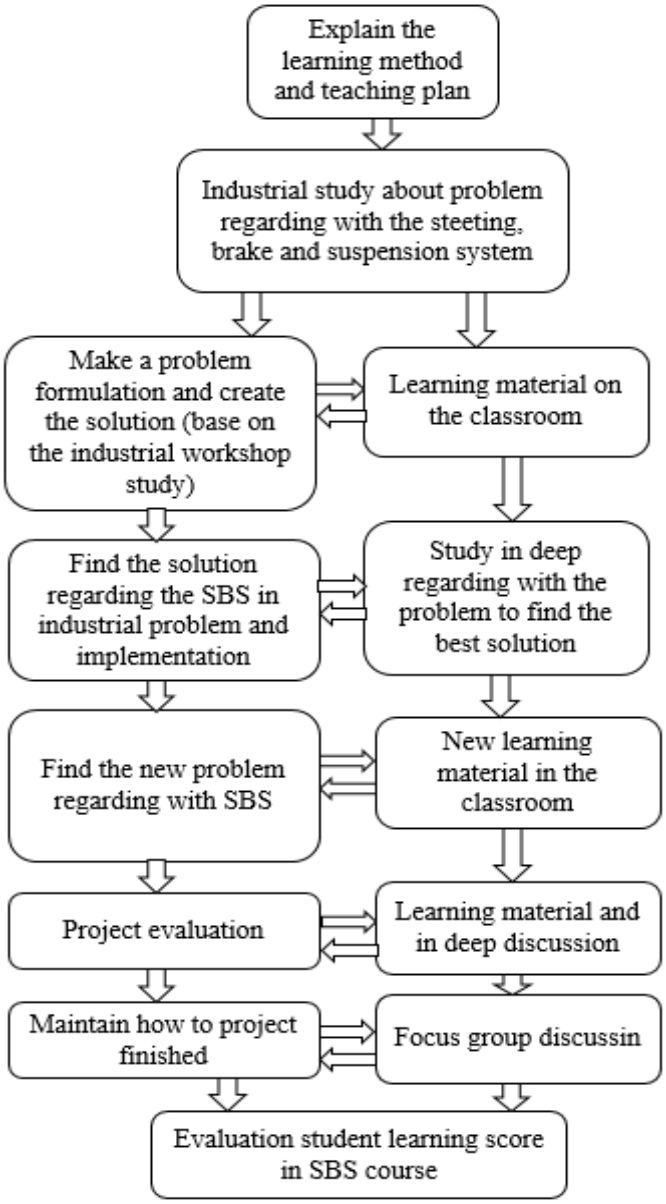

Figure 2. Learning process flowchart

5. Research Methodology

Experimental research was used in this study, by applying two classes as a control class and experiment class [15]. The control class will be the class whose learning method uses the method that has been applied in the automotive department, namely the opening, introduction, lecturer giving the theory, students asking and doing assignments and, evaluating. While the experimental class is a learning method given to students by applying the concept of problem-based learning. The study population was students who took SBS courses in the semester of

January-June 2018. The SBS courses in the automotive department were divided into nine course sessions in each course session consisting of 32 students. While the sample of this study is two sessions of students taking courses with criteria, 1) participants who have even ability and, 2) have similar activity. To find out the criteria, observations will be conducted by checking the study results sheet, activeness and profile of the courses that have been taken.

6. Results and discussion

After the learning process is carried out by using problem-based learning in the experimental class, an examination is conducted to measure the learning score obtained by students as well as to find out the success of the problem-based learning method with the concept of teaching factory. Initially the test of learning score is taken by using questions. Learning scores that have been achieved are seen in Table 1.

Table 1. The learning score from experimental and control class

No	Statistics	Experimental class	Control class
1	Total score	2573.29	2415.53
2	Highest score	93.33	88.89
3	Lowest sore	64.44	64.44
4	Average	80.42	75.49
5	Standard deviation	8.97	8.69
6	Modus	79.16	74.68
7	Median	80	75.55

From the frequency distribution in Table 1. It is known that the total score achieved by students is 2573.29 with a class average of 80.42 learning outcomes, while the highest results that students can achieve are 93.33 and the lowest result 64.44 with a standard deviation 8.97 with mode 79.17 and median 80.00. The highest score achieved by students in intervals of 91–95 was obtained by 9 students with a percentage of 28.17%. While the control class is known the total score achieved by students is 2415.53 with an average score of 75.49 and the highest score that can be achieved by students is 88.89, while the lowest score achieved by students is 64.44

with a standard deviation of 8.69 and median 75.55 and mode 75.68. The highest range of learning outcomes achieved by students is 66–70 as many as 11 students with a class percentage of 34.38%.

The requirements analysis test was conducted to find out whether the data obtained was normally distributed, and the results of the experimental class from the normality test showed that L_{hitung} is 0.16 and L_{tabel} is 1.8223 at the alpha level of 0.05 showed $L_{count} < L_{tabel}$ showing experimental student learning score normally distributed. While the learning score of the control class from the normality test obtained L_{count} 0.22 and L_{tabel} 1.8223 with an alpha level of 0.05. This shows that the learning outcomes of the control class are normally distributed. While the homogeneity test of the results obtained shows the learning score variables also obtained $F_{count} < F_{table}$ where 1.0321 and F_{table} is 2.07 indicating student learning score are homogeneous.

Based on the results of the study, the application of the problem-based learning method to the concept of factory teaching can increase the results of student KRS. The average student learning outcomes after applying the overall learning process is higher than the control class students. This can be seen from the average achieved by the experimental class higher than the control class. The description above is in line with the observations that the author made during the learning, that students in the experimental class have high enthusiasm, seen from the way of learning and how to study the learning topic in an effort to master learning material when compared to the control class. This indicates that students who learn with problem-based learning feel they have a tool to understand learning material in addition to being able to learn together with the teacher in an effort to master learning material.

7. Conclusion

Research with the concept of problem-based learning that has been completed provides convenience for students in learning both in industrial workshops and in automotive workshops. It is seen that experimental class students get higher scores than the control class. This learning system can provide convenience to students in learning. The concept of workshop

learning can inspire students to find solutions to problems in the company which will later become a provision for students to become entrepreneurs.

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