



# Analyzing Undergraduate Students' Critical Thinking Skill in Science Course

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**Abstract:** One of the most important skills to be mastered by the students in 21st century is Critical Thinking, specially in science matter. It belongs to the higher-order thinking skill which requires the students to have the ability to think logically, reflectively, productively and systematically in making consideration and finally making the best decision. In Indonesia, one of the purposes of education is to build the students who are independent and can think effectively and critically to solve problems in difficult situations. In order to support this idea, most of learning activity which asks the students to memorize needs to be replaced to the activity requiring the students to analyze and give the logical solution. In this study, the researcher tried to find the data related students' critical thinking in the university. The descriptive quantitative is used to conduct this research. 50 undergraduate students were used as the subject of this research. The test given to the participants consisted of various categories such as C1, C2, C3, C4 and C5 which belongs to the Higher Order Thinking Skills (HOTS) and Lower Order Thinking Skills (LOTS). Based on the findings, the critical thinking of undergraduate students belongs to high with 62.55%. The highest indicator of critical thinking skills are analysis and evaluation, while the lowest indicator is inference. It can be concluded that students' critical thinking for undergraduate level after pandemic era are quite high as well as before the pandemic happened.

**Keywords:** Critical Thinking Skill; Science; Undergraduate

## Introduction

Nowadays, one of important skills to be mastered by students in education is critical thinking. Critical thinking belongs to the high-order thinking skill that potentially increases students' critical analytical power (Mislia et al., 2019; Sulistyanto et al., 2022). It is not only on how to use thinking skill or creativity (Runco, 2014), but also qualified problem solving skills, scientific and technological literacy skills because these are skills that are required for sustainability and lifelong education in addition to basic education. Therefore, it is necessary to develop the students' critical thinking skills in learning as an effort to improve students' learning results.

The critical thinking was a useful characteristic in school learning at every level, although critical thinking rarely got the attention from the teachers (Al-Husban, 2020; Kuhn, 2019). Students need to repeatedly practice

their thinking skills even though this skill is already part of their way of thinking. Regular practice that the students do will have an effect on the efficiency and automation of their thinking skills.

Critical thinking skills are skeptical, open, analytical and evaluative thinking skills (Hasanah et al., 2020; Majid, 2022). It belongs to the higher-order thinking skill which requires the students to have the ability to think logically, reflectively, productively and systematically in making consideration and finally making the best decision. The critical thinking is a person's ability to formulate something and give arguments or opinions, compile reports, conduct deductions and inductions, decide on something to be implemented later, and interact with other people to solve problem (Kurniawan et al., 2023). With this critical thinking ability, a person will be able to regulate and adjust, change and improve his thoughts (Mitsea et al.,

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2021), so that one can make decisions to act more quickly and precisely.

It also a reflective thinking process for making decisions accompanied by critical analysis based on evidence and reasons that are relevant and accountable. It starts with lower-order thinking skills like remembering and understanding, and progresses with higher order thinking skills such as analyzing, evaluating, and creating (Ghanizadeh et al., 2020). These skills are important for students not only to understand learning material, but also recognize problems, find solution to those problems, and find ways to solve problems in everyday life. There are formulas six indicator of critical thinking skills as follows (Seventika et al., 2018).

Interpretation, namely students' skills to make interpretations or interpret an experience, event, data, or criteria. Analysis, namely the skills of students to conduct investigations related to the causal relationship of a statement. Inference, namely the skills of students to draw conclusions from a data/statement based in evidence and relevant reasons. Evaluation, namely the skills of students to make judgements about the credibility of an information using inductive or deductive reasoning. Explanation, namely the skills of students to make detailed explanations of an event or problem based on concepts, methods, and strong considerations. Self - Regulation, namely students' skills to ensure or convince themselves that they have understood a statement or event.

The thinking skills are not inherited and are not automatically owned by students. It can be developed through a quality of education process. Critical thinking skills are obtained through guided practice. Setiawati & Corebima (2017) stated to teach critical thinking, teacher should use appropriate strategy in order to empower the critical thinking skills for different academic ability students. If in the teaching of critical thinking skills the students have not reached the stage where the students understand and learn to use it, the thinking skills will not be much useful.

However, since the Covid-19 spread in 2020 in Indonesia, the education system was change. The government issued a distance learning policy. The government issued a policy for all students to study at home, reduce social activities outside the home. This is unique challenge in the world of education as this pandemic has had a wider impact on society accompanied by a massive downturn, job losses, widespread protest over financial injustice, and the real health threat of Covid-19 (Herliandry et al., 2020). In education side, teachers and educators must undergo the ongoing massive migration from conventional face-to-face education to distance education as a basic

element of teaching even though educators and learners are in several locations (Dewi, 2017; Susanti, 2019).

The urgency of this research is to evaluate students' critical thinking in undergraduate level after the pandemic Covid-19 era. It also gave comprehension information related on how distance education affects students' critical thinking as Indraswati et al.( 2020) found that distance learning was less development thinking, and less relevant to the environment, supervision, and teaching professionalism.

### Method

This research was conducted using quantitative research and descriptive research design. It is used to analyze the level of critical thinking of students in Universitas Sari Mulia after pandemic situation end. The subjects in this study consisted of 50 undergraduate students. Students' critical thinking skill were measured by using cognitive learning test in the form of essay test as many as 12 items adopted from Facione (2014) in the forms of a description that was compiled based on indicators of critical thinking skills. The type of the data is in the forms of scores of students' critical thinking skills. The rubric used was the rubric of cognitive learning result adapted from Hart et al. (2021) consisting of five scales (1-5). Then analyzed using quantitative descriptive analysis techniques. First, calculate the average score of students' critical thinking skills with the Formula 1.

$$\text{Mean} = \frac{\text{Total score of indicators}}{\text{Total students}} \tag{1}$$

Second, determine the percentage of the average score obtained by the Formula 2.

$$\text{Percentage} = \frac{\text{Mean score}}{\text{Maximum score}} \times 100\% \tag{2}$$

The percentage score of students' critical thinking skills is then converted into qualitative values (categories) as shown in Table 1.

**Table 1.** Category of students' critical thinking skills level

Percentage (%)	Category
>80	Very High
>60-80	High
>40-60	Medium
>20-40	Low
<20	Very Low

## Result and Discussion

### HOTS in Science

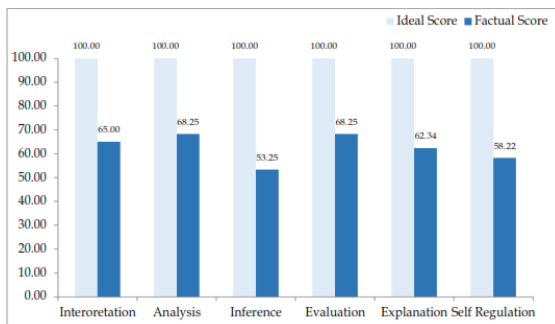
Based on the results of the test, it can be seen the mean score of students' critical thinking skills for undergraduate students in Banjarmasin for each indicator of critical thinking skills in Table 2.

**Table 2.** Mean score of students' critical thinking skills in Science

Indicator of critical thinking skills	Mean	Percentage (%)
Interpretation	1.3	65.00
Analysis	1.36	68.25
Inference	1.06	53.25
Evaluation	1.36	68.25
Explanation	1.25	62.34
Self Regulation	1.16	58.22
Total Mean Score		62.55

It can be seen from Table 2 that the average score of the students' test for critical thinking skills for undergraduate student in Banjarmasin are included sufficient category with a score of 62.66%. Based on the table 1, it can be interpreted that the highest indicator of critical thinking measured is in the term of analysis and evaluation with the mean score 1.36 or 68.25%. While the lowest mean score is inference with the total mean score is 1.06 or 53.25%. From the table, it can be seen the overall of the critical thinking of the students is quite high even though it is still need to be improved. The data in the table 2 can also be visualized in the form of histogram in Figure 1.

Based on the test, it is shown that the critical thinking of undergraduate students in Banjarmasin as a whole were quite high, which amounted 62.55%. These result are in line with the research study by Utami et al. (2018) which states that critical thinking skills of undergraduate students in West Java before the pandemic are still at average category. From the six critical thinking skills indicators, the inference and self-regulation indicators get the lowest average score, which is less than 60%.



**Figure 1.** Mean score of students' critical thinking skills

Inference indicator has the lowest achievement compared to other indicators at 53.25%. Sub indicators including asking for evidence, guessing alternatives and concluding. Students are able to make conclusions from a phenomenon that occurs precisely. The ability to inference is best because the students are accustomed to concluding events, close to daily life, and already have previous concepts. In this part, students who have the ability to deduce more experienced and mastered in describing, guessing according to reality, principle, proof, beliefs, concepts and other forms of representation.

The low critical thinking skills of students cause students to be more difficult to master the learning holistically (Kwangmuang et al., 2021; Oliveira & de Souza, 2022). Students' knowledge and skill are limited to information conveyed by the teacher or written in the textbook. It is line with the research conducted by Nuryanti et al. (2018) which found that the expected learning can take place interactively with the presence of further discussion in the class does not occur. In addition, the low critical thinking skills of the students not only make it difficult for students to solve the problems related the material, but also the difficulty to solve problems in daily life. Furthermore Aizikovitsh-Udi et al. (2015) explained that low critical thinking skills can influence students' ability to chose the right profession in the future.

On the other hand, analysis and evaluation indicators are the highest achievement in the test. The ability of analysis owned by the students is 68.25 %. It can be inferred that students in general do not have any significant difficulties to make connection between concepts, ideas and evidence. Analysis relates to principles, evidence, judgment, beliefs, opinion, concepts, reasons, and information (Hammersley-Fletcher & Hanley, 2016; Shaheen, 2016). The ability to analyze leads to face certain condition, problems of objects, determine the decision and efforts made. Their strategies in learning, in this case, by memorization make it difficult to develop logic, think critically and analyze. Through memorization is not powerful enough to enhance understanding in learning, students tend to do it with the purpose of emergence questions on the final test. Analytical indicators attribute existing information with concepts and problem solving. The learning process requires concepts and strategies un understanding concepts. Students are given assignments as projects related to daily life.

The evaluation indicator is also the highest percentage as same as the analysis. Evaluation as a form of evaluation of a statement or opinion of someone who answers a logic of the statement. The process of evaluating is done by examining each step of action,

reviewing information, and verifying referential and supporting evidence. Evaluation indicators are used so that students are able to update information, remember to work systematically and carefully.

Interpretation is the third highest indicator with the result 65.00% which has the category high. Interpretation is the ability of students to express and understand the meaning of a statement, situation, data, or event that is characterized by its ability to categorize, understand or make symbols, and to clarify the meaning of things (Facione, 2014). In this indicator, the students have begun to be trained in providing explanations of phenomena or ideas through giving ideas or opinions. The ability of the students in the category is high enough to explain about certain thing. Most of students can answer and explain about the topic questioned.

High critical thinking skills can help increase students' curiosity and guard to improve their abilities (Hacioglu & Gulhan, 2021; Rahayu & Dewi, 2022) in both academic field and daily life, such as: facing challenges in learning, discovering new things, and finally finding the solution to good problems that are often faced and have never been encountered (Hunaepi et al., 2020; Zetriuslita et al., 2016). Students who have high critical thinking will have more confident, independent, and able to solve any problem wisely both in daily and contextual way.

The low critical thinking in term of analysis and self-regulation by the undergraduate students in Banjarmasin can be caused by several factors, both internal and external factors. Internal factors are factors that come from students themselves such as students' age, gender, motivation, and intellectual level. The external factors that can influence students' critical thinking skill, for example, come from the learning process in the classroom, including: the model/ method/ approach/ strategy used, teacher competency, as well as facilities and infrastructure of the institution.

For the level of undergraduate students, they tend to have the stabilized in term of age. In this phase, students' average age is 18-20 years old who has passed the operational-concrete intellectual stage. Ideally, the students in this phase have the proportional ability of critical thinking, because they are able to process any abstract idea. The more age, the better skills in critical thinking, because they have more experience dealing with problems that require critical thinking. However, the age is not enough. The gender, IQ, motivation and intellectual level are matter. It is supported by Razak (2017), the results show that students' intellectual level has a correlation with students' critical thinking skills. So, the students with a higher level of IQ tend to have higher critical thinking skills as well (Artinta & Fauziah, 2021).

## Conclusion

The result of the study about students' achieving in critical thinking for undergraduate students is 62.55% high category. The lowest indicator is inference with 53.55%. based on these findings, it can be found that students critical thinking after pandemic Covid-19 era is still high as well as before pandemic era, although it is still necessary to improve students' critical thinking skills and conduct learning activities that integrate critical thinking skills. The students can increase critical thinking then the teachers develop learning that prioritizes critical thinking processes. Further researcher may do experimental research to improve students' critical thinking in the classroom using certain method, strategies, or media.

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## Conflicts of Interest

In this research, there is no tug of interest and or hidden interests among the researchers. In addition, this research is also not an order from any funder because it is independent research

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