Analysis of Critical Thinking Ability of High School Students in Sleman Regency on Virus Material

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Abstract: The benefits obtained if someone think critically is to make students active and effective in life, they can also develop understanding, evaluate different insights, develop problem solving skills so that later students have the ability to analyze further. The purpose of this analysis is to describe the critical thinking abilities of students in Sleman Regency. This research uses a quantitative descriptive method using an essay with 5 questions referring to indicators of critical thinking. Apart from that, the population in this analysis is all state high schools in Sleman Regency with a purposive random sampling technique of 9 schools, totaling 258 students. The results of the research show that students' critical thinking abilities are in the low category, so it is hoped that innovation will be needed in the form of developing methods, media, strategies and learning models that support students' 21st century abilities, especially in the aspect of critical thinking abilities.

Keywords: Critical thinking indicators; Critical thinking skills; Education; Viruses; 21st Century

Introduction

The definition of education as stated in Law Number 20 of 2003 concerning national education is a conscious and planned effort with the aim of students being able to realize their desires in a better direction which will then be able to explore the natural potential within students and make students active. There are several ways that the government can implement in realizing the goals of education in Indonesia, one of which is by developing an innovation to reform the education system which is useful for improving educational outcomes, and educational goals so that they can be achieved optimally in making the nation's life more intelligent.

Currently education in Indonesia is in the 4.0 revolution which is known as 21st century education, namely 6C where students must be able to have good character, citizenship, be able to think critically, be creative, be able to collaborate and speak well (Arisoy & Aybek, 2021; Chairunnisa, 2021; Darmayanti et al., 2022).

In its application in participating in 21st century education, students in learning are faced with various problems and are asked to be able to find solutions or analyze and study these problems, so the teacher's role is very important in combining C4-C6 questions during learning (Mai et al., 2019) . Critical thinking is very important for everyone, both rural and urban communities. Students who are able to think critically are usually able to understand concepts and apply them, are able to study and evaluate information and are able to make conclusions rationally. The ability of students who have high thinking will produce new knowledge and relevance from the environment outside the school (Sasson et al., 2018). Apart from that, critical thinking skills can make students active and effective throughout life, they can also develop understanding, evaluate different insights, develop problem solving skills so that later students have the ability to analyze further (Inganah et al., 2023).

Critical thinking skills can be obtained through the process of problem solving and collaboration (Pradana et al., 2020). The impact that arises if we are unable to think critically is that we give up easily, cannot argue,

complain, and cannot control our emotions. Apart from that, 21st century education is known for the use of digital tools in various fields so that it is called the century of knowledge and technology (Arif et al., 2021).

Based on the results of interviews with high school teachers in Yogyakarta, it was found that students were not able to analyze questions and did not dare to express opinions for conclusions regarding a problem in biology subjects. This is thought to be because in biology subjects there is material that is imsivible, one of which is virus material so that students do not understand conceptually or practically. Apart from that, the results of interviews with several students also showed that the learning media used in schools were still textbooks and used the 5M learning model. Students' low critical thinking abilities in learning are influenced by the inappropriate choice of learning methods and models (Utomo et al., 2023; Kania et al., 2023).

This research needs to be carried out because it can measure the level of students' critical thinking abilities broadly, namely throughout Sleman Regency, so that later researchers and other developers can carry out further research to improve critical thinking abilities. Moreover, education will begin to enter the 5.0 era, namely based on big data and robots to help community activities (Nastiti & 'Abdu, 2020) so it requires human resources (HR) who are able to process or analyze this information. Apart from that, this research has never been carried out so that later the data in this journal will be very useful for achieving the development of models, media, methods or learning strategies to support better education.

Method

The method applied for the research was quantitative descriptive using the population of all class The researcher's technique in determining the sample is using *purposive random sampling.* Determining the sample in this way was carried out using a random survey technique by taking around 15-20% of the total population (Danaryanti & Lestari, 2018) which consisted of 9 schools consisting of 258 students. The researcher's technique for collecting data is a test that is given once in the form of an essay/description using 5 questions that trigger indicators of deep thinking critical thinking (Irwandi, 2020), namely building basic skills, giving simple explanations, providing further explanations, organizing strategies and tactics. And draw conclusions from a problem.

The sample in this analysis is all high schools in the Sleman district which can be presented in table 1.

Table 1. High School Data in Sleman District

High School Data in Sleman Regency	
School name	Lots of samples
SMA N 1 Seyegan	29 People
SMA N 1 Ngaglik	23 People
SMAN 1 Ngemplak	32 People
SMA N 1 Prambanan	23 People
SMA N 1 Godean	33 People
SMA N 1 Minggir	35 People
SMA N 1 Pakem	25 People
SMA N 1 Depok	34 People
SMA N 1 Mlati	24 People
Amount	258 People

The data used in the analysis is critical thinking data on virus material. The test given to students is taken for 60 minutes and then analyzed using a 0-3 scoring rubric and then converted into 0-100 interval data. Based on the score results, a formula can be used, namely:

$$Grade = \frac{score\ obtained}{total\ score} \times 100\ \% \qquad (1)$$

Next, the values obtained will be interpreted into several criteria to determine the level the ability of each indicator and each SMA. Interpretation of values refers to the interval criteria applied by Danaryanti in (Supriyati et al., 2018) which can be observed in table 2 below:

Table 2. Critical Thinking Ability Criteria

Criteria	Intervals
Very high	$81.25 \leq x \leq 100$
Tall	$71.5 \leq x \leq 81.25$
Currently	$62.5 \leq x \leq 71.5$
Low	$43.75 \leq x \leq 62.5$
Very low	$0 \leq x \leq 43.75$

Next, after the values have been interpreted, percentage calculations are carried out using the Danaryanti formula in (Supriyati et al., 2018) as follows:

$$P = \frac{\Sigma x}{n} \times 100\ \% \qquad (2)$$

Information:
P : percentage value
∑X : percentage frequency to be searched for
N : number of frequencies

After the data is created in percentage form, the data is then processed and interpreted into an average to obtain an average for each school and the entire school using the Danaryanti formula in (Supriyati et al., 2018) as follows:

$$X = \frac{\Sigma Fx}{n} \qquad (3)$$

Information :
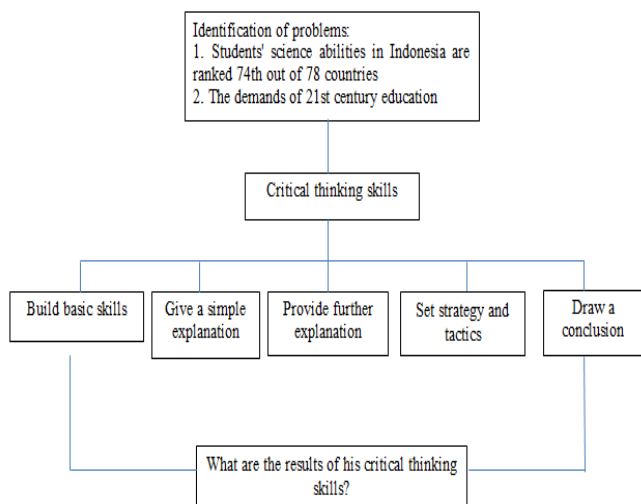X = Average score
Σ Fx = Sum of all data
n = lots of data

Figure 1. Framework of thought

Results and Discussion

Based on the analysis carried out using the E nnis indicator essay test in (Irwandi, 2020), the ability to think critically as seen from the average virus material in Sleman Regency is still relatively low. These results can be presented as table 3.

Based on the data in table 3, information was obtained that the 21st century abilities of students in the aspect of critical thinking skills in Sleman Regency are still relatively low with the category $43.75 \leq x \leq 62.5$, namely 99 students. The least category is in the interval $81.25 < X \leq 100$, namely only 14 students with a percentage of 5.42%. The high category is in the interval $71.5 \leq x \leq 81.25$ obtained by 33 students with a percentage of 12.79% and the medium category $62.5 \leq x \leq 71.5$ obtained by 28 students with a percentage of 10.85%. Apart from that, the very low category was in the interval $0 \leq x \leq 43.75$, obtained by 84 students with a percentage of 32.55%.

Table. 3 Average Score of Students in Sleman District

Category	Intervals	The number of students	Percentage (%)	Sleman Regency Average
Very high	$81.25 \leq x \leq 100$	14	5.42	
Tall	$71.5 \leq x \leq 81.25$	33	12.79	
Currently	$62.5 \leq x \leq 71.5$	28	10.85	52.79 (Low)
Low	$43.75 \leq x \leq 62.5$	99	38.37	
Very low	$0 \leq x \leq 43.75$	84	32.55%	

This indicates that students in high schools in Sleman Regency are relatively low with an average of 52.79. Students' critical thinking abilities can be improved in various ways, namely through activities in the classroom assisted by the teacher (Robi et al., 2018). The average achievement of students in each high school in Sleman Regency is also different , this can be seen in table 4.

Table 4. Scores Obtained by Students in Sleman Regency

School name	Average value	Category
SMA N 1 Seyegan	47.65	Low
SMA N 1 Ngaglik	54.39	Low
SMA N 1 Ngemplak	47.87	Low
SMA N 1 Prambanan	63.43	Currently
SMA N 1 Godean	59.15	Low
SMA N 1 Minggir	55.31	Low
SMA N 1 Pakem	48.24	Low
SMA N 1 Depok	47.70	Low
SMA N 1 Mlati	53.33	Low

Sleman Regency generally have 2 categories, namely low and medium. The lowest average score category for 21st century abilities in the critical thinking ability aspect was 47.65 at SMA N 1 Seyegan, while for the medium category students at SMA N 1 Prambanan got an average of 63.43. The low category was obtained by 8 schools, namely SMA N 1 Seyegan with an average score of 47.65, SMA N 1 Ngaglik 54.39, SMA N 1 Ngemplak 47.87, SMA N 1 Godean 59.15, SMA N 1 Minggir 55, 31, SMA N 1 Pakem 48.24, SMA N 1 Depok 47.70, and SMA N 1 Mlati, namely an average of 53.33. This indicates that 21st century abilities in the aspect of critical thinking skills in high schools in Sleman Regency are still classified as low and no one is in the high or very high category.

Apart from that, students' critical thinking abilities can be seen from the percentage of overall indicators for students in Sleman district in table 5.

Judging from the results of the table presented, it can be seen that in general the value of each indicator is different. The highest average score from 258 students was for the indicator of managing strategies and tactics and the lowest was for the indicator of providing a simple explanation. This was because students did not understand the concept of viruses. Differences in the

results of each aspect can be caused by learning habits at school, namely indicators that are often presented by teachers, repeated delivery so that it triggers students' high memory power (Ramdani et al., 2020), so it can be seen that students can think critically if the teacher also have good critical thinking skills (Julianto et al., 2023).

Table 5. Average Value Indicator of Critical Thinking Ability

Average value of critical thinking ability indicators		
Indicator	Average value	Category
Provide a simple explanation	29.32	Very low
Build basic skills	59.68	Low
Make inferences (conclusions)	44.57	Low
Provide further explanation	63.43	Currently
Set strategy and tactics	69.63	Currently

The low average achievement and low average value of indicators can be seen from the average achievement of each indicator, namely the first indicator provides simple explanation in table 6 as follows:

Table 6. The Average Value of Students in Providing Simple Explanations

Score	Question number 2	
	The number of students	Percentage (%)
0	103	39.92
1	93	36.04
2	52	20.15
3	10	3.87

The table shows the percentage of critical thinking abilities with indicators providing simple explanations. The critical thinking ability questions given to students consist of: 1 question. From the table, the average indicator value is 29.32. In the results in the table, the simple explanation indicator is in the very low category, namely students are unable to analyze statements regarding the characteristics of the virus. In the table it can be seen that the number of students who answered the most was at score 0, namely 39.92% and 1, namely 93%, and those who answered the least were at score 3 with a total of 3.87%. Students' skills in answering questions number 0 and 1 are classified as very low because they are unable to analyze a statement. Students will be able to provide simple explanations if they have social skills in communicating (Maksum et al., 2021). The results of this study are in accordance with research (Wayudi et al., 2020) that students' low ability at the simple explanation stage is because students feel unfamiliar with focusing questions or studying in more depth the questions given first.

Based on the table 7, the value of the aspect of building basic skills can be seen. The results obtained an average value of 59.68 which is in the low category with a total of 1 question, namely about observing and considering the results of observations. In the data, various scores were obtained, namely score 0 with a percentage of 15.11%, score 1 with a percentage of 31.39%, score 2 with a percentage of 12.79% and the highest score, namely 3 with a percentage of 40.69%. The low level of students' basic skills can be influenced by teaching materials which generally use textbooks and worksheets (Nurhayati et al., 2022), the learning models or methods used in schools do not yet lead to C4-C6 questions so that students' skills have not been honed. Similar opinions were also expressed (Luzyawati, 2018) where *the inquiry riddle learning model* can build skills so that students can discover concepts in their own way regarding virus material. Apart from that, students' basic skills can be improved through the habit of analyzing problems so that this habit will become a basic attitude, and ultimately students' basic skills will be formed (Jamaluddin et al., 2019).

Table 7. Average Student Scores in Building Basic Skills

Score	Question number 5	
	The number of students	Percentage (%)
0	39	15.11
1	81	31.39
2	33	12.79
3	105	40.69

Table 8. The Average Score of Students in Making Inferences (Conclusions)

Score	Question number 1	
	The number of students	Percentage (%)
0	40	15.50
1	123	47.67
2	63	24.41
3	32	12.40

In the table it can be seen that the percentage value of the indicator for making an inference (conclusion) with an average of 44.57 which is in the low category. The number of questions used is 1 item about considering the results of decisions regarding virus material in life. Apart from that, from the table it can be seen that the highest score for students was score 1, which was 47.67 and the lowest score was score 3, which was 12.40% of students who could answer the maximum.

Students' inability to make conclusions is influenced by learning strategies. This is in accordance with researchers (Fuad et al., 2017), namely to sharpen students' thinking skills. Learning strategies can support students to connect one concept with another

concept so that they can easily make conclusions . Students can explain the relationship between problem solving concepts with help from teachers or teaching materials in the form of books and modules that can make things easier for students (Nuri et al., 2023). In making conclusions, teachers can help students to connect concepts through developing learning tools such as *inquiry learning*, where students are able to solve problems in everyday life because they are directly involved in their competencies (Doyan et al., 2020).

Table 9. Average Score of Students in Making Further Explanations

Score	Question number 4	
	The number of students	Percentage (%)
0	27	10.46
1	62	24.03
2	78	30.23
3	91	35.27

Based on the table, the indicator percentage results provide further explanation with an average of 63.43 which is in the medium category. The number of questions used is 1 item about identifying assumptions about the types of problems related to the HIV virus. Apart from that, from the table it can be seen that the consecutive scores are score 0 with a percentage of 10.46%, score 1 with a score of 24.03%, score 2 with a percentage of 30.23% and score 3 with a score of 35.27%. Students' low scores in providing further explanations can be influenced by insufficient discussion of arguments. This is in line with research by Mahanal (2017) that debates can help students' critical thinking skills so that they are able to gather further information and students are not only recipients of information but also users who are directly involved and are able to provide further explanations regarding virus problems. Students' low basic skills are influenced by the absence of practical virus experiments using laboratories, but this can be overcome by creating learning tools that make it easier for students, namely 5E , which can make it easier for students to carry out experiments directly so that students can build basic skills easily through their experience (Muh. Nasir et al., 2015).

Table 10. The Average Value of Students in Managing Strategy and Tactics

Score	Question number 3	
	The number of students	Percentage (%)
0	6	2.32
1	78	30.23
2	61	23.64
3	113	43.79

Based on the table, the data obtained on the percentage of indicators for managing strategy and tactics obtained an average of 69.63 which is in the medium category. The number of questions used is 1 item about deciding on a course of action regarding preventing the monkey pox virus. Apart from that, from the table it can be seen that the consecutive scores are score 0 with a percentage of 2.32%, score 1 with a score of 30.23%, score 2 with a percentage of 23.64% and score 3 with a score of 43.79%.

From the results of the explanation above, it can be seen that the low ability to think can be influenced by the activities of students who are not used to working on critical thinking skills, the lack of supporting media from teachers regarding invisible lessons. In line with opinion Wayudi et al. (2020) that teachers are obliged to design learning that is fun, interactive, challenging, so that it can improve students' 21st century abilities. Low student ability in providing further explanations can be caused by students' low daily experience and cause learning at school to be meaningless (Wahyudiati, 2022).

Increasing students' critical thinking skills is also influenced by the learning model applied at school. The learning model at school can help students build their own understanding by carrying out each syntax in the model because it can help students be more independent, creative and innovative (Qurniati et al., 2019). Learning models that can help improve thinking skills include the PJBL model which is a model that can provide space for students to choose topics and be directly involved in activities so that students can more easily achieve critical thinking ability indicators. (Zulyusri et al., 2023).

Students' critical thinking abilities can also be improved with learning centered on problem solving and contextual learning such as innovative learning media (Alifteria et al., 2023).

Conclusion

Based on the obtained data, research results and data analysis showed that based on scores and average critical thinking abilities, the 21st century abilities of students in Sleman Regency were still in the low category with an overall average of 52.79. If we look at the average for each school, there are 8 schools in the low category and 1 school in the medium category, namely SMAN 1 Prambanan, while for the high and very high categories there are no schools that meet these criteria. The results of critical thinking abilities can also be seen from each indicator, namely for the indicators for making inferences, building basic skills and making simple explanations, all students are still in

the low category, but for the indicators for providing further clarity and organizing strategies and tactics, all the rest can be concluded in the medium category. There are several factors that influence low critical thinking results, namely differences in learning styles, learning interests, learning models, learning media, learning methods and external factors, namely availability. facilities available at school. There are several suggestions that researchers provide regarding 21st century abilities in the aspect of critical thinking skills, namely that educators should train students by giving questions about critical thinking skills and For other researchers related to the 21st century, it would be better to develop teaching materials, models, methods, media and learning strategies that support the improvement of students' critical thinking abilities .

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