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

Ridwan
Postgraduate
Yogyakarta State University
Yogyakarta, Indonesia
ridwan.2016@student.uny.ac.id

Supriyadi
Lecturer of Electrical Engineering
Yogyakarta State University
Yogyakarta, Indonesia
edy_via@yahoo.com

Mutia Nurmanita
Postgraduate
Yogyakarta State University
Yogyakarta, Indonesia
mutia.nurmanita@yahoo.com

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 in the form of purposeful sampling technique obtained sample of 64 learners in SMK 3 Yogyakarta which divided into experimental 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 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 Ho 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 strive 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]. Steps 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 and 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 [3]. 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 not optimal. The best solution of the problem needs to be renewed 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 a 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 Parneosbor 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 subject concepts and activities 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: exploring 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 referential studies, perform data processing, test results obtained, and draw conclusions. The following is a syntactic difference between the treflinger learning model and the learning discovery learning in Table 1 below:

| Treflinger Learning Model | Discovery Learning Model |
|---------------------------|-------------------------|
| Constructing opportunities (develop relevance) | Stimulation |
| Exploring data (find out data) | Problem statement |
| Framing problems (formulating problems) | Data collecting |
| Generating ideas | Data processing |
| Developing solutions | 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 treflinger 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 under 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 TTTL-2 consisting of 32 learners who made the control group and class X TTTL-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 treflinger learning model and discovery learning model. Furthermore, the normality test using kolmogorov smirnov 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.

\[ t = \frac{\bar{X} - \mu}{\frac{S}{\sqrt{N}}} \]

Information

\( T \): calculated t value
\( \bar{X} \): mean sample value
\( \mu \): population mean
\( S \): standard deviation of sample values
\( N \): number of samples

If \( t \) arithmetic > \( t \) with \( dk = n-2 \) and alpha 0.05, Ho is rejected. Instead, \( H_1 \) is accepted.

B. Method

The research method in the research procedure is the way used by the researcher 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.

| Groups         | Treatment | Post-test |
|----------------|-----------|-----------|
| Experimental   | X         | O         |
| Control        |           |           |

Table 2 shows the experimental group was treatment with treflinger learning model and the group was not given treatment. Both groups (O1 and O2) 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.

| 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 compared to 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 easier 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.

![Aspects of critical thinking ability](image)

Fig. 1. Aspects of critical thinking ability

The acquisition value 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 than the control group. Thus, it can be concluded the application of the 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 is 106, while the value obtained from the control group is 101. Thus, it turns out the critical thinking ability of learners from one of the higher analyzing aspects of the experimental group than the control group. Thus, it can be concluded the application of the 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.

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 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 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 the 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, which the test using Kolmogorov-Smirnov with a significance level of 0.05. 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 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. 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.

| Levene Statistic | df | df2 | Sig |
|------------------|----|-----|-----|
| 0.607            | 1  | 62  | 0.439 |

The acquisition of homogeneity test results using statistical analysis level obtained 0.607, which is the significance level of 0.439 > 5%. Thus, it turns out that the entire subject of research comes from a homogenous group. The same thing has been proven in the form of data on the pre-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.

| Group          | Sig | t  | df | P   | Hypothesis |
|----------------|-----|----|----|-----|------------|
| Equal variance | 0.607 | 0.439 | 2.44 | 3 | 0.017 | Ho rejected |

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 because the value of t calculated 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 the 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 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 than those taught using conventional learning model. This means that the solving problems 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 of 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. The t-test calculation shows t-test analysis because t count value > t table is 2.443 > 1.969 and P value is 0.02 < 0.05 then H0 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 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.

ACKNOWLEDGMENT

The author would like to thank Edy Supriyadi and Mutiaru Nurmanita who have provided advice and input so that this article can be better.

REFERENCES

[1] Trimanto. "Model-model Pembelajaran Inovatif berorientasi Konstruktivis," Jakarta, Pustaka Aneka, 2007.
[2] Dimayani, R., and Muzattiah., Implementation Of Contextual Teaching and Learning Approach Based Media Towards Students Cognitive Achievement of Class X at SMA Negeri 1 Kebakkanrat In Academic Year 2010/2011," Akmad Pendidikan Biologi 3 (2), 15-25 (2011).
[3] Schon, D.I., "Learning: Theresies on Educational Perspective," 3rd Edition, Boston, Person Education Inc, 2002.
[4] Tomlinson, C.A., and Moon, TR., "Assessment and Student Success in a Differentiated Classroom," New York, Aced, 2013.
[5] Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 54 Tahun 2013 Tentang Standar Kompetensi Lulusan Pendidikan Dasar dan Menengah.
[6] Treffinger, DL., and Isaksen, SG., "Creative problem-solving: the history, Development, and Implications for Gifted Education and Talent Development," Journal Sage 49 (4), 342-353 (2005).
[7] Huda, M., "Model-Model Pengajaran dan Pembelajaran," Yogyakarta, Pustaka Pelajar, 2013.
[8] Firi, F., "Penerapan metode pembelajaran resitasi dan treffinger dalam pembelajaran fisika," Jurnal PKIP 3 (2), 63-66 (2016).
[9] Pompala, and Saron, W.D., "Pengaruh Model Treffinger dalam Pembelajaran Matematika dalam Mengembangkan Kemampuan Kreatif dan Kemampuan Pencernan Masalah Matematika siswa," 2005, http://digitals.puska.up.ac.id/abstract/id-1208105-144846o/pencernlah I Feburary 2018.
[10] Harvono, AR., "Pembelajaran Model Treffinger Untuk Menumbuhkan Kreativitas Dalam Pemecahan Masalah"
[11] Treffinger, DJ. “Creative problem-solving (cps) powerful tools for managing change and developing talent gifted and talented international,” 22 (2), 8-18 (2007).

[12] Isaksen, SG., Dorval, KL., and Treffinger, DJ. “Creative Approaches to Problem-solving: A Framework for Change,” Dubuque, Iowa Kendall, 2000.

[13] Prince, J. M., & Felder, R. M. “Inductive teaching and learning methods: definitions, comparisons and research bases.” Journal of Engineering Education, 95 (2), 123-138 (2006).

[14] Kementerian Pendidikan dan Kebudayaan. “Penerapan mentori pendidikan dan kebudayaan nasional nomor 81a tahun 2013, Tentang Implementasi Kurikulum pendidikan umum pembelajaran” (2013).

[15] Orlich, D. C., Harder, R. J., Callahan, R. C., & et al. “Teaching strategies: A guide to effective instruction (edition nine),” Boston, MA: Wadsworth, Cengage Learning, (2010).

[16] Williams, J.D. “How Science Works Teaching and Learning in The Science Classroom,” New York, Continuum, 2011.

[17] Ennis, RL. “The Nature Of Critical Thinking: An Outline Of Critical Thinking Disposition And Abilities,” Sixth International Conference On Thinking At MIT. (2011).

[18] Liu, JYF. “An Introduction to Critical Thinking and Creativity: Think More, Think Better,” Hoboken, John Willey And Sons Inc 2011.

[19] Arikunto, S. “Prosedur Pendidikan Suatu Pendekatan Praktek,” Jakarta: PT. Rineka Cipta, 2002.

[20] Sari, YL. and Putra, DF. “Pengaruh model pembelajaran treffinger terhadap kemampuan berpikir kritis dan kreatif mahasiswa Universitas Kasjarian Malang.” Jurnal Pendidikan Geografi 20 (2), 30-38 (2015).

[21] Alatas, F. “Hubungan pemahaman konsep dengan kecenderungan berpikir kritis melalui model pembelajaran treffinger pada mata pelajaran fisika dasar.” Jurnal EDUSAINS 6 (1), 88–96 (2014).

[22] Wahyuni, S. Pengaruh Penggunaan Model Treffinger Terhadap Kemampuan Berpikir Kritis Siswa Dalam Memecahkan Masalah Matematika Pada Materi Lingkaran Siswa SMP Negeri 22 Kota Jambi. Artikel Ilmiah him 2 http://repository.unja.ac.id/id/eprint/2748 (2017).

[23] Huda, C. “Meningkatkan Kemampuan Berpikir Kritis Siswa dalam Memecahkan Masalah Matematika dengan Model Pembelajaran Treffinger pada Materi Perkalian dan Pembagian Persegi Panjang,” Skripsi, (Sumbawa: Fakultas Tarbiyah) (2011).
# The Effect of Treffinger Learning Model on Critical Thinking Ability of Students in SMK 3 Yogyakarta

## ORIGINALITY REPORT

| Similarity Index | Internet Sources | Publications | Student Papers |
|------------------|------------------|--------------|----------------|
| 17%              | 12%              | 9%           | 10%            |

## PRIMARY SOURCES

1. **www.scribd.com**
   - Internet Source
   - 5%

2. **Submitted to Universitas Negeri Padang**
   - Student Paper
   - 1%

3. **Submitted to Universitas Negeri Surabaya The State University of Surabaya**
   - Student Paper
   - 1%

4. **download.atlantis-press.com**
   - Internet Source
   - 1%

5. **A.I.T.P Sabrila, Dafik, I M Tirta, R S Malik.**
   - "Investigation the effect discovery-based learning on students’ metacognition in solving rainbow 2-connection numbers", IOP Conference Series: Earth and Environmental Science, 2019
   - Publication
   - 1%

6. **repository.unikama.ac.id**
   - Internet Source
   - 1%
| Rank | Source                  | Title                                                                 | Authors                                                                                           | Publication Details                                      |
|------|-------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 7    | repository.uinsu.ac.id  | Internet Source                                                      | D Indarti, Mardiyana, I Pramudya. "Group investigation with scientific approach in mathematics learning" | Journal of Physics: Conference Series, 2018              |
| 8    | journals.sagepub.com    | Internet Source                                                      | Nuryakin, Riandi. "Improving Middle School Students’ Critical Thinking Skills Through Reading Infusion-Loaded Discovery Learning Model in the Science Instruction" | Journal of Physics: Conference Series, 2017              |
| 9    | docplayer.net           | Internet Source                                                      | A H Inda, D B Widjajanti. "Modifying a discovery learning model with an aptitude-treatment interaction strategy for teaching senior high school mathematics" | Journal of Physics: Conference Series, 2019              |
| ID | Title                                                                 | Author(s)                                                                 | Details                                      |
|----|----------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------|
| 14 | Submitted to Columbia Southern University                             |                                                                          | Student Paper                                |
| 15 | Submitted to Universiti Selangor                                      |                                                                          | Student Paper                                |
| 16 | Frans Aditia Wiguna, Susi Damayanti.                                  | "PENGARUH MODEL PEMBELAJARAN BERBASIS MASALAH TERHADAP KEMAMPUAN BERPIKIR KREATIF SISWA PADA PEMBELAJARAN IPS DI SDN NGADIREJO KOTA KEDIRI", JURNAL PENDIDIKAN DASAR NUSANTARA, 2018 | Publication                                 |
| 17 | Submitted to Bolton Institute of Higher Education                      |                                                                          | Student Paper                                |
| 18 | unsri.portalgaruda.org                                                |                                                                          | Internet Source                              |
| 19 | www.ai.org                                                           |                                                                          | Internet Source                              |
| 20 | id.123dok.com                                                         |                                                                          | Internet Source                              |
| 21 | Submitted to Universitas Kristen Satya Wacana                         |                                                                          | Student Paper                                |
| 22 | Submitted to Universitas Muria Kudus                                  |                                                                          | Student Paper                                |
Submitted to University of York
Student Paper

Ana Yuniasti Retno Wulandari. "Correlation between critical thinking and conceptual understanding of student’s learning outcome in mechanics concept", AIP Publishing, 2018
Publication

Ghina Nafs Nugroho, Onwardono Rit Riyanto. "MATHEMATICAL CRITICAL THINKING ABILITY REVIEWED FROM SELF-EFFICACY IN DISCOVERY LEARNING", Eduma : Mathematics Education Learning and Teaching, 2019
Publication

pt.scribd.com
Internet Source

M G Devi, N Aznam. "The effect of science-technology-society (STS) model on scientific literacy and scientific attitude of students on the subject of buffer", Journal of Physics: Conference Series, 2019
Publication

Ya-Ling Huang, Chih-Ming Chen, Mi Lin. "An English Diagnosis and Review System Based on Brainwave Attention Recognition Technology for the Paper-Based Learning Context with Digital-Pen Support", 2017 6th IIAI International
Congress on Advanced Applied Informatics (IIAI-AAI), 2017

29 Fernando A. D’Alessio, Beatrice E. Avolio, Vincent Charles. "Studying the impact of critical thinking on the academic performance of executive MBA students", Thinking Skills and Creativity, 2019

30 Submitted to Western Governors University Student Paper

31 repository.uinjkt.ac.id Internet Source

32 Submitted to UIN Raden Intan Lampung Student Paper

33 journal.unnes.ac.id Internet Source

34 Submitted to General Sir John Kotelawala Defence University Student Paper

35 Khusnul Qotimah, Supari Muslim. "STUDY ON APPLICATION OF PROBLEM-BASED LEARNING TO INCREASE STUDENT’S LEARNING OUTCOME AT DATABASE LESSON IN VOCATIONAL HIGH SCHOOL", Humanities & Social Sciences Reviews, 2019
M Hafiz, Darhim, J A Dahlan. "Comparison of Mathematical Resilience among Students with Problem Based Learning and Guided Discovery Learning Model", Journal of Physics: Conference Series, 2017