

# The Effect of Treffinger Learning Model on Critical Thinking Ability of Students in SMK 3 Yogyakarta

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**Abstract**—This research aims to determine the effect of treffinger learning model toward the critical thinking ability of students in SMK 3 Yogyakarta. This research is a quasi-experimental research design with post-test only non-equivalent group design. The sampling is in the form of purposive sampling technique obtained sample of 64 learners in SMK 3 Yogyakarta which divided into experiment and control groups. The experimental group apply treffinger learning model in TITL-1 while control with discovery learning model in TITL-2. This study was conducted for 8 meetings. The analysis of test data used t-test with SPSS 16 program. The result hypothesis analysis of t-test obtained  $t$  count  $>$   $t$  table is  $2,443 > 1,999$  and  $P$  value is  $0.017 < 0.05$  then  $H_0$  is rejected. The research indicates that between a group of experiments using model learning treffinger with controls that use the discovery learning has the effect of significantly different critical thinking ability of students. It concludes that there is a difference in average critical thinking ability on both models of learning.

**Keywords**—critical thinking ability, Treffinger learning model

## I. INTRODUCTION

The development of science, technology, and communication can provide ease in humans so that the work becomes easier and faster. School as one of the educational institutions where there are main activities of teaching and learning process strived to pace themselves in improving the quality of education in accordance with the demands of technological development. The main activity in the school is the teaching-learning process that has the objective to produce qualified individuals according to predetermined standards at the education level. Schools should always try to make the learning process work well and implemented professionally. It is therefore important that schools become educational institutions that are capable of creating not only skills but can also support future lives to continue higher schools.

The process of learning activities in schools cannot be separated from the learning activities of

teachers and learners to achieve learning success. The learning and teaching process is gained through learning activities in the classroom to support changes in individual behavior patterns in a better direction [1]. Efforts made by learners is to interact with each other as a form of success in learning. Learning is the process of changing the behavior of an individual that is influenced by several factors such as internal factors that is the ability to think critically, independently, behavior while external factors are the methods, techniques, and strategies of teachers in preparing learners for learning [2]. Therefore, all these factors must exist in the learning process. Classroom learning can be influenced by the training and activities of learners that sometimes cause problems [3].

The learning activities can be planned with processes that can change the nature of a person through stimulus or response to the surrounding environment. The learning process becomes good when teachers with students interact with each other for the purpose of learning. Therefore, it is very important for teachers, especially teachers to understand the learning process of students either in a guided or individually in the learning environment. Thus, the teacher can see as far as the ability of students to the learning process provided by the teacher. Moreover, the five elements include the learning environment, curriculum, evaluation or measurement, teaching activities, and organizing and managing the class [4]. Learning activities are very important in changing the mindset of individuals affected by the system in achieving the goals expected by students and teachers, especially in vocational high school. Therefore, vocational high school learning has different characteristics from learning in senior high school.

Generally, learning activities in vocational schools emphasize more on the skills of learners to work, entrepreneurship, and work with great opportunities to be accepted into the industry. It is the kind of thing that makes learning activities in vocational high

schools focusing on productive learning or work that can be done in workshops and laboratories as a form of teaching practicum activities. Therefore, learners are required to have the morale, skills, ability to think, act actively and creatively in the existing learning activities in the vocational school. Learners are also required to be able to develop from what they have learned in school independently [5]. The process of implementation of learning in Vocational High School makes the place to be conducted research by researchers at SMK 3 Yogyakarta.

In the application of learning at SMK 3 Yogyakarta, it required a process of learning activities that require students to think critically in accordance with the strategy of teachers in applying lessons. There needs to be alignment between learning materials that teachers provide to learners with the ability of understanding learning materials, especially on passive component materials through mathematical calculations in accordance with the theory and practice. The fact is that many learners tend to be passive and silent in the delivery of material activities by teachers in class.

Furthermore, when teachers instruct students to work on problems or exercises, students feel confused to solve problems, process data to draw conclusions from questions. In the result, the achievement of learners' knowledge for the calculation and concept analysis is still not optimal. The best solution of the problem needs to be renewal or innovation by matching the learning activities associated with the material to be taught let alone problem-solving learning by using mathematical analysis and calculation. One of the lessons that emphasizes liveliness and creativity in problem-solving that leads to the step of mathematical analysis and calculation by proving experiments is the treffinger learning model.

The treffinger learning model is one model of learning that is based on problem-solving actively and creatively by learners. This learning model consists of three important components: understanding the challenge, generating ideas or ideas, and preparing for action. At each step of the treffinger learning model itself, learners are required to actively know the problem, seek and encourage to argue, to prepare to act on it. In each of these steps will be seen the critical thinking ability of learners can be done to improve the quality of learning and facilitate in solving problems.

The Treffinger learning model is theoretically included in learning that enables learners where they will be more dominant to perform all learning activities. Treffinger learning model included in the creative problem solving model proposed by Parnes is a learning model that involves active and creative learners in problem solving. In this model, of course, in problem solving will grow in the learners of

critical thinking ability who feel like knowing, understanding, and analyzing the cause of the problem arises [6]. An important role of the treffinger learning model is develop the ability of learners to define problems, analyze, collect data, hypothesize and experiment with problems [7]. Therefore, this learning model is useful for classroom applications.

The based on the problem proposed, alternative solutions need to be done by further reviewing ways to innovate and approach the use of active, effective and interesting learning models of the material presented to students. Therefore, it is necessary to do research on treffinger learning model to know the effect of learning achievement, especially on critical thinking ability of learners for learning materials that have mathematical analysis and conceptualization. The hope of ahead with the existence of Treffinger learning model in the learning activities can develop the existing capabilities of the students so that the achievement of results obtained by teachers in accordance with the completeness expected of the learning organized by SMK 3 Yogyakarta.

## II. RELATED WORKS/LITERATURE REVIEW

Previous research related to the treffinger learning model is described below. Earlier researchers have come to the conclusion that differences in the application of recitation and treffinger learning to mastery of students' concepts and activeness in physics learning. The results of the study showed that the activity of learners with treffinger learning was higher than that of recitation learning [8]. Another study obtained the result that this model has an active and creative problem-solving stage with systematic development, with various methods and techniques for each stage that can be applied flexibly [9]. Furthermore, the treffinger learning model can foster the creativity of learners in problem-solving activities that include: courage, fluency in answering questions, open ideas, confidence, curiosity, and up to apply in life [10].

Actually, to achieve success in treffinger learning, there should be steps that are arranged systematically in order to run effectively. Treffinger learning model consists of 3 important components of understanding Challenge, Generating ideas, and preparing for action [11]. It is then detailed in six stages including: developing chance, finding out data, formulating problems, generating ideas, developing solutions, and building acceptance [12].

Furthermore, discovery learning model is a learning that is done with basic inquiry approach which learners are instructed to answer questions or questions from topics discussed during learning to do observation analysis by itself and to describe the conclusion [13]. The next, discovery learning is a learning activity of the inquiry process in which learners answer questions and seek results obtained

from the problem when educators explain in learning [14,15]. Therefore, this learning model acquires students' knowledge to learn to find problem analysis. there are several steps in the application of discovery learning model in the provision of responses (stimulation), identify problems, collect data or referral studies, perform data processing, test results obtained, and conclusions. The following is a syntactic difference between the treffinger learning model and the learning discovery learning in table 1 below:

TABLE I. DIFFERENCES IN LEARNING STEPS BETWEEN TREFFINGER LEARNING MODEL AND DISCOVERY LEARNING

Treffinger Learning Model	Discovery Learning Model
Constructing opportunities (develop chance)	Stimulation
Exploring data (find out data)	Problem statement
Framing problems (formulating problems)	Data collecting
Generating ideas	Data processing
Developing solution	Verification
Building acceptance by furthering the problem in greater depth	Generalization or conclusion

The based on table 1, researchers would like to see the difference in the steps of both models of learning between treffinger and the existing discovery learning in vocational secondary school. Furthermore, critical thinking ability is the potential that exists for individuals to think based on existing knowledge in the natural environment in a tangible and understandable way [16]. Some of the characteristics that can be taken in critical thinking include identify, understand, analyze, evaluate, and conclude formulating appropriate problem-solving that is required of the active learner in overcoming the existing solutions in the learning process [17], [18]. Thus, this research will try to find out some characteristics of critical thinking ability of learners, especially in vocational high school.

### III. MATERIAL & METHODOLOGY

#### A. Data

Data collection techniques in this study were conducted with the following stages. First, the researchers did a test problem to learners who have learned about the material understand the passive components in a direct current circuit. Then, to determine which groups included experiments and controls were applied by knowing the previous results with the criteria of repetitive results that are not much different in class X students. Group determination was taken in the form of purposive sampling because of limitations place, time, and formation of classes that have been set by the school. Therefore, based on sampling in this study, the students class X TITL-2 consisting of 32 learners who made the control group

and class X TITL-1 consisting of 32 learners who made the experimental group.

Furthermore, the provision of the final test (post-test) is a technique performed to obtain data from research results. Therefore, in this research, post-test is used to know the acquisition result of critical thinking ability of learners on treffinger learning model and discovery learning model. Furthermore, the normality test using kolmogorov sminov test to see whether the data is normal or abnormal distribution and homogeneity test using levene statistic. Then, the data analysis using t-test technique that is intended to know the presence or absence of difference of ability of critical thinking in between experiment group and control group. The following formulation of t-test as follows.

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} \quad (1)$$

Information

T : calculated t value

$\bar{x}$  : mean sample value

$\mu$  : population mean

S : standard deviation of sample values

N : number of samples

If  $t_{\text{arithmetic}} > t$  with  $dk = n-2$  and alpha 0.05,  $H_0$  is rejected. Instead,  $H_1$  is accepted.

#### B. Method

The research method in the research procedure is the way used by the research in collecting the research data [19]. The method of research is the way done by researchers in obtaining data to test, analyze and interpret a science that discusses a work using a particular technique to achieve the expected goal. This study used a quantitative descriptive method. The reason to use the quantitative descriptive method was because the data variable in this research is numerical and data analysis using graph and statistic. In addition, it is expected that this method can use the appropriate way, the symptoms found in the study and can provide information about the observed events. Design this study is a quasi-experimental study using post-test only with a group design that is not equivalent to the following table.

TABLE II. RESEARCH DESIGN

Groups	Treatment	Post-test
Experimental Group	X	O <sub>1</sub>
Control Group	-	O <sub>2</sub>

Table 2 shows the experimental group was treatment with treffinger learning model and the group was not given treatment. Both groups (Q<sub>1</sub> and Q<sub>2</sub>) are given post-test to know the critical thinking ability of learners at the learning process about basic competence analyzes alternating current circuits.

IV. RESULTS AND DISCUSSION

A. Result

In this research, data used post-test assessment tool for critical thinking ability through SPSS 16 program. The analysis was obtained from the post-test t-test to determine the effect of critical thinking ability from the application of learning model between the treffinger learning model in the experimental group and the discovery learning model in the control group. Based on the results obtained the average value of the results of critical thinking ability can be seen in table 3.

TABLE III. THE RESULTS OF CALCULATION OF DESCRIPTIVE STATISTICS

Group	N	Mean	Std Deviation
Experimental	32	77.34	7.930
Control	32	72.03	9.407

Based on table 3, it can be explained that the experimental group is higher than the control group. The average yield obtained in the experimental group was 77.34 while the average yield obtained in the control group was 72.03. Based on these results, it can be said that the descriptive test of students' critical thinking ability in the experimental group is higher than the control group. Thus, the application of the Treffinger model is better than the discovery learning model. As for the comparison of the mean value of each aspect of the critical thinking ability of the experimental group and the control group is described in Figure 1.

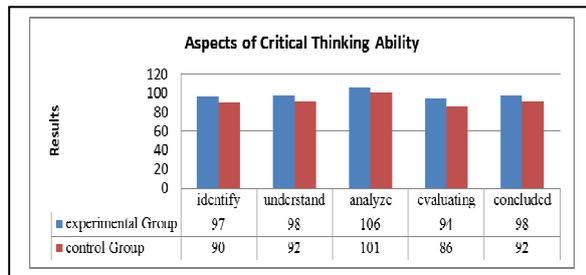


Fig. 1. Aspects of critical thinking ability

The based on results in Figure 1, it is stated that the identify aspect value obtained by the experimental group is worth 97, while the value for the control group is obtained 90. Thus, it can be concluded that the learners in the experimental group can better learning the ability of the control group from the aspect of identifying the problem. The data have shown that the identification aspect in the experimental group is higher than the control group because in the experimental group, the learning process used the treffinger learning model. It turns out to be a more directional problem identification than the control using the discovery learning model.

Furthermore, the acquisition of values obtained from students' critical thinking ability on the understanding aspect for the experimental group is 98, while the value obtained from the control group is 92. Thus, it turns out that the critical thinking ability of learners from one aspect of higher understanding of the experimental group rather than control group. Thus, it can be concluded the application of treffinger learning model at the time of learning can develop the potential of existing understanding of learners very well from the discovery learning model. However, the discovery model is good enough understanding aspects of problem solving that can make learners to remain eager to learn.

The acquisition value obtained from the critical thinking ability of learners on the analyzed aspect for the experimental group of 106, while the value obtained from the control group of 101. Thus, that it turns out the critical thinking ability of learners from one of the higher analyze aspects of the experimental group than the control group. Thus, it can be concluded the application of treffinger learning model at the time of learning can develop the knowledge potential of the existing problem solving analysis of learners very well from the discovery learning model. However, the discovery model has a good level of problem-solving analysis that can allow learners to think in learning.

The acquisition value obtained from students' critical thinking ability on evaluating aspect for experimental group is 94, while the value obtained from the control group is 86. Thus, it turns out that the critical thinking ability of learners from one of the higher evaluating aspects of the experimental group than the control group. Thus, it can be concluded the application of treffinger learning model at the time of learning can evaluate the problem solving faced by learners very well from the discovery learning model. However, the discovery learning model is good enough for the level of evaluating problems in the learning process. Basically, every model of learning has the stages of evaluating learning, but the treffinger learning model is more dominant in every implementation of the learning steps.

The last aspect of students' critical thinking ability is to conclude that the result value for the experimental group is 98 whereas the value obtained for the control group is 92. Thus, the data has shown that the conclusion aspect of the problem in the learning process is better than the control group. Furthermore, to test the hypothesis first tested the normality using SPSS 16 program in which the test using Kolmogorov Smirnov with a significance level of 5%. Here are the results of the normality test by using Kolmogorov Smirnov in table 4.

TABLE IV. RESULTS TEST OF NORMALITY WITH KOLMOGOROV SMIRNOV

Sample Kolmogorov-smirnov	N	Mean	Std deviation	Sig
	64	74.69	9.036	0.110

The table 4 shows results obtained by Kolmogorov Smirnov of 64 number of learners for both models of learning on critical thinking ability is 0.110. Thus, it shows that the significance for each variable is significant > 5% ( $0,110 > 0,05$ ) so it can be concluded normal distributed data. Then, homogeneity test aims to determine whether the subject of research comes from a homogeneous population or not. Testing homogeneity used variance analysis with significant level 5%. Ho: consideration of ability of both groups has the average value of the same result. Ha capabilities of both groups have different mean results. The following is the result of homogeneity test using variance analysis seen in table 5 below.

TABLE V. TEST RESULTS OF HOMOGENEITY OF VARIANCES

Levene Statistic	Df	df2	Sig
0.607	1	62	0.439

The based on table 5, the acquisition of homogeneity test results using statistical analysis level obtained 0607, which is the significance level of 0.439 > 5%. Thus, it turns out that the entire subject of research comes from a homogeneous group or the same. This has been proven in the form of data on the post-test in the experimental group using the treffinger learning model and the control group using the discovery learning model. Furthermore, the acquisition of calculation result of descriptive statistical data and t test result of research can be seen in table 6 below.

TABLE VI. RESULTS T-TEST

Group	F	Sig	t	df	P value	Hypotesis
Equal variances assumed	0.607	0.439	2.44 3	62	0.017	Ho rejected

The based on table 6, the results obtained for test precondition data analysis, it concluded with the normality test and homogeneity test. Furthermore, newly analyzed t-test. Furthermore, the results of calculations for the analysis of t-test test because the value of t calculated > t table is  $2.443 > 1.999$  and a P value of  $0.017 < 0.05$  then Ho rejected. Based on these results, it can be interpreted that there is a difference between the average ability of critical thinking learners on both models of learning. Therefore, the application of learning model to know the critical thinking ability of learners in this research has unequal or different result between treffinger learning model and discovery learning.

## B. Discussion

In the statistical results show that the hypothesis produced for treffinger learning model will have better effect on the critical thinking ability of learners compared with the model discovery learning. Thus, after the calculation, it turned out to have a significant difference between the two learning models. The achievement of these results is in accordance with the expected and specific among the learning models on the ability to think critically. It can be obtained that the average value of students' critical thinking ability obtained by experimental group with treffinger learning model is higher than control group using discovery learning model. Through the model of treffinger learning model, learners can be actively involved both physically and mentally in problem-solving in learning activities. Then, with this learning model, learners can more easily follow the steps of the learning process so that if there are obstacles or problems they can re-examine every step.

At the time of learning activities learners not only emphasize what he understands but how individuals can solve problems in learning with the ability to think. Therefore, the application of treffinger learning model is very suitable for learners needed in dealing with problem-solving and practice critical thinking ability. Application of learning model in treffinger learners proved to activate learners in learning. It can be obtained at the time of learning activities in the classroom which when administering a problem or a question, students are invited to learn the basic knowledge of the issue, give you an idea of what he saw, up to getting ready for action in performing troubleshooting and solutions. With this sort of thing, the students active thinking recognized the issue disclose problem-solving ideas, designing her own investigation to answer the problems encountered, the investigations to find the answer to a problem facing up to the preparation of the conclusion.

The next critical thinking ability will arise when in the learning activities are in the phases starting from identifying, understanding, and drawing ideas or conclusions from the problem. Observing the results, evidence of a Treffinger learning model has a significant effect on students' critical thinking ability and Treffinger learning model has a significant effect on students' creative thinking ability. Through the ability to think critically, they are able to solve problems that first find the facts, make hypotheses, describe the problem, and then draw conclusions [20]. Thus, the results of treffinger learning model study affect the ability to think critically for the learners through several aspects: recognize, understand, analyze, evaluate, and summarize the elements necessary to draw conclusions that come rationally.

The supporting factor in the previous research concludes the implementation of the Treffinger learning model of the sub subject of static fluid seen based on the activity of educators during the learning

process at each meeting can improve the critical thinking ability of learners ranging from problem solving to finding solutions. This influence is evidenced by the practiced treffinger learning model [21]. The use of the Treffinger model can significantly increase students critical thinking ability in solving problems, especially in the matter of mathematical analysis and problem solving. Entrepreneurs are enthusiastic and become more critical in following the learning activities, so that the learning outcomes obtained become the better [22]. learners activities during learning are also active and students responses to the Treffinger learning model are included in the enjoyable and beneficial response for learners. During applying the learning process there are differences in the ability of problem solving learners in learning between the use of learning models Treffinger higher critical thinking ability than those taught using conventional learning model. This means that in solving the problem the students' ability taught by the treffinger learning model are better than the conventional learning models taught by previous teachers [23].

The based on some previous research results, that all the supporting factors for research leads to the treffinger learning model better influence the critical thinking skills of learners and have an active positive impact on learners. Furthermore, there are several aspects arise when solving problems during learning by using treffinger learning model from identifying problems in fact, then understood, analyzed, to conclude by finding the best solution in learning. There are several important points in previous research especially for the results of critical thinking skills. First, each step of the treffinger learning model emphasizes the learner to be actively involved in their learning activities. This outcome will develop the potential for critical thinking skills within the individual. Second, it develops thinking skills because in the treffinger learning model, present problems early on and give freely to learners for solving problems individually. Third, it can create an active learner in the learning process applied by educators. Fourth, it develops the ability of learners to define problems, collect data, analyze, hypothesize and experiment in disparaging statements. Thus, the treffinger learning model can produce the ability in problem solving is critical and active thinking. The results of previous research supported by this study, the model asserts that treffinger learning can be applied to the learning activity process.

## V. CONCLUSION

A conclusion should give a summary that at the time of learning that educators do with the model discovery learning, it turns out learners in learning achievement, especially on the think critically ability on the post-test results are still not low. It is seen from the data obtained by researchers between treffinger

learning model with discovery learning model. There is a significant achievement in the application of treffinger learning model that affect the critical thinking ability of learners. The result shows that t-test calculation shows t-test analysis because t count value  $> t$  table is  $2.443 > 1.999$  and P value is  $0,017 < 0,05$  then  $H_0$  is rejected. Based on these results, it can be interpreted that there is a difference between the average critical thinking ability of learners on both models of learning. Therefore, the application of learning model to know the critical thinking ability of learners in this research has unequal or different result between treffinger learning model and discovery learning. Based on the results of research conducted SMK 3 Yogyakarta, the benefits obtained that it turns out active learners in the process of learning that educators apply in class. Able to develop the ability of learners to define problems, analyze, collect data, hypothesize and experiment in problems. After doing research, it should be recommended that treffinger learning model can be used as motivation of educator and alternative solution for process of learning activity especially on material in the form of analysis that require skill to prove result obtained by learners through experiment.

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