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Critical Thinking Skills Profile Through EDUSAN as a Mobile Learning Application in Science Learning

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Abstract: Critical thinking skills are still infrequently tested in science classes. This study aims to identify students' thinking skills in integrated science learning with subject temperature and conversion. This type of research uses descriptive quantitative—data sampling using a purposive sampling technique. The subjects of this study were 30 students of class VII SMP Negeri 2 Mlati, Sleman, DIY. The instrument used to identify students' critical thinking skills is within the form of 10 multiple choice tests, with indicators of critical thinking skills consisting of (1) categorizing, (2) concluding deductively and inductively, (3) stating the results, (4) providing solutions and (5) explaining reasons. Data analysis techniques were processed with descriptive statistical data and analysis of each item in critical thinking indicators based on the multiple-choice test results. The results showed that the overall critical thinking skill was 79,33% in the high category. Among the indicators measured, the "categorizing" indicator has the highest percentage, while the "providing solutions" indicator has the lowest percentage. Integrating designs and strategies in further learning media needs to increase student learning activities.

Keywords: Critical thinking; Edusan; Science

Introduction

Science education is the science of natural phenomena consisting of facts, concepts, and laws and is tested for truth through research (Waldrip et al., 2010). Gericke & Hagberg (2007) explains that science is about describing, expecting, and discovering explanations for natural phenomena within the world as they are experienced. Science learning aims to build critical thinking skills, scientific expertise, and conceptual knowledge (Solikhin & An Nuril Maulida Fauziah, 2021). One of the objectives of learning science is to be able to facilitate students' critical thinking skills.

Critical thinking is an individual mental process that actively and skillfully understands concepts, applies, analyzes, synthesizes, and evaluates the information in conclusion (Cáceres et al., 2020). Critical thinking ability is a crucial skill that must be mastered by students (Bunt & Gouws, 2020; Murat Karakoc, 2016). This ability needs to be mastered by students because future work is based on analyzing, producing, distributing, and consuming information, analyzing it in formation, verifying its truth, and stating conclusions (Bellaera et al., 2021; Sugandi, 2021). This is supported by Putriani & Hudaidah (2021) explained that critical thinking skills are skills required to understand a complex problem and link information with other information to produce various views or perspectives and get solutions to a problem. In science learning, students must analyze and evaluate any information they obtain using their critical thinking skills. Therefore, critical thinking skills need to be trained in the science learning process.

Critical thinking indicators consist of classifying and clarifying, proving conjectures, explaining arguments and rationality, compiling evidence, creating hypotheses, checking the integrity of questions, stating results, evaluating procedures, expressing reasons, self-regulating, and self-assessment (Facione, 2011). Furthermore, Ennis (2011) describes five categories that

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indicate someone being able to think critically, which are presented in Table 1.

Table 1. Critical thinking ability indicator

Category	Indicator
Contents	Focusing questions
	Analyze questions
	Ask and answer questions
Simple skill building	Consider whether the source can be trusted or not
	Observe, consider the observation report
Conclude	Perform and consider the results by deduction
	Perform and consider the results by induction
	Create and determine the value of the consideration
Provide further explanation	Define, consider a definition
	Identify assumptions
Arrange strategy and tactics	Define an action
	Interact with others

Based on the categories and indicators of critical thinking from several experts, a synthesis is obtained in the form of indicators: 1) categorizing, (2) concluding deductively and inductively, (3) stating results, (4) providing solutions, and (5) explaining reasons.

Learning strategies and media that support effectiveness must be adjusted to improve critical thinking skills. Critical thinking skills can be improved by applying various learning models that can support, including inquiry (Suryanti et al., 2018; Wale & Bishaw, 2020), problem-based learning (Arifin, 2021; Thompson, 2019), and project-based learning (Eldiva & Azizah, 2019; Issa & Khataibeh, 2021). Plotnikova & Strukov (2019) argued that teamwork could improve critical thinking. In addition, critical thinking skills, especially in science learning, can also be improved through learning media that are adjusted to the level of student characteristics (Prieto et al., 2019; Wahyuni et al., 2019; Wright et al., 2015). Learning media may be in the form of mobile learning applications that can be accessed via a smartphone.

Mobile learning is learning media developed on smartphones in the form of Android, IOS, and so on operating systems (Hardinata et al., 2018; Rachmawati & Kurniawati, 2020). Mobile learning has the advantage that students can access learning materials anywhere and anytime and can increase motivation and attention in student learning activities (Faqih, 2020; Pangalo, 2020). The use of mobile learning also impacts increasing students' critical thinking skills in the learning process (Mariani et al., 2021; Setiawan et al., 2021; Sumari & Aminatun, 2020).

The results of research from Erlita & Hakim (2022) conditions were found that students needed help working on critical thinking questions because students were only used to the questions available in the handbook. Besides, students' abilities are less honed because applied learning is still teacher-centered. This information is in line with Ramdani et al. (2019) stated that the problem of students' low critical thinking skills was still not feasible because the test questions were developed to measure these abilities. Some teachers have not been able to create test questions oriented towards 21st-century skills and only make low-level questions classified as LOTS (low-order thinking skills). Students with low critical thinking ability also have low learning outcomes (Fitria, 2020).

One of the materials belonging to the difficult category in science learning for students is temperature and heat material (Zayyinah et al., 2018). For solving temperature and heat material questions, students experienced difficulties because they only memorized science concepts and equations and required critical and logical skills (Sundari et al., 2018). Students with critical thinking skills should use logic critically to solve problems (Wulandari et al., 2017).

Observations at SMP Negeri 2 Mlati show that science learning in schools rarely measures and facilitates critical thinking skills. Evaluation of learning usually focuses on the mastery of concepts. Submission of material information has yet to involve students fully in discovering the concept of temperature and heat. To support mobile learning-based learning, students already have mobile devices and can use them in learning. However, learning resources and media have not yet utilized technology and have not supported students in developing their skills.

From the description that has been explained, integrating the Edusan application as a mobile learning product should facilitate students' critical thinking skills. This study aimed to identify students' critical thinking skills through science learning assisted by the Edusan mobile learning application.

Method

This study used a quantitative descriptive method with a quasi-experimental research design. This research was conducted at SMP Negeri 2 Mlati with a population of class VII students. The sample used was 30 students from class VII D. The sample was taken using the cluster random sampling technique. Students use a mobile learning type of android application called Edusan as a medium of learning which can be seen in Figure 1.

Figure 1. The appearance of the Edusan Application

The data collection technique used in this study was a test technique. The test instrument used was a reasoned multiple-choice test used to measure students' critical thinking skills. The score obtained is converted into a percentage score obtained by using equation (1) as follows:

$$\text{Percentage} = \frac{Score\ obtained}{Max\ Score} x100\% \quad (1)$$

The test results are then categorized according to the criteria for critical thinking ability according to table 2. Furthermore, each indicator is analyzed so that the average score for each indicator is obtained for students' critical thinking skills.

Table 2. Interpretation of critical thinking skills categories

Criteria	Interpretation
Very high	80% < X ≤100%
High	60% < X ≤80%
Average	40% < X ≤60%
Low	20% < X ≤40%
Very low	0% < X ≤20%
	(Junaidi, 2017)

Result and Discussion

The study results were obtained from student scores from critical thinking skills tests on the material temperature and heat. The indicators of critical thinking skills obtained include (1) categorizing, (2) drawing conclusions deductively and inductively, (3) stating results, (4) providing solutions, and (5) explaining reasons. The test items were designed based on indicators of students' critical thinking skills on temperature and heat. The results of the test scores obtained are shown in table 3.

Table 3. Percentage of students' critical thinking skills

Percentage	79.33%
N	30
Standard Deviation	2,116
Category	High

Based on table 3, a percentage value of 79.33% is obtained from 30 students with a standard deviation of 2.116. From the data above, it is known that through science learning assisted by Edusan mobile learning, students' critical thinking skills are obtained with high category results. Students can be more active in learning new things supported by interactive features from Edusan media. This is in line with Purwanto et al. (2019), suggesting that using smartphones lets students discover learning materials quickly and without problems and stimulates students to think critically and selectively in deciding on information associated with a given problem. As for the category level for each student, the results are obtained in table 4.

Table 4. Category of students' critical thinking skills

Category	Value Criteria	Total Students	%
Very high	80% < X ≤100%	17	54.84%
High	60% < X ≤80%	7	22.58%
Moderate	40% < X ≤60%	4	12.9%
Low	20% < X ≤40%	3	9.68%
Very low	0% < X ≤20%	0	0%

Table 4 shows the categories of students' critical thinking skills in answering questions on temperature and heat. Students with critical thinking skills in the high category are 17 students with a percentage of 54.84%. Furthermore, there are 7 students with a percentage of 22.58% in the high category. As for the moderate category, there exist 4 students with a percentage of 12.9%, and 3 students with a percentage of 9.68% in the low category. As for the lowest category, it has a percentage of 0%. According to the results of the category of students' critical thinking skills, more than half of the students were classified as very high, namely 54.84%, so it was stated that these students were allowed to explore the factors of critical thinking skills through Edusan-based learning.

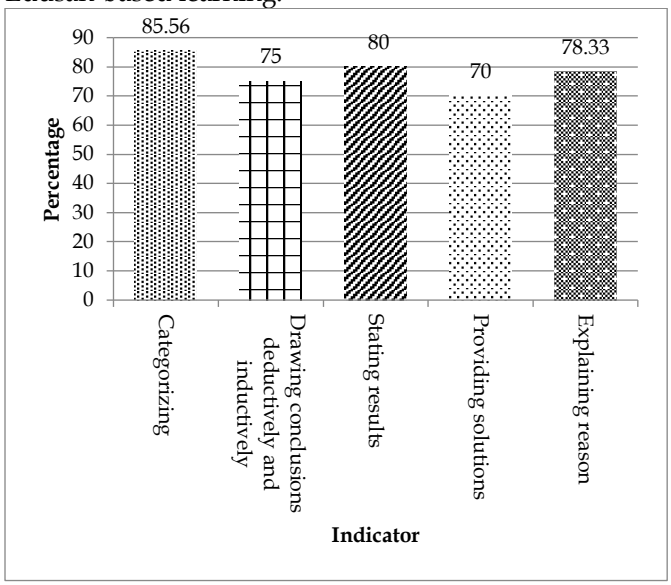

Figure 2. Percentage of critical thinking skills indicators

Figure 2 informs that each indicator of critical thinking ability has different percentages. The percentage value of each indicator is above 70%, with a "categorizing" percentage of 85.56% as the highest indicator. This value can be interpreted that students having acquired high critical thinking skills. The high acquisition of critical thinking skills is supported by using Edusan in learning which can create more effective student learning conditions by exploring students' knowledge when using the application. This is in line with the opinion of Pillena et al. (2019), who stated that integrating mobile learning media would impact higher student learning outcomes because it can train them to develop a deeper understanding of concepts related to the material they are studying.

The first "categorizing" indicator obtained a result of 85.56%, which is the highest indicator compared to other indicators. This proves that students can categorize based on the objects presented in the problem. In improving the categorization indicators, students need to increase the practice questions, especially by observing an object to obtain knowledge (Setiorini & Nurita, 2018).

The second indicator, "concluding deductively and inductively," obtains a percentage of 75%. From these results, some students have started to be able to draw conclusions presented in the questions from general to specific or vice versa from specific to general. Improving the "conclude" indicator can be done by practicing more on various types of practice learning questions, specifically regarding science material that is contextual in their lives (Arini & Juliadi, 2018). In learning using Edusan media, students take advantage of the practice quiz feature, which can be trained and studied repeatedly until students can master these questions.

The third indicator is that the results obtained are 80%. This indicator is high, and it can be said that some students have been able to collect the required information and interpret it into an experimental result that has been explained in the problem. Erlita & Hakim (2022) stated that the indicators stated the results of low critical thinking skills were caused by students not being able to understand the purpose of the questions given, so the answers written by students were not quite correct.

The fourth indicator is providing solutions. This indicator has the lowest percentage among other critical thinking skills, with a percentage of 70%. Some students still have difficulty evaluating an event presented in the problem. In improving indicators of providing solutions, students need to get used to interpreting a problem so that it will produce answers that are more systematic and easier to understand (Rahayu & Hakim, 2021).

The last indicator is "explaining reasons" with a percentage gain of 78.33%. Some students have been able to explain the cause and effect of an event presented in the problem. This is also supported by the condition of students who are enthusiastic about trying new things during virtual practicum activities using the PhET Simulator presented in the Edusan application. This is in line with the opinion of Suriati et al. (2021) that to improve indicators of expressing reasons, students need to identify problems from the causes and effects of an incident to increase their understanding of these students.

Figure 3. Student activities when conducting virtual lab experiments with the PhET Simulator

Strategies, learning resources, and learning media need to be designed in science learning that can support students' thinking skills (Argarini & Sulistyorini, 2018; Kusumawati & Adawiyah, 2019; Putri et al., 2020). By having critical thinking skills, students can more quickly discover information, study issues systematically, produce innovative questions, employ ideas or information, can compare and regulate it to provide the best ideas (Hidayah et al., 2017).

Conclusion

Based on the study's results, it was found that students critical thinking skills had an average percentage value of 79.33% in the high category. The "categorizing" indicator has the highest percentage, while the "providing solutions" indicator has the lowest percentage. Based on the conclusions above, it is necessary to examine the suggestions put forward in more detail related to the profile of students' critical thinking in science learning, considering the several limitations, both in terms of research target subjects, time, place of research, and research procedures. Integrating designs and strategies in further learning media needs to increase student learning activities. In addition, mobile learning-based media needs to be

adapted to students' character by analyzing students' needs.

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Author Contribution
Main Author, Hilman Yusri, contributed to designing research, conducting research, and writing research articles. The second author, Galih Rohmansya Dirasta, has a role in helping to develop EDUSAN and conducting research. Insih Wilujeng, Suyanta, and Sri Rejeki Dwi Astuti contributed as lecturers who guided this research and the writing of the article. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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