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Analysis of Students' Critical Thinking Ability Through Science E-Module Learning Based Google Sites

Mulya Dwi Putra Muhammad[1*], Imesta Zulfanida Ernest[1], Muhamad Arif Nur Rokhman[1], Rilo Pangastuti[1], Insih Wilujeng[1], Sri Rejeki[1]

[1] Prodi Magister Pendidikan Sains, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Yogyakarta, Indonesia.

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Corresponding Author:
Mulya Dwi Putra Muhammad
mulyadwi.2021@student.uny.ac.id

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Abstract: Critical thinking skills are rarely measured in science learning. This study aims to analyze students' critical thinking skills through learning science e-modules based on Google sites. This type of research includes quantitative descriptive research. The subjects of this study were class VII students of SMP Negeri 6 Yogyakarta, totaling 61 students. The data collection technique used essay questions on critical thinking skills which totaled 7 items. The results showed that the identifying indicators had an achievement of 66.39% in the medium category, interpreting indicators had an achievement of 61.75% in the low category, indicators analyzing had an achievement of 69.26% in the medium category, indicators expressing opinions or arguments had an achievement of 69.26% 73.36% in the high category, the evaluating indicator has an achievement of 58.61% in the low category, and the indicator concludes that it has an achievement of 63.93% in the medium category. Thus the average students' critical thinking skills as a whole are in the medium category with an achievement percentage of 64.43%.

Keywords: Analysis; Critical thinking; IPA e-module; Google Sites.

Introduction

Natural Sciences (IPA) is learning that does not only explore theoretical information or concepts taught by teachers, but emphasizes direct understanding to develop creativity and competence (Aldiyah, 2021). Science learning focuses on students being directly involved in understanding and observing the natural surroundings scientifically.

Science learning currently places more emphasis on student orientation as a subject. One of the abilities students must have according to the Department of Defense Education Activity (DoDEA) is the ability to think critically (Ningsih et al., 2018). Science learning has a special characteristic, namely doing scientific work to produce a product and process so that students can develop various critical thinking skills and understand concepts (Hidayati et al., 2021; Solikhin & Fauziah, 2021).

According to the statement of the Depdiknas (2011), that learning science that must be carried out is learning that can prepare students for science and technology knowledge, to think logically, critically, and creatively and to think comprehensively when solving various real problems. Therefore, science learning is expected to be able to develop students' critical thinking skills.

Critical thinking ability is one of the thinking skills needed by current learning. Critical thinking is the ability to think with deep thoughts to obtain correct and accountable information (Hidayat et al., 2019). According to Agnafia (2019) the ability to think critically is the ability to think wisely and support arguments with reasonable reasons. Students must have critical thinking skills (Bunt & Gouws, 2020). Students who think critically can solve problems more clearly and effectively (Saputra et al., 2020; Wahidin & Romli, 2020).

Students' critical thinking skills must be trained in the learning process. Aspects of critical thinking indicators are classified into five according to Ennis

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(2011), namely providing simple explanations, building basic skills, drawing conclusions, providing further explanations, and setting strategies and tactics. Fisher (2007) emphasizes that there are six critical thinking indicators which include; (1) identify; (2) interpret; (3) analyze; (4) express opinions or argue; (5) evaluate; and (6) conclude.

Students' critical thinking skills in Indonesia are still low (Saputri et al., 2018; Zubaidah et al., 2018). Basri et al. (2019) revealed that some students were passive in working on group assignments, students were still not proactive in dealing with learning problems, only a few students were involved in answering problems that arose. In addition, Saputra et al. (2019) revealed that students' critical thinking skills were still weak, reflected in the dominating problem symptoms, such as (1) students had difficulty working on high-level questions (C4-C-6); (2) there are still many students who find it difficult to relate concepts and problems; (3) some of the students had difficulty expressing opinion arguments during discussions. This situation can be used as an indicator that students' critical thinking analytical skills are still low.

Based on a field study conducted at SMP Negeri 6 Yogyakarta, this school rarely measures students' critical thinking skills. One of the obstacles is teaching materials that have not been able to facilitate and train students to learn independently. Teachers still use Electronic Student Books (BSE), textbooks, and student worksheets which are displayed in front of the class using PowerPoint (PPT). This makes students feel bored and less active during learning. Based on research conducted Dani et al. (2019), that the use of electronic student books has not facilitated critical thinking skills from using language that is too complex, complicated, the content is incomplete, and the question level is relatively low. As a result, students have difficulty understanding and developing their critical thinking skills.

In addition, various educational innovations must be implemented properly to foster an academic culture so as to achieve high quality (Dewi et al., 2021; Gunawan et al., 2021). One alternative that must be done is to choose learning strategies and media that support effectiveness in the learning process (Farwati et al., 2021; Listianingsih et al., 2021). Learning media is an intermediary tool that is useful for facilitating communication between teachers and students. Learning media that are widely used are e-modules and digital flipbooks to make it easier with a combination of print and computer media (Astalini et al., 2019).

E-modules are modules packaged in electronic form with the support of computers and smartphones. E-modules in learning are starting to be widely used both in offline and online learning. The use of e-modules in learning can improve students' critical thinking skills (Haryanto et al., 2021; Suarsana, 2013). E-modules can be used in various websites, one of which is Google Sites.

Emodules can be accessed by students anywhere and anytime as long as they have the tools they need. If face-to-face learning is carried out in the near future, e-modules will not lose their continuity as a learning tool because the world of education is expected to change according to the rapid development of technological advances in accordance with the changing needs of society (Mounsey & Reid, 2019). So, e-module can be interpreted as a form of media learning that contains the presentation of independent learning materials that are arranged systematically into specific learning units to achieve learning objectives. Which is displayed in an electronic format, where each learning activity is linked by a link as navigation equipped with a display. Video tutorials, animations, and audio provide fun learning experiences and make students more active in learning and achieving the expected competencies (Pedersen et al., 2009; Wisco et al., 2011).

Google sites are facilities on Google that have features as visiting sites. The visiting site is managed in the form of a website display containing text and learning videos (Sevtia et al., 2022). This google sites-based e-module was developed to help students develop critical thinking skills through direct experience because they not only listen to the teacher's explanation but carry out other activities such as observing videos, pictures, and carrying out simulations. Research related to Google sites-based e-modules has been conducted by Mahmudin et al. (2022) and Rahmawati et al. (2022), e-modules based on Google sites are very interesting to use because they are easy to access, stimulate student interest in learning, facilitate understanding of material and use language that is easy to understand according to students' thinking levels.

The ability to think critically is of course very important in science learning which is useful for the application of science in society with full responsibility (Santos, 2017). The subject of motion and force is one of the materials in science subjects. Critical thinking skills can be trained in all students through a lesson. Based on the description that has been explained, the integration of Google sites-based science e-modules should be able to facilitate students' critical thinking skills. The purpose of this study was to analyze students' critical thinking skills in class VII SMP movement materials through e-modules based on Google sites.

Method

This research is a quantitative descriptive research. Quantitative research is to describe, research, explain,

and draw conclusions about what is learned by using numbers (Sugiyono, 2020). This study aims to analyze students' critical thinking skills at SMP Negeri 6 Yogyakarta. The population includes students of class VII. The sample used was 61 people consisting of 30 students from class VII A and 31 students from class VII B. The sample taken was cluster random sampling technique. According to Sugiyono (2018), cluster random sampling is a regional sampling technique used to determine samples when the object to be studied is very large.

The data collection instrument used in this study was an essay test which consisted of 7 questions on motion and style material used to measure students' critical thinking skills which had been validated by experts. Critical thinking refers to the indicators developed by Fisher (2007), namely; (1) identify; (2) interpret; (3) analyze; (4) express opinions or arguments; (5) evaluate; and (6) conclude.

The data analysis technique used in the critical thinking ability test is based on scores taken from student answers and then categorized based on the aspects obtained. Here's how to find out the percentage score with equation 1. The percentage value of critical thinking skills obtained from the calculation is then categorized according to Table 1.

$$Percentage\ value = \frac{gain\ score}{sMaximum\ score}\ x\ 100\% \quad (1)$$

Table 1. Category Percentage of Critical Thinking Ability

Value Interval (%)	Category
$81.25 < X \leq 100$	Very High
$71.50 < X \leq 81.25$	High
$62.50 < X \leq 71.50$	Medium
$43.75 < X \leq 62.50$	Low
$0 < X \leq 43.75$	Very Low

(Jarmita & Hazami, 2013)

Result and Discusion

This research was conducted to analyze students' critical thinking skills in science learning by using e-modules based on Google sites that have been validated by media experts. This research activity took place from October-November 2022 at SMP Negeri 6 Yogyakarta. The media used is an electronic module based on Google sites, this e-module can be accessed online by teachers and students using computers, laptops, notebooks and various gadgets with the Android and IOS operating systems. This module is an alternative that can support the learning process in class and independently teach materials outside of school hours (Sumiati et al., 2018). The device used is supported by Google which can be accessed easily. The following is a snippet of the Google Sites-based e-module.

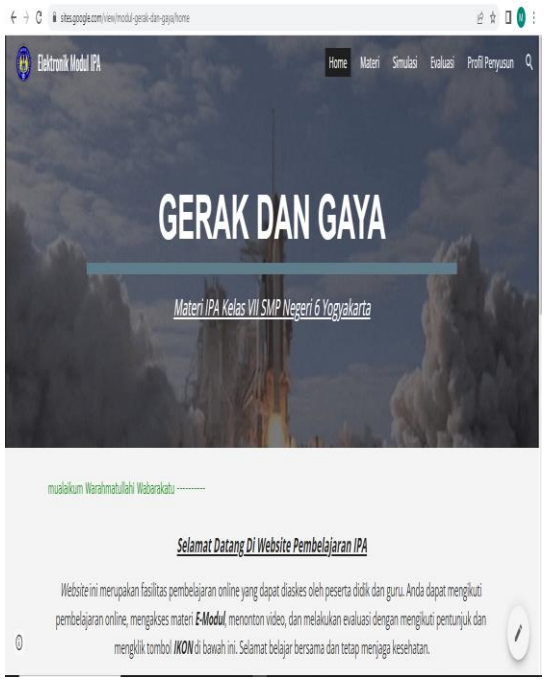

Figure 1. Initial Appearance of Google Sites-Based Websites

Based on the research results obtained on students' critical thinking skills tests on motion and style material with indicators of critical thinking ability according to (Fisher, 2007), namely; (1) identify; (2) interpret; (3) analyze; (4) express opinions or arguments; (5) evaluate; and (6) conclude. The items in the test are arranged according to the indicators of students' critical thinking skills. The results of the overall student critical thinking ability test scores obtained can be seen in table 2.

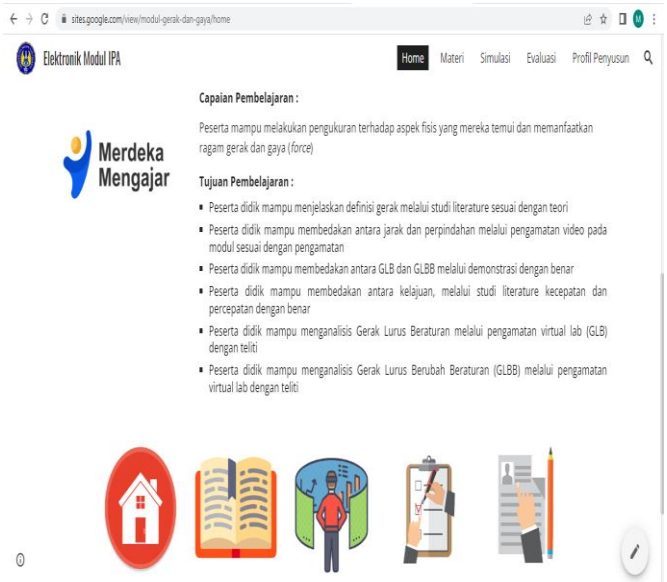

Figure 2. Display of the Google Sites Based E-module Dashboard

Figure 3. Display of Google Sites Based E-Module

Table 2. Categories of Critical Thinking Ability

Parameters	Value
Score Minimum	17.5
Score Maximum	87.5
N	61
Average	64.43
Standard of Deviation	17.36
Category	Medium

Based on the data in table 2, it can be seen that the lowest score of the 61 students who were given a critical thinking ability test was 17.5 and the highest score was 87.5. The standard deviation of the data on critical thinking skills is 17.36 with an average percentage of the overall score obtained at 64.43. So it can be seen that students' critical thinking skills are in the moderate category. The results of the study according to Nugraha et al. (2017), reveal that a person with moderate critical thinking skills cannot improve the process of deep thinking, which means that his way of thinking is still limited, indicated by the answers to questions which conclusions and the results of the analysis are incomplete. The category level for each student can be seen in table 3.

Table 3. Categories of Students' Critical Thinking Ability

Interval of Value(%)	Number of Student	Percentage	Category
0 – 43.75	9	14.75	Very Low
43.75 – 62.50	8	13.11	Low
62.50 – 71.50	23	37.70	Medium
71.50 – 81.25	8	13.11	High
81.25 – 100	13	21.31	Very High

Table 3 shows the categories of students' critical thinking abilities in solving problems related to motion and style. The scores obtained by students are then categorized based on their level. There were 14.75% of students who were in the very low category, namely 9 students. There were 13.11% of students in the low and high categories, namely 8 students. Furthermore, there were 37.70% of students who were in the moderate category, namely 23 students, and students who got very high categories, there were 21.31%, as many as 13 students. Based on these data, it shows that the level of students' critical thinking ability in answering questions is partly quite good.

The results of the test scores for students' critical thinking skills through e-module learning based on Google Sites in terms of each critical thinking indicator have an average percentage of 65.55% in the medium category, this can be seen in Figure 4.

Based on Figure 4, it can be seen that each indicator of critical thinking ability obtained has a different percentage value. The percentage value of each indicator obtained by the lowest indicator is evaluating by 58.61% and the highest indicator is by arguing by 73.36%. This value can be interpreted that students have good critical thinking skills. The good results of students' critical thinking obtained are supported by the use of e-modules based on Google sites in learning which are able to create more effective student learning conditions by exploring students' knowledge when using these Google sites. This is in line with Nurmanita's research (2022), using Google Sites will be able to improve critical thinking skills because it makes it easier for someone to learn and improves one's thinking ability to be the focus when educators deliver material.

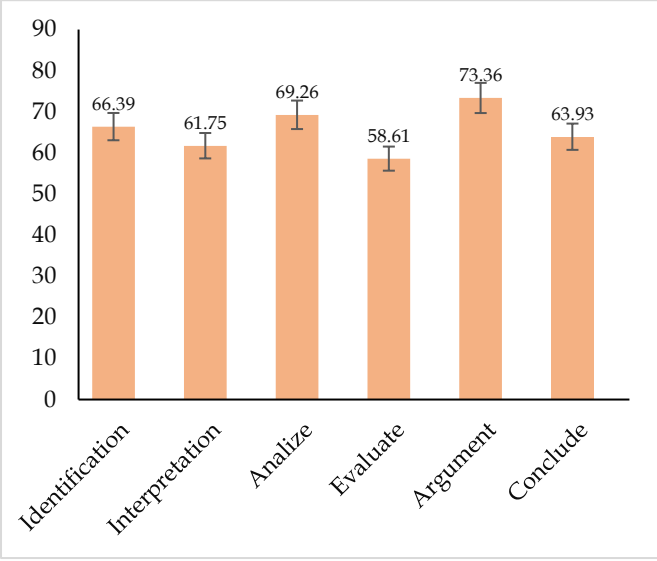

Figure 4. Critical Thinking Indicators

The identifying indicator explains how students find the answer criteria needed to form a reasoned conclusion. The identifying indicator in this study is in question number 7 which discusses text information about the state of the moving ball. This result obtained a percentage value of 66.39%. From these results, some students have been able to identify relevant information in accordance with the theory. In improving identifying indicators, students need to increase the practice questions, especially by observing an object so that knowledge is obtained (Setiorini & Nurita, 2018).

Interpreting indicators explain how students develop problem-solving abilities or concepts based on the meaning of data, regulations, procedures, events and existing information. Interpreting indicators in this study are in questions no. 3 and 6 which discuss the relationship between speed and straight motion. This result obtained a percentage value of 61.75%. In these questions students are expected to be able to express the meaning of straight motion. As a result, some students have been able to find the concept of the meaning of straight motion from moving object events based on existing tables and graphs. These skills can be trained using a learning process that invites students to apply the concepts and skills that have been learned to solve a problem or conclude it (Ridho et al., 2020).

Analyzing indicators explain a series of activities that look for or link the causes and effects of something happening to a conclusion. The indicator for analyzing in this study is in question number 4 which discusses the types of uniform rectilinear motion. This result obtained a percentage value of 69.26%. From the questions given students are expected to be able to provide conclusions based on a story about the motion of an object and its characteristics. The results of students' answers show that the average ability of students is in the moderate category and it can be said that some students are able to analyze story questions based on the types and characteristics of the moving objects given. This ability can be trained by conducting an experiment in inquiry-based science learning (Arsal, 2017).

This indicator of expressing an opinion or argument means expressing thoughts accompanied by reasons to strengthen or reject an idea. The indicator for expressing an opinion or argument in this study is found in question number 2 which discusses the acceleration of a moving car. The result obtained a value of 73.36%. From these questions, most of the students were able to answer the questions correctly in the high category. This shows that most students are able to express their thoughts by expressing opinions based on the theory they have done. This is in line with the opinion of Suriati et al. (2021) that to improve this indicator, students need to identify problems from the causes and effects of an incident so as to increase understanding for these students.

Evaluating indicators are activities of gathering information from a fact or idea that is used to determine the right alternative in making decisions, stating reasons, giving judgments based on certain criteria both qualitatively and quantitatively. The evaluating indicator in this study is in question number 5 which discusses how long it takes to cover a trajectory. The result obtained a value of 58.61%. From these questions it shows that the ability of students to understand and conclude a problem is still in the low category. The student was able to provide an answer but the answer given was not quite right. According to Astuti et al. (2020), this skill can be trained by habituating students to work on problem-solving type questions to increase student understanding.

The concluding indicator is a good decision-making that contains several things such as supporting reasons, alternatives or other options and compares them from a result standpoint. The concluding indicator in this study is in question number 1 which discusses speed and acceleration. Several students were told to do the calculations and then conclude the results. The results obtained with a percentage of 63.93% in the medium category. The ability to conclude can be trained by applying the concepts, principles and skills they have learned to solve the problems they face or conclude them (Fakhriyah, 2014).

In learning science, it is necessary to design strategies, learning resources and learning media that can support students' thinking skills (Kusmawati & Adawiyah, 2019; Putri et al., 2020). By having critical thinking skills, students can more quickly identify information, study problems systematically, formulate innovative questions, utilize ideas or information, can evaluate and modify them to produce the best ideas (Hidayah et al., 2017).

Conclusion

The results of the study show that students' critical thinking skills at SMP Negeri 6 Yogyakarta have an achievement of 64.43% in the moderate category. Analysis of critical thinking skills for each indicator shows varying abilities. The identifying indicator has an achievement of 66.39% in the medium category, the interpreting indicator has an achievement of 61.75% in the low category, the analyzing indicator has an achievement of 69.26% in the medium category, the indicator expresses an opinion or argument has an achievement of 73.36 % in the high category, the evaluating indicator has an achievement of 58.61% in the

low category, and the indicator concludes that it has an achievement of 63.93% in the medium category.

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Author Contribution
Lead Author, Mulya Dwi Putra Muhammad, contributed to designing the study, conducting the research, and writing the research article. The second author, Imesta Zulfanida Ernest, played a role in assisting in conducting research and preparing research instruments. The third and fourth authors, Muhammad Arif Nur Rokhman and Rilo Pangastuti, played a role in assisting the process of collecting research data. The fifth author, Insih Wilujeng, played a role in guiding research to writing articles. The sixth author, contributed to guiding the writing of the article until it was published. All authors have read and agree to the published version of the manuscript.

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The authors declare no conflict of interest.

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