

## Critical Thinking Skills Profile in Decision Making on Optical Materials At SMA Negeri 10 Surabaya

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### Abstract

Critical thinking skills is the ability to be possessed by every individual in the face of various problems. Differences level thinking skills of each individual affects all aspects of their daily activities, especially related to the concept and materials physics. Manifold ex post facto study aims to describe the profile of the students' critical thinking skills to solve the problems of optical devices. Instruments critical thinking is modified from standard instruments critical thinking Watson-Glaser Critical Thinking Appraisal (W-GCTA) and the California Critical Thinking Skills Test (CCTST) on the material of optical devices. The samples were 63 students (2 classes XI MIA) SMA Negeri 10 Surabaya, 10% of the total number of students as many as 261 students. Based on the test of critical thinking skills can be obtained that the average percentage of each indicator critical thinking is inference (23%), assumptions (62%), deduction (72%), interpretation (53%), arguments (54%), analysis (34%), evaluation (37%), and the conclusion (26%), as well as an explanation (33%). Each indicator of the level of critical thinking skills profiles majority being down. In an essay about the indicator value is still a small percentage even though other indicators enough and it was very good.

**Keywords:** Critical Thinking Skills Profile, Optical Device Material, Problem Solving

### Abstrak

Keterampilan berpikir kritis merupakan kemampuan yang harus dimiliki oleh setiap individu dalam menghadapi berbagai masalah. Perbedaan tingkat kemampuan berpikir setiap individu tersebut mempengaruhi seluruh aspek dalam melakukan kegiatan sehari-hari khususnya yang berkaitan dengan konsep dan materi fisika. Penelitian berjenis *ex-post facto* ini bertujuan untuk mendeskripsikan profil keterampilan berpikir kritis siswa dalam menyelesaikan permasalahan alat optik. Instrumen berpikir kritis dimodifikasi dari instrumen baku berpikir kritis *Watson-Glaser Critical Thinking Appraisal* (W-GCTA) dan *California Critical Thinking Skill Test* (CCTST) pada materi alat optik. Sampel penelitian adalah 63 siswa (2 kelas XI MIA) SMA Negeri 10 Surabaya, 10% dari total jumlah siswa sebanyak 261 siswa. Berdasarkan nilai uji keterampilan berpikir kritis dapat diperoleh bahwa rerata persentase masing-masing indikator berpikir kritis adalah inferensi (23%), asumsi (62%), deduksi (72%), interpretasi (53%), argumentasi (54%), analisis (34%), evaluasi (37%), dan kesimpulan (26%), serta penjelasan (33%). Setiap indikator tingkatan profil keterampilan berpikir kritis mayoritas sedang ke bawah. Pada indikator soal esai nilai persentase masih kecil meskipun indikator lain cukup dan sudah sangat baik.

**Keywords:** Profil Keterampilan Berpikir Kritis, Materi Alat Optik, Penyelesaian Masalah

### INTRODUCTION

The development of science and technology requires competence and skills that can be used to withstand the changes, one of them through education. Education is the most appropriate means to increase the competitiveness of the global world in desperate need of personal skilled in the field. Because of the inclusion of the ASEAN Economic

Community to Indonesia, the government provides a standard on the 21<sup>st</sup> century skills, which are implemented scientific inquiry. Using a student-centered approach in order to make creative thinking, critical, problem-solving, innovating, and prioritizing communication and collaboration skills (Hastuti, 2013), Critical thinking skills are still not widely recognized in the educational world powers,

because there are many teachers who consider the ability of students to be transferred from the teacher. Supposedly students should have to be trained to develop critical thinking skills by providing problems that students are often experienced at each age levels, where students are trained to argue on the issues presented, get the opportunity to provide solutions and should consider about the risk of the solutions taken. To find, discover, and solve problems in understanding the physics concepts and materials, students are accused to be actively involved and responsible for himself (Umami & Jatmiko, 2013),

Critical thinking is an important concept for all regions of the world, especially in education, which is a priority for students (İşlek & Hürsen, 2014) but in Indonesia critical thinking skills are still very low (Reta, 2012). Critical thinking skills were able to be applied to evaluate new information and justify the concept of initially misconceptions (Thohir, et al., 2013). Critical thinking is a process of intellectual discipline of activeness and conceptual skills, applicative, analysis, synthesis, and evaluation of information obtained based on observation, experience, reflection, reasoning, and communication as guidelines (Kustijono, 2012), Critical thinking can be defined as a period of effective cognitive, organized, and operations that allows us to increase the understanding of our own minds in the form of ideas and skills (Özsoy-Güneş, et al., 2015) as a process of evaluation and interpretation of available information before making a solution or a final decision which then act based on solutions are made. Critical thinking skills are very important to measure, because students who have these skills is able to examine the arguments of a problem based on knowledge and scientific truth so as to assess these arguments without any doubt (Rahmawati, et al., 2016),

According to Mulyani&Fitriany (2015), more than 50% of students still do not understand the concept of optical devices and many have difficulty in resolving a problem though on the problem the majority of concepts that are in the cognitive C2 to C4. That is because knowledge is still lacking or optical applications obtained the concept is still not fully understood.

**Table 1.** Indicators Critical Thinking Skills

Indicators	Skills	Description
Watson Glaser Critical Thinking Appraisal	Inference	Ability to assess the level of probability of accuracy / validity of a conclusion based on the information available
	Assumption	The ability to identify the assumptions implicit in a statement
	Deduction	The ability to determine whether the conclusions are made logically based on the information available
	Interpretation	Ability to assess a proof (evidence) and make a decision whether generalizations / conclusions resulting guaranteed based on data available
	Evaluation of the argument	The ability to evaluate the strength and relevance of an argument related to a specific issue or problem
California Critical Thinking Skill Test and Facione	Analysis	The ability to identify relationships inferential of expectations and facts in between statements, questions, concepts, description, or other representation requirements to express the conviction, judgment, experience, reason, information, or options.
	Conclusion	The ability to identify and sort keywords to draw reasonable conclusions; form conjectures and hypotheses; consider relevant information; and mitigate the consequences will be of the data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other form of representation.
	Evaluation	The ability to assess the credibility of statements or other representations which is a record or description of perception, experience, situation, judgment, belief, or opinion of someone; and assess the logical strength of the actual inferential relationships or contemplated in the statements, descriptions, questions, or other forms of representation
Facione	Explanation	Confirm and justify reasoning with evidence, consideration of the conceptual, methodological, and contextual results obtained; and convey one's reasoning in the form of a convincing argument

Based on the selection of indicators, nine of the indicators fit in assessing the level of students' critical thinking skills. Five early indicators devoted

assess initial critical thinking ability of the students, while the remaining assess critical thinking skills are applicable in everyday life. Of the indicators that have been selected to illustrate the thinking ability of individuals in determining a choice and a decision of the many solutions offered. Decision-making in critical thinking is important because rapid and precise decision will be made to have an impact in the efficiency of time to solve problems and there is time for reflection when taken solution has its drawbacks.

Decision-making means taking certain actions, carrying out a plan of action, is the final stage of the decision process, but it does not stop there. Someone should always evaluate the result of the decision, to measure the level of compliance with the objectives that have been outlined as a policy or there are new things that require change its original purpose. Evaluation results provide inputs or feedback is very useful for repairing a decision or to change its original purpose as changes occur. In the circumstances where the information is incomplete or simply estimated only, (Danupranata, 2006),

## METHOD

This research is quantitative description model of ex post facto that focuses on critical thinking skills, especially in the matter of optical devices. The data collection took place in SMA Negeri 10 Surabaya

Determination of research subjects using purposive stratified random sampling, the number of samples used at least 10% of the total student population (261 out of the entire class XI MIA) (Amirullah, 2015) thus obtained 26 respondents. Data retrieval researchers set out on samples with a total of 63 students, so the distribution of student ability levels are met. Determination stratified randomly obtained from two classes at the school.

In the preparation phase, an analysis of KD 3.1 to analyze the workings of an optical instrument uses the properties of reflection and refraction of light by a lens and then dividing the lesser degree of competence to be achieved. Then formulate indicators of achievement and set goals based on indicators in the basic competencies. Adopt critical

thinking instruments tailored to the optical material. During the implementation phase, test-a test on a sample to acquire critical thinking skills profile of each sample. At the final stage of implementation, an analysis of the nine indicators assessed by the instruments provided later depicted in the form of a comparison chart.

The test results obtained critical thinking skills of each student profile of each indicator set out in the form of a numeric percentage, by way of calculation.

$$\text{Percentage Value} = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100\%$$

Large percentages obtained for each of the indicators described in the category of critical thinking skills levels are high, low, and moderate as the description in Table 2.

**Table 2** Critical Thinking Skills Profile Description (Susilowati, et al., 2017)

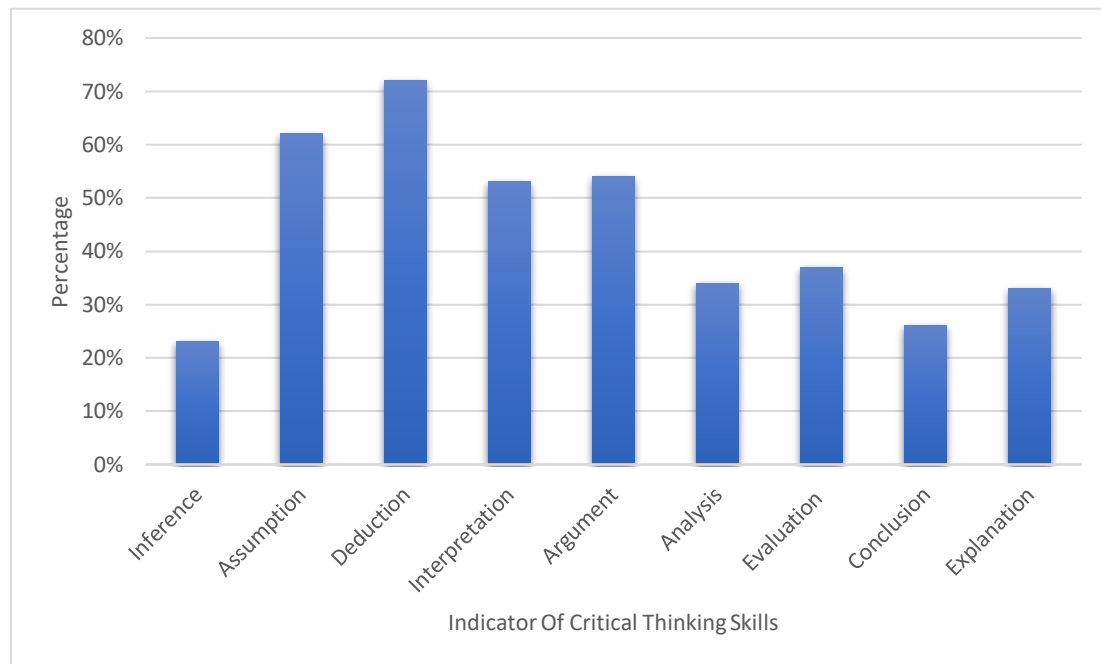
Interpretation (%)	Category
61 < x ≤ 100	High
31 < x ≤ 60	Medium
0 < x ≤ 30	Low

## RESULT AND DISCUSSION

Based on the analysis of data that have to be got Graph 1 profile critical thinking skills possessed by students of SMAN 10 Surabaya with the percentage obtained from the calculation of the amount of each indicator critical thinking skills than the ideal value which should be obtained by the student.

Based on Figure 1, there are several indicators of critical thinking skills with a percentage value that can achieve high category, assumptions and deductions. The percentage value shown on Figure 1 shows the level of critical thinking skills of the students at the school. The description of the criteria of critical thinking skills are divided into three categories: low, medium, and high. Description percentage value for each category can be seen in Table 2 Description of Critical Thinking Skills Profile.





**Figure 1** Critical Thinking Skills Profile

In Figure 1 it can be observed that the percentage of inference indicator is below 30% so that means the ability of students on this indicator remains low. Factors causing the low percentage gained is the ability menginferensi students are still lacking, coupled with the choice of answers about the item inference which is divided into five, making the chance to answer correctly gets smaller although students still able to do about it.

On the assumption indicator of students has reached a percentage above 60%, it means that the students' ability to make an assumption of a statement is quite good. Assumptions will impact on delivering relevant allegations against a problem but will possibly happen error in assuming the intent of permasalahan only chance for one was not as big when assuming are lacking capabilities.

In indicator deduction students also get a fairly high percentage when compared to other indicators is above 70% which is included in the high category. Deductive powers can not be separated from the ability to assume that prior to making the deduction approaching students should not be any solution in the assumed intent of the problems encountered so far deduction is made not to deviate from the problem. Here students of SMAN 10 Surabaya own ability to make deductions that can be said to be very good.

In the interpretation of the indicator get a percentage above 50%, it means that the ability of students already in the category enough.

Interpretation is very important in a problem where if the ability to interpret the lack or low then the person will experience confusion when looking at the results presented, otherwise when the ability to interpret a good problem the person will not experience a misunderstanding. In this case the students of SMAN 10 Surabaya has been said to be able to interpret the intent of a given problem.

In the evaluation indicators argument shows that the percentage reached more than 50%, it can mean that students already have a pretty good ability to evaluate the arguments of a problem. With a high percentage rate of students should be able to receive and reject the argument of a problem with a good reason, and is able to provide an explanation of the reasons.

Factors that affect a fairly high percentage are caused by management in making assumptions, deduction, interpretation and argument is relatively good in all indicators to be seen but the inference is still low. The fifth indicator assessed only see a few basic stages of decision-making as to formulate the problem, collect insformasi, choose alternatif answers provided, as well as making the answer itself which is then visible results on the indicator analysis, evaluation, inference, and explanation.

In the analysis indicators essay type of questions being obtained percentage levels above 30%, it can mean that students already have the ability to analyze a pretty good although very close to the lower limit of the medium category. This

analysis capabilities appear to be low at about the form of essays, require students to analyze the problem by using the stage of completion of the problem. When the stage of completion of the problem is not bypassed with both the ability of students to the analysis indicators are still considered less despite their critical thinking level is good enough. Based on the description of existing profiles and school students are still not able to choose the main ideas contained in the statement or identify the information needed to solve the problems.

In the evaluation indicators with the type of questions essay moderate earn a percentage above 30%, it means that the students' ability to evaluate the matter quite well. The ability to evaluate issues are required to obtain a solution and make a final conclusion. The ability of such evaluation requires fundamental assumptions, deduction, as well as the interpretation of a problem due to the evaluation needs to know the crux of the problem so that the solutions obtained in accordance with the evaluation.

At the conclusion of the type indicator essay about being a percentage rate of less than 30% so that it can be said that the ability of students in the conclusions indicator is still lacking. It shows that there is still inequality in students the ability to make inferences. In Figure 1 shows the percentage of students who have the ability to make conclusions by identifying ideas on the problems given and students are still mangalami confusion in making a conclusion of a problem. Basically, it is necessary to conclude the ability to give a brief explanation of a problem in outline.

In the explanation indicator earn a percentage greater than 30%. This suggests that the ability to explain have enough levels. The percentage value clarification high accuracy in determining a final outcome by passing the correct procedures and able to provide explanations that are easy to understand, while the lowest value showed still an error in determining the outcome though has gone through the proper procedures so that the results presented can not be described as an organized , On the indicator analysis, evaluation, inference, and explanation, the ability to solve problems has been applied to the full which is a percentage value obtained stage picture achieved by each. If the percentage is less than 30% the ability to solve the problem just beyond the stage of formulating the problem and gather information. On a percentage

less than 60%, the ability of the sduah reached the stage of finding and selecting an alternative answer to the problems encountered. For percentages above 60% have reached the stage of being able to evaluate the results obtained in the form of conclusions and reasons of the problems.

In the Appendix on the assessment results have seen the total value of highest and lowest scores of all students, which is the highest score 31 points and the lowest value of 5 points. The difference from the value large enough that 26 points where the lowest rating are not able to solve problems on the indicator analysis, evaluation, inference, and explanation to get a value of 0, while the highest value is still able to resolve the issue on four idnikator mentioned. Of the total students (63 people), there are 39 students who have a total value of more than 17 points and 24 students had a total value of less than 17 points out of 17 questions given. Based on these data it can be seen that more than 50% of students were able to solve the problem given well, so that critical thinking skills profile of the students of SMAN 10 Suarabaya majority in the category enough. Look at all the gaps critical thinking skills of the students. Of points gained visible difference in the ability of the students, which often occurs due to many factors including the students themselves and the outside factors that affect only not more than 30% the ability of the student. Although many students who have not exceeded the expected points, many students who have basic skills in critical thinking to solve problems. Thus it is necessary and required all teachers or a teacher mentoring in improving the capabilities that have been owned by the students. Of points gained visible difference in the ability of the students, which often occurs due to many factors including the students themselves and the outside factors that affect only not more than 30% the ability of the student. Although many students who have not exceeded the expected points, many students who have basic skills in critical thinking to solve problems. Thus it is necessary and required all teachers or a teacher mentoring in improving the capabilities that have been owned by the students. Of points gained visible difference in the ability of the students, which often occurs due to many factors including the students themselves and the outside factors that affect only not more than 30% the ability of the student. Although many students who have not exceeded the expected points, many students who have basic skills in critical thinking to

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## CLOSING

### Conclusion

Critical thinking skills profile of the students of SMAN 10 Surabaya most indicators remained at kriteia moderate, although some indicators remained at low criteria or less but still be offset by other indicators. Level thinking skills Krtis shown in profile has an influence on the settlement of the problems that exist on the instrument. Broadly speaking, critical thinking skills profile is still quite yet approached less, because at the applicable indicators are seikit above 30%. At the initial capability despite a good approach, but not enough to support the applicative if you want to be better.

### Suggestion

To obtain more accurate results, further research is expected to describe the profile of a population which is owned by taking more samples in the population in order to profile interpretation can be observed clearly and in detail.

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