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The Effect of Problem-Based Learning and Critical Thinking Skills on Students' Learning Outcomes of Vocational Schools

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ABSTRACT

Critical thinking skills are one of the important 21st century competencies. Vocational High Schools should develop critical thinking skills of their students in every learning process. Its graduates do not only require hard skills which are generally easily obsolete. More important skills are soft skills, including the ones to collaborate, communicate, think critically and creatively. This study aimed to analyze the effect of learning models and critical thinking skills on learning outcomes. This type of research was experimental, using a pretest-posttest control group design. The research subjects were students of class XI culinary 1 and class XI culinary 2 SMK YPM 2 (a vocational high school) Taman, Sidoarjo, East Java. The data collection instruments used was achievement tests and observation sheets on learning outcomes of critical thinking skills. The data analysis technique used was Anova. The results showed that there was an influence of the students' critical thinking skills on the learning outcomes, no effect of the application of learning models on the learning outcomes, and there was an influence of interactions between the critical thinking skills and learning models on the learning outcomes.

Keywords: *problem-based learning, critical thinking skills, learning outcomes*

I. INTRODUCTION

Problem-based learning is a learning model which addresses ways of solving problems. Students actively look through the provided problems to be analyzed by using their thinking skills. Learning to solve problems is basically learning to use scientific methods or think systematically, logically, orderly, and thoroughly. The aim is to acquire cognitive abilities and abilities to solve problems rationally, straightforwardly, and completely. For this reason, students' ability to master concepts, principles, and generalizations is considerably needed.

Through the problem-based learning, students can construct their own knowledge, develop high-level inquiry and skills so as to improve their learning outcomes [4] [47] [19] [41]. Reference [37] argues that problem-based learning models employ various kinds of intelligence needed to confront real world challenges, the ability to deal with new things and There are five phases of the syntax of problem-based learning models five phases. They are: orienting students to the problem, organizing students to learn, helping independent and group investigations, developing and presenting their work and exhibiting it,

existing complexities. The problem-based learning can make learning more challenging, motivating and fun [36].

On the contrary, critical thinking skills cannot be immediately owned by students but are obtained through practice. It is due to the fact that the ability to think critically is essential, it should be trained in learning. Reference [31] proves that problem-based should learn and solve problems [23].

The ability to think critically serves as a capital that students must possess as a provision in facing the development of science and technology at the present time. The ability to think also as a means to achieve educational goals is so that students are able to solve complex problems [30] [34] [39]. learning can improve learning outcomes, critical thinking, communication, mutual respect, and teamwork.

and analyzing and evaluating the problem solving process [33] [4]

There have been numerous studies regarding the problem-based learning model (popularly abbreviated as MPBM) and the results achieved vary greatly. The problem-based learning can improve learning outcomes

[9] [15] [27] [8] [49], critical thinking skills [25] [18] [5] [8] [34] [16] [48] [28] [21], and mathematical disposition [18]. Furthermore, Sun-hee [45] discovered the contribution of learning models based on problems in enhancing learning attitudes, critical thinking and decision making in the field of nursing. In addition, [50] revealed that problem based learning models contribute to the improvement of critical thinking skills, learning motivation and social studies learning outcomes.

Critical thinking is a model of thinking about things, substances or problems in which the thinker improves the quality of his or her thinking by handling skillfully the structures inherent in thought and applying intellectual standards to it [12]. The critical thinking must be adherent to the characteristics of analysis, synthesis, recognition of problems and their solutions, conclusions, and judgments [2] [1]. In line with [22], critical thinking is a directed and clear process employed in mental activities such as solving problems, making decisions, persuading, analyzing, assuming and conducting scientific research. Reference [6] suggests that critical thinking is rational and reflective thinking focused on what is. Critical thinking is a model of thinking about things, substances or problems in which the thinker improves the quality of his or her thinking by handling skillfully the structures inherent in thought and applying intellectual standards to it [12]. The critical thinking must be adherent to the characteristics of analysis, synthesis, recognition of problems and their solutions, conclusions, and judgments [1] [2]. In line with [22], critical thinking is a directed and clear process employed in mental activities such as solving problems, making decisions, persuading, analyzing, assuming and conducting scientific research. Reference [20] suggests that critical thinking is rational and reflective thinking focused on what is believed and executed. Chanche [17], a cognitive psychologist, defines critical thinking as the ability to analyze facts, arouse and organize ideas, defend opinions, make comparisons, draw conclusions, evaluate arguments and solve problems. In line with [34] critical thinking is thinking reasonably and reflective by emphasizing decision making about what to believe or do.

There are six basic elements in critical thinking according to [7]. They include focus, reason, inference, situation, clarity, and overview. In line with of [11], critical thinking has the characteristics of inference, assumptions, deduction, interpretation, and evaluation. Reference [42] argues that critical thinking means placing oneself in a clear position towards the problem, providing the relevant thought and rational argument, taking the decision to accept or reject a reason, and the decision must come from oneself.

Meanwhile, [40] argues that one of the weaknesses of the learning process implemented by teachers is the lack of efforts to develop students' thinking skills. In each learning process on any subject the teacher is more encouraging so that students can master a number of subject matters. The teacher always requires students to learn, but does not teach how students

Based on the previously-illustrated discussion, the present study aims to analyze the effect of problem-based learning models and critical thinking on the student learning outcomes.

II. METHOD

The present study employed a quasi experimental design. The study population was vocational students from SMK YPM 2 Taman, Sidoarjo, East Java. The sample of the study was the XI Food Catering class which was divided into two groups, the experimental group and the control group, each consisting of 36 students. The experimental group was treated by applying the problem-based learning, while the control group was treated with a direct learning model.

This study used a group design [44]. The data collection techniques used were achievement test, tests of critical thinking, and questionnaires. The data analysis technique used was the two-way ANOVA with statistical hypothesis tests.

III. RESULTS AND DISCUSSION

The results of two-way ANOVA are summarized in Table 1. These results indicated that the critical thinking skills affected the student learning outcomes with a significance level of $0.000 < 0.05$; whereas the application of the learning model did not affect the student learning outcomes, it can be seen from the significance level of $0.781 > 0.05$. However, the interaction between the critical thinking skills and learning models had an effect on the learning outcomes with a significance number $0.005 < 0.05$.

The results of this study certainly aroused several important questions about why the learning model had no effect on the students' learning outcomes. Even though it is stated that the problem-based learning model is an effective approach to teaching high-level thought processes [47]. In fact in this study the results revealed that the learning model alone had no effect on the learning outcomes. However, if the learning model is integrated with the students' critical thinking skills, the interaction between the two has a significant effect on the learning outcomes.

This shows how important the role of critical thinking skills is. According to [12], critical thinking is a model of thinking to know things, substances or problems in which the thinker improves the quality of his or her thinking by handling skillfully the structures inherent in thought and applying intellectual standards to it. In this way it can be understood, if students who have critical thinking skills, the learning outcomes will be better.

Learning outcomes will appear in every change in aspects of knowledge, understanding, habits, skills, appreciation, emotional, social, physical, ethical or moral, and attitude [15]. Student learning outcomes are influenced by two main factors, namely the factors within the students and factors that come from outside the students or environmental factors. Factors that come from students, especially the ability they have, include critical thinking skills. They have a great influence on learning outcomes [43].

Table 1 Tests of Between-Subjects Effects
Dependent Variable: Test/ Critical Thinking Skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3529.885 ^a	3	1176.628	40.641	.000
Intercept	410448.293	1	410448.293	1.418E4	.000
Kritis	3181.737	1	3181.737	109.897	.000
Model	2.253	1	2.253	.078	.781
Kritis * Model	25.154	1	25.154	1.869	.005
Error	1968.727	68	28.952		
Total	447612.000	72			
Corrected Total	5498.611	71			

a. R Squared = .642 (Adjusted R Squared = .626)

IV. CONCLUSION

This study results indicated that critical thinking skills affected the student learning outcomes, whereas the learning model had no effect on the students' learning outcomes. The interaction between critical thinking

skills and learning models, however, has an effect on learning outcomes. Because of the importance of critical thinking skills in achieving learning outcomes, these skills need to be continuously trained in learning.

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