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The Implementation of Treffinger Learning Model using *Jelajah Alam Sekitar* (JAS) Approach in Respiration System Subject to Improve High School Students' Critical Thinking

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Abstract

The purpose of this study was to analyze the influence of the Treffinger learning model using the *Jelajah Alam Sekitar* (JAS) approach on students' critical thinking skills in the respiratory system. This research conducted at SMA N 1 Ungaran in the even semester of the 2020/2021 school year. The research design was a pre-experimental type One-group pre-test-post-test design. The population was all students of class XI MIPA SMA N 1 Ungaran. The samples of this research were students of class XI MIPA 1, XI MIPA 2, and XI MIPA 3 who were taken by purposive random sampling technique. The result showed that the students' critical thinking skills, based on the N-gain test, the percentage of students who categorized medium to high criteria was 94.44%. The students who achieved classical completeness were 87.96%. The average percentage achievement of critical thinking skills indicators were 1) analyzes arguments of 91.66% is in a very good category, 2) considers reliable or not reliable sources of 90.75% is in the very good category, 3) induces and considering the result of induction of 80.83% is in a good category, 4) defines the problem and considering the definition of 90.80% is in the good category, and 5) determines an action of 92.00% is in the very good category. Students and teachers gave positive responses to Treffinger's learning model using the *JAS* approach. This research concludes is that the implementation of the Treffinger learning model using the *JAS* approach is proven to improve the critical thinking skills of high school students on the respiratory system subject. To an extent, the highest category was discovered in the indicators of determining action and the lowest category was found in the indicators of inducing and considering the results of induction.

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INTRODUCTION

Learning in the 21st century expected to able to prepare the younger generation of Indonesia to welcome the advancement of science and technology in social life. Syahputra (2018) explains that there are many abilities that students must have in 21st-century learning, namely the ability to think critically, creatively, construct knowledge, solve problems and master the learning material well. The learning process based on the 2013 curriculum is directed at scientific learning which includes questioning, observing, gathering information, associating and communicating. The 2013 curriculum emphasizes students to be more active in the learning process, the teacher is only a facilitator so that the learning process can take place in two directions.

Based on the results of the 2018 Program for International Student Assessment (PISA), Indonesia's science ability score is 396 with a ranking of 71 out of 79 countries. PISA questions need problem-solving skills and the ability to reason which consists of 6 levels (lowest level 1 and highest level 6). Students in Indonesia are only able to answer at level 1 and level 2 (Lestari & Anas, 2020). Acquire of this value shows that the student's ability to answer questions that refer to critical thinking skills is still low. Based on the results of interviews with Biology teachers on October 20, 2020 and several students at SMA N 1 Ungaran on March 6, 2020, it was known that there were still problems in the classroom when biology online learning was only 55.55% of students' daily test scores who reached minimum criteria of mastery learning, students still did not. trained to analyze problems that exist around students and online learning that carried out has not used the web conference application to its full potential, which is still only limited to giving assignments to whatsapp grub so that students are less active during learning and students are not active in asking or expressing opinions during learning, many students who only memorize the material without understanding the material presented. Based on the results of the pretest, the critical thinking ability is only 12.96% of students who get more than the minimum criteria of mastery learning. This proves that student's critical thinking skills are less honed. Student's critical thinking skills can be trained and improved when using an attractive and proper learning model, the teacher can convey material content easily and give opportunities for students to think critically, rationally and reason quickly so that they no longer use concepts directly. (Rahayu et al, 2015). Critical thinking is a process of intelligence in learning that is active in making definitions or concepts, applying, analyzing, making a synthesis, and evaluating the information obtained or the information generated. All of these activities are the result of observation, experience, thought, consideration, and communication (Zubaidah, 2010).

The learning method most often used in schools is the lecture method which causes the learning activities carried out not to able to stimulate students' thinking abilities. Therefore, there needs an effort on the part of the school to change the learning model from being teacher-centered to student-centered learning. Teachers must make several innovations in learning to increase students' activity and thinking skills (Sukarman, 2020).

An effort to improve students' critical thinking skills is to change the learning model used, namely using the Treffinger learning model. Treffinger's learning model is known as the Creative Problem Solving model which is develop the model developed by Osborn (Huda, 2013). According to Chotimah (2018) Treffinger is a model designed to directly address students' criticality problems by covering cognitive and affective abilities. Sari's research (2015) shows that the Treffinger learning model effect on the critical and creative thinking skills of Kanjuruhan University students in Malang. The results of Alifia's (2018) research show that the Trifingger learning model with metacognition strategies improves the critical and creative thinking skills of class VIII students of SMPN 1 Dau Malang.

In practicing critical thinking skills, especially in biology, problem solving is done by exploring the environment around students. Fatimah (2015). The application of the Treffinger model with the *Jelajah Alam Sekitar* approach leads students to find the concept of phenomena that exist around students. The *Jelajah Alam Sekitar* Approach emphasizes the delivery of material which includes the nature, scope and ways of exploratory activities as well as providing real experiences to students during learning activities so that their learning outcomes are more meaningful and efficient (Alimah & Marianti, 2016). Research

conducted by Dion et al (2021) proves that apply an audio-visual assisted *Jelajah Alam Sekitar* approach can improve learning outcomes in the context of critical thinking skills. Through the *Jelajah Alam Sekitar* approach, it can give opportunities for students to link learning concepts with real-world problems so that learning will be more effective and meaningful. Through the application of the *Jelajah Alam Sekitar* approach, it expected to improve students' critical thinking skills.

Based on the above background, it is necessary research to analyze the effect of the Treffinger learning model with the *Jelajah Alam Sekitar* approach on student's critical thinking abilities.

RESEARCH METHOD

This research conducted at SMA N 1 Ungaran in 2021, even semester of the 2020/2021 school year by carrying out a series of online learning processes due to the Covid-19 pandemic which until early 2021 had not ended, so face-to-face learning was abolished and replaced with online learning use Zoom, Google Classroom, and WhatsApp. The subjects used in this study were students of class XI MIPA 1, XI MIPA 2, and XI MIPA 3. Sampling by using the purposive random sampling technique. The treatment given during the online learning process is the learning process using the Treffinger or Creative Problem-Solving model combined with 6 components of the *Jelajah Alam Sekitar* approach (exploration, learning community, constructivism, science processes, bio edutainment, and authentic assessment) students are trained to express ideas, the solution to problems and carry out independent practicum by the SDS (student discussion sheet) and SW (student worksheet).

The research data were in the form of test results of student's critical thinking skills, teacher response questionnaires, student response questionnaires, and implementation of learning syntax. This research procedure includes three stages, namely the preparation stage, the research stage, and the last stage of the research. Data collection methods used tests, questionnaires, and observations. The results of the student questionnaire responses analyzed descriptively quantitatively. The results of the student's critical thinking ability tests analyzed using the N-gain test, The results of the posttest scores of each student analyzed using classical completeness calculations to determine the percentage of students who were declared to have completed learning. The percentage of critical thinking ability indicator achievement in the essay test analyzed descriptively quantitatively. The results of teacher responses analyzed descriptive qualitatively.

RESULTS AND DISCUSSION

This study used the Treffinger model using the *Jelajah Alam Sekitar* (JAS) approach which applied online to three experimental classes. The results of the study consisted of critical thinking skills tests, teacher response questionnaires, student response questionnaires, and learning implementation analysis.

Critical Thinking Ability Test Results

Students' critical thinking skills are cognitively measured using pretest and posttest questions. The question consisted of 6 item description questions which consisted of 5 indicators of critical thinking skills according to Ennis. The results of the student's critical thinking ability tests obtained from the post-test results. To explain the increase in the critical thinking ability of the experimental class, the N-Gain test conducted. The results of the N-Gain test analysis presented in Figure 1 below.

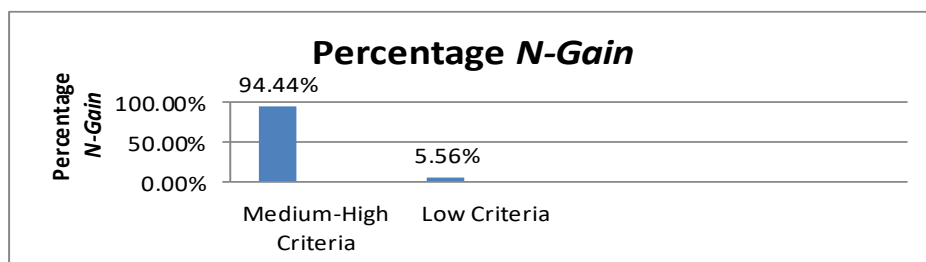


Figure 1 Percentage N-Gain scores

The students' critical thinking skills increased, as shown by the results of the percentage of N-gain scores that received moderate to high criteria of 94.44% and the percentage of N-gain scores on low criteria of 5.56% as shown in graph 4.1. This proves that students' critical thinking skills have increased, namely the percentage of the number of students who get a moderate to high N-gain criterion score > 80%. The success of learning also implies completeness in learning and completeness in the learning process. In this study, in addition to the N-Gain test, the results of the students' pretest and posttest were also analyzed classically. The results of the percentage of classical completeness presented in Table 1.

The increase in students' critical thinking skills is because when the online learning process takes place using the Treffinger or Creative Problem Solving model combined with the *Jelajah Alam Sekitar* Approach the teacher encourages students to think more critically and actively. Learning that carried out has several levels and stages that affect on students' critical thinking skills. Teaching thinking skills requires a student-centered learning model (Reza, 2014).

The teacher gives problems in the environment around students such as lung fibrosis, the dangers of smoking for health, and air pollution. Students and their group of friends analyze the problems that have been given to SDS (student discussion sheet) and SW (student worksheet), namely expressing ideas related to problems as well as how to solve existing problems. Students trained to think critically on how to develop solutions to existing problems by exploring existing sources from journals, articles, books, and the internet.

The technique in Treffinger's learning is problem-based. Problem solving is closely related to critical thinking. This technique is combined with the *Jelajah Alam Sekitar* part, especially the exploration part, where students are given the freedom to explore as much information as they can from various sources. Exploration activities carried out are not limited to exploration of learning resources, but students also carry out independent research in their own homes. The problem-solving process carried out by students will encourage them to think analytically so that they can improve their critical thinking skills in the respiratory system material. This is agreed by Sunaryo (2014) that student's critical thinking skills will grow if they trained to do exploration, inquiry, discover, and solve problems.

The success of learning also implies completeness in learning and completeness in the learning process. In this study, besides the N-Gain test, the results of the student's pretest and posttest were also analyzed classically. The results of the percentage of classical completeness presented in Table 1.

Table 1 Average percentage results of students' classical completeness Treffinger model using the *Jelajah Alam Sekitar* Approach in SMA N 1 Ungaran

Category	Pretest	Posttest
Average Highest Value	81.33	96.00
Lowest Value Average	41.33	65.33
Overall Average	60.25	89.12
Total Students Completed	14	95
Total of Students Didn't Completed	94	13
Minimum criteria of mastery learning	75	
Classical Completeness (%)	87.96%	

Based on Table 1, it is known that the average learning achievement in the experimental class is that there are students who complete classically with a percentage of 87.96%. Based on these data, the experimental class has met the criteria for classical learning completeness, namely those who get more than the minimum criteria of mastery learning (75) as many as $\geq 75\%$ of students. In this study there were still 13 students whose learning outcomes (posttest scores) got a score below ≤ 75 , based on the reflection journals that students filled in on google form, some obstacles were also met during online learning using the Treffinger model with the JAS approach. There are some students whose internet connection is not stable so that the learning material they receive is not ideal.

The percentage of student's critical thinking abilities for each indicator has analyzed achieve critical thinking skills obtained after students worked on the posttest. The average data on achieve critical thinking skills can seen in Figure 2.

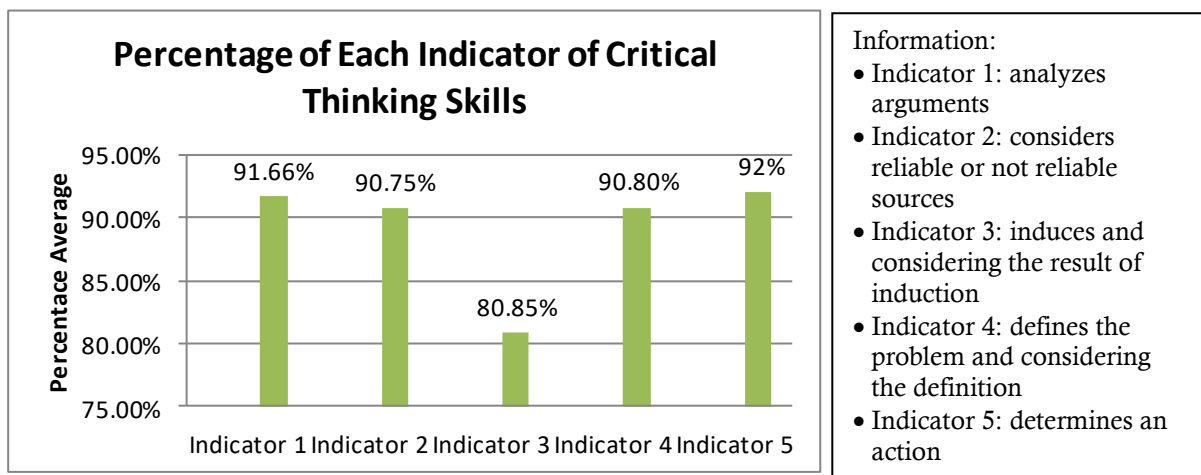


Figure 2 Average percentage of achievement in thinking skills by the criterion of each indicator

Figure 2 explains the average percentage of each indicator of critical thinking skills from the test results. The highest indicator achievement is the fifth indicator, which is determining an action at 92.00% and the lowest percentage is the third indicator, namely inducing and considering the induction result of 80.85 %, but is still in the good category. This is because students have not been able to formulate the problem properly but have been able to make conclusions based on the observation data table provided.

The first indicator analyzes the argument, the average achievement of this indicator is 91.66%, which is in the very good category. This is because most students can summarize and see the structure of an argument, students can make arguments according to their thoughts about the effectiveness of masks to prevent the Covid-19 virus and the impact of this virus on the health of the human respiratory system based on the articles that presented. In addition, students are also can analyze how well the daily phenomena experienced, namely choking, related to the human breathing process. During the learning process, students trained to open-minded, express ideas and ideas about pulmonary fibrosis, how the structure of the lungs is normal, prevention of pulmonary fibrosis, organs and structures of organs that constrict the human respiratory system, differences in the vital capacity of men's lungs -men and women, things that cause changes in respiratory frequency are also how pollutants and air quality affect the human respiratory system. According to Fathiah (2014) by having critical thinking skills, students will have the courage to express ideas, always have curiosity, flexible, open-minded, honest, careful in making decisions, have a clear mind, orderly and coherently in solving a problem, and never give up in looking for the desired results.

The second indicator considers reliable sources or not, the average achievement of this indicator is 90.75%, which is in the very good category. Considering whether the sources are reliable or not is that students can answer questions referring to the knowledge they have read and received from books, journals, and articles. Students can analyze and sort in their thinking whether the information obtained is

correct or not by comparing the information that has been obtained during the learning process and when doing the given assignments. Based on the essay test answers, it can be seen that students can give reasons and consider proper information about how activities affect the respiratory frequency and other factors that can affect human respiratory frequency. During the learning process students encouraged to gather information from various sources by reading books, articles, journals and doing an independent research in their own homes. Critical thinking does not always mean being seen as just activity criticism in a negative connotation, but activities to analyze, interpret data, evaluate existing evidence, also apply knowledge (Diyanni, 2016).

The third indicator induces and considers the results of the induction, the average achievement of this indicator is 80.85%, which is in the good category. This indicator has the lowest average percentage of the other four indicators. It can be seen that most students have not been able to formulate the problem properly but have been able to put forward the right conclusions from the experimental data table that has been given. During the learning process, the Treffinger model with the *JAS* approach facilitates students to be able to achieve inducing indicators and consider the results of induction. One of them is syntax which requires students to be able to formulate problems and explore data. However, many reasons are a factor in the low achievement of this indicator compared to other indicators, namely students still do not understand the contents of the questions, still have difficulty analyzing and evaluating information. In the learning process carried out at three meetings, students trained to formulate problems in only two meetings, this causes students to be less trained in formulating problems, the solution that can be done is to train students to formulate problems in the three learning meetings are held.

The fourth indicator defines the problem and considers the definition, the average achievement of this indicator is 90.80%, which is in the very good category. Students can define problems and consider definitions, namely being able to make a form of definition by linking the structure and function of the respiratory organs with the human respiratory process. Students can give further explanations or further responses about why the temperature of the air that enters the human body, the temperature must adjust first about the structure and function of the nose. The learning model used has facilitated students to be able to achieve this indicator, namely during constructivism and the scientific process through question-and-answer activities carried out during the learning process.

The fifth critical thinking indicator determines an action, the average achievement of this indicator is 92.00% including the very good category, this indicator has the highest average percentage compared to the other four indicators, this proves students can express problems about how cigarettes can cause lung cancer as well as being able to reveal solutions to prevent the disease properly and appropriately. During the learning process using the Treffinger model with the *JAS* approach students trained to be able to reveal solutions to various problems through literature studies and independent research, namely in expressing solutions for how to prevent pulmonary fibrosis, proving differences in the vital capacities of the lungs of men and women, activity affect the respiratory frequency, prevention of lung cancer due to smoking and reduction of air pollution in Indonesia. This is following Eunice's (2019) research that there are several activities when someone thinks critically, namely: identifying problems, carefully considering a problem that pursued through inquiry and reasoning, gathering crucial information, recognizing implied assumptions and values, using language accurately, interpret data and conclude.

The treatment given during the online learning process is the learning process using the Treffinger or Creative Problem Solving model combined with the *Jelajah Alam Sekitar* approach, by encouraging students to think more critically and actively. Learning that is carried out has several levels and stages that affect on students' critical thinking skills. Teaching thinking skills requires a student-centered learning model (Reza, 2014). According to Shoimin (2015), the Treffinger model to encourage critical learning describes a three-stage arrangement starting with elements and moving up to more multiple thinking functions, students are actively involved in skill building activities in the first two stages to then deal with life problems. real in the third stage. By using the Treffinger learning model, it can affect student's high order thinking skills.

Level I (basic tools) is the stage of determining aims, extracting data and formulating. This stage

combined with the *JAS* components in the form of constructivism and the scientific process. At the level I, the basic technique is a divergent function, the technique used is open-ended questions, and brainstorming. Students observe the picture presented by the teacher at the zoom meeting and ask questions. The pictures and questions related to the material to be studied in learning. The stage of collecting data and formulating it is also combined with the *JAS* component in the form of a learning community, namely the teacher guides students to determine ideas in groups, analyze solutions, and answer questions on SDS (student discussion sheet) and SW (student worksheet).

The next step is at level II (research with the process) the stage of generating ideas, this stage combined with *JAS* components in the form of a science process and learning society. Students in groups discuss in the WhatsApp group of each group to decide the right ideas based on the discourse and pictures that are presented in the SDS (student discussion sheet) and SW (student worksheet). By the *JAS* approach, makes students more flexible to study independently, exchange ideas, and do group assignments by conducting investigations guided by SDS and SW, this is one of the characteristics of the *JAS* approach, namely the existence of a learning community (Budiman & Marianti, 2020). At this level, it functions to develop ideas in creative thinking. students independently train their minds to analyze problems, describe to find ideas in problem solving then emphasize the details of the action. This is following what stated by Yuli & Dwi (2015) that problem solving activities will increase students' sensitivity to problems. One that characterizes Treffinger's learning or Creative Problem Solving. Amir (2010) states that "problems provide opportunities to increase motivation in students". This indicates that giving problems provides motivation and challenges for students that lead to finding solutions so that they demand critical thinking. At this stage students freely determine the ideas they make. The results in the SDS and SW show that all groups presented more than two ideas.

Next is level III (working with real problems), the stage of developing solutions and building acceptance, this stage combined with *JAS* components of bio edutainment, experimentation, learning society, constructivism, and authentic assessment. Together with their group members, students formulate ideas on how the difference between normal lung and pulmonary fibrosis, prevention of pulmonary fibrosis, organs and structures of the constituent organs of the human respiratory system, differences in the vital capacity of the lungs of men and women, things that cause changes in respiratory frequency, dangers cigarettes for the health of the respiratory system and how pollutants and air quality affect the human respiration system through pictures, data and snippets of articles on SDS and SW. Through problem solving students will first look for facts then make hypotheses and describe the information obtained and then draw conclusions. Furthermore, students choose the best solution and detail in the form of operational ideas. This series of activities indirectly brings students to a higher level of thinking and leads to critical thinking. This is as stated by Syaefi (2015) that the learning method that can develop students' critical thinking is learning that emphasizes the need for students to plan problem-solving strategies from various sources, generate many ideas, compare solution strategies with earlier experiences or theories.

Teacher Responses

The teacher's response to the Treffinger model online learning with the Natural Exploration Approach to the Respiration System material can be seen in Table 2.

Table 2 Results of the teacher's responses to online learning by Treffinger's model using *Jelajah Alam Sekitar* Approach in SMA N 1 Ungaran

No.	Main Questions for Teacher's Response	Main Questions for Teacher's Response
1	Impression of learning Students look more active, the learning atmosphere is interesting and fun	Impression of learning Students look more active, the learning atmosphere is interesting and fun
2	Ease of learning can increase student learning activities and improve students' critical thinking skills	Ease of learning can increase student learning activities and improve students' critical thinking skills
3	Learning difficulties progressed smoothly,	Learning difficulties progressed smoothly, however, there were

	however, there were some students whose internet connection was not smooth	some students whose internet connection was not smooth
4	Interested in learning Interested, because students are more active in working in groups, students are also able to express their opinions well, observe pictures and analyze problems. Fun learning atmosphere	Interested in learning Interested, because students are more active in working in groups, students are also able to express their opinions well, observe pictures and analyze problems. Fun learning atmosphere
5	Criticisms and suggestions for online learning that have been implemented have been good, controlling attention must always be done when students present so that other students always pay attention to what their friends say	Criticisms and suggestions for online learning that have been implemented have been good, controlling attention must always be done when students present so that other students always pay attention to what their friends say

Table 2 shows the teacher gave a positive response to the learning that done. Apply the Treffinger model online learning model with the JAS approach can make students more active in a learning atmosphere. Student activeness can arise because of involve students in every process of learning activities carried out so that their critical thinking skills can trained. This is following the results of research by Cipto (2018) which states that Treffinger learning can increase student activeness and their critical thinking skills.

Student Responses

Student responses to online learning using the Treffinger model with the Natural Exploration Approach taken after the learning process of the respiratory system material is complete. The results of the analysis of student responses presented in Table 3.

Table 3 The results of the analysis of students' responses to the Treffinger model online learning using *Jelajah Alam Sekitar* Approach at SMA N 1 Ungaran

No.	Statement of Mean Value (%) Criteria	Statement of Mean Value (%) Criteria	Statement of Mean Value (%) Criteria
1	I am interested in following the process of learning the biology of the respiratory system material using the applied learning model	85.65%	Very good
2	I feel happy during the process of learning the respiratory system material	83.80%	Very good
3	Respiration system learning was interesting so it motivated me to take part in the lesson	82.41%	Very good
4	The learning process doesn't feel boring	83.80%	Very good
5	I studied the respiratory system material by understanding, not just memorizing	84.26%	Very good
6	I can express ideas on problems regarding the respiratory system	81.02%	Very good
7	I can provide precise solutions to ideas and problems about the respiratory system	81.71%	Very good
8	I work together with group members during the learning process	87.97%	Very good
9	I am able to carry out an independent practicum well and not make mistakes that result in work accidents	87.27%	Very good
10	I am more courageous in expressing my opinion during the learning process	76.39%	Good
11	The learning process is carried out according to the respiratory system material	86.57%	Very good
12	The learning process that is carried out needs to be applied to other biology materials	84.95%	Very good
Average		83.82%	Very good

Based on the results of student responses in Table 3, it can be seen that the average answer to the questionnaire responses of students has a percentage of 83.82% in the very good category. Student interest

in the learning process is quite good and students motivated to carry out direct learning activities. The application of Treffinger's online learning model with the *JAS* approach makes students discover the concept of the respiratory system material through a process of question and answer, group discussions and independent research carried out by students. Learning by involving students in analyzing the problems and material being studied makes student learning activities better. Students are more enthusiastic and enthusiastic to learn by actively expressing arguments, answering questions, analyzing solutions to problems. Independent practicum for the vital capacity of the lungs and respiratory frequency which is then made documentation in the form of a video or photo that presented makes a learning atmosphere that is different from online learning which usually just stays at home while doing the assignments given by the teacher.

The application of the Treffinger online learning model with the *JAS* approach makes it easier for students to understand the material of the respiratory system well, namely students learn by not only memorizing the material but understanding the concept first. Treffinger's learning model can be used in a variety of situations. This model combines complex thinking so that it can be used in developing critical thinking (Yuswanti et al, 2018). In carrying out learning activities with the *JAS* approach, student activities are needed because one of the characteristics of this approach is constructivism in which students build their knowledge through the direct exploration of learning sources. Problem solving activities and independent research can foster scientific thinking skills, instill and develop scientific attitudes (Anggreani, 2015).

From the beginning to the end of learning, the steps presented in the Treffinger online learning model with the *JAS* approach designed to direct students to explore previously owned knowledge and learning activities are always linked to problems that occur in the environment around students directly or indirectly, namely by using learning media. This knowledge can come from previously obtained material or even from experiences in everyday life. The first knowledge they have becomes the capital for students to understand and master the concept of the material conveyed by the teacher in learning. The teacher acts as a facilitator and motivator to guide and direct students so that the learning process goes well according to the stages. Students construct the knowledge they already have by relating it to the learning material. Students research and hone their skills in thinking and analyzing events that occur to get the concept of the material being taught.

Some things that need to be considered in applying the Treffinger learning model using the *Jelajah Alam Sekitar* approach are that the teacher needs to focus student's attention when other students express opinions or during discussions because learning carried out online using zoom meetings which cause controlling student activity to less than optimal. Good timing makes learning activities, especially during the discussion, take place optimally, so that the process of understanding the material becomes better. In addition, this research can be carried out not only in one school to get better results, but this research only measures the improvement of student's critical thinking skills, not measuring the psychomotor and affective aspects of students. These limitations can be used as a consideration to improve the implementation of further research or as material for further research.

CONCLUSION

Based on the results of data analysis and discussion of research results, it is concluded that the application of the Treffinger model learning using the *Jelajah Alam Sekitar* approach can improve the critical thinking skills of high school students on the respiratory system material. Critical thinking skills for analyzing indicators are in the very good category, indicators consider reliable sources or are not in the very good category, indicators induce and consider the results of induction including good categories, indicators define problems and consider the results of definitions including very good categories and defining indicators an action categorized as very good. The highest category is the indicator determining an action and the lowest is the indicator inducing and considering the result of the induction.

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