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The Impact of Technology-Based Learning Media on the Critical Thinking Skills of 11th-Grade Students at MAN 2 Mojokerto

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ABSTRACT

Critical thinking is a vital skill for students in the 21st century. The integration of technology into learning plays a crucial role in enhancing the effectiveness and quality of education by providing broader access to information, fostering interactive methods, and supporting the understanding of complex concepts. This study aims to examine the impact of using technology-based learning media on the critical thinking skills of 11th-grade students at MAN 2 Mojokerto. The research is a field study employing a quantitative approach, where data was collected through primary sources and analyzed using simple linear regression to measure how significantly the use of learning media influences students' critical thinking abilities. The findings show that the use of technology-based learning media has a fairly strong impact, with an effectiveness rate of 76%. Meanwhile, students' critical thinking skills at MAN 2 Mojokerto are also categorized as fairly good, with a score of 72.5%. In conclusion, the study indicates that technology-based learning media positively influence the critical thinking abilities of 11th-grade students at MAN 2 Mojokerto.

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1. INTRODUCTION

In this digital era, information and communication technology has become an essential part of the educational landscape. Technology-based learning media such as educational software, instructional videos, and online platforms have significantly modernized the teaching and learning process by increasing interactivity and flexibility. Educational resources are no longer

confined by time or place, allowing for the implementation of more innovative, engaging, and effective teaching methods. Furthermore, online platforms promote global collaboration among students, enriching their understanding of diverse cultures and perspectives. This clearly highlights the role of technology as a driving force in the transformation of modern education (Arsyad&Rahman, 2019, p.66).

Education plays a critical role in cultivating students' critical thinking abilities. Through structured learning experiences, students are encouraged to analyze, evaluate, and reflect deeply on various ideas and concepts. Education today is not merely about transferring knowledge; it also serves as a foundation for shaping independent, critical thinkers who are prepared to navigate real-world challenges. This underlines the importance of education in developing a mindset that is both analytical and reflective (Prabowo, 2021, p.175).

Technology-based learning media offer flexible access to a wide range of content, including videos, simulations, and interactive games, all of which support active and exploratory learning. These tools do more than just present information in engaging waysthey actively promote critical thinking through hands-on experiences and experimentation. The challenges embedded within these media help students enhance their problem-solving abilities, making the learning process more dynamic and enjoyable. Ultimately, they contribute to the development of essential critical and analytical thinking skills that are increasingly important in everyday life (Kurniawan&Susanto, 2019).

Technology-based learning media play a crucial role in fostering collaboration and communication among students. Through online learning platforms, discussion forums, and information-sharing tools, students are able to interact, exchange ideas, and provide constructive feedback. These collaborative activities help develop critical thinking by encouraging students to consider different perspectives, construct well-reasoned arguments, and solve problems collectively. This kind of active engagement allows students to learn not only from instructional materials but also from the experiences and thoughts of their peers, creating a dynamic learning environment that supports both social and intellectual growth (Kholid et all., 2021)

The 2018 Programme for International Student Assessment (PISA) study ranked Indonesia among the bottom seven out of 72 participating countries, indicating that Indonesian students still struggle with higher-order thinking skills. This result highlights significant challenges in areas such as analysis,

evaluation, and reflection core components of critical thinking. It also emphasizes the urgent need for educational reform aimed at strengthening students' critical thinking abilities so they can be more competitive on a global level (Dimas et all., 2020).

Critical thinking is an essential skill that every student needs to master. It enables students to deeply analyze information, assess various options, and make sound decisions in solving both simple and complex problems. Moreover, critical thinking helps students develop logical arguments and create effective solutions to the challenges they encounter whether in academic settings or in everyday life (Affandi et all., 2019).

This ability is vital to students' success in understanding academic material. With critical thinking skills, students can analyze, evaluate, and interpret information more effectively. This not only enhances their comprehension but also improves their capacity to apply knowledge across different contexts. Ultimately, strong critical thinking contributes to better learning outcomes, helping students gain a more comprehensive understanding and achieve higher academic performance (Dewi et all., 2019).

Based on interviews conducted by the researcher at MAN 2 Mojokerto, it was found that teachers are increasingly using a variety of learning media, ranging from visual aids like images and posters to more advanced technology in their teaching practices. However, students' critical thinking skills at MAN 2 Mojokerto have received relatively little attention and, notably, this area has not been the focus of prior research.

Therefore, this study aims to examine the impact of using technology-based learning media on the critical thinking skills of students. The research is expected to offer insights into how technology can support the development of critical thinking, and how different types of media can be effectively integrated into teaching to achieve that goal.

2. METHODS

This study builds upon previous research that examined the influence of technology-based learning media on students' critical thinking skills. Overall, these studies consistently highlight the positive impact of incorporating technology into the teaching and learning process. Tools such as

multimedia presentations, interactive simulations, and e-learning platforms have been shown to significantly enhance students' abilities to analyze information deeply, critically evaluate arguments, and effectively synthesize data from various sources.

Such improvements not only help students better understand academic content but also equip them with essential thinking skills needed to face real-world challenges. Thus, technology-based learning media serves not only as a supportive tool but also as a catalyst for developing students' critical thinking skills in a more comprehensive way.

This research adopts a quantitative approach, as the data collected consists of numerical values used to measure the impact of technology-based learning media on students' critical thinking abilities. Statistical methods are employed to analyze the data and determine the extent of this influence. Hypothesis testing is conducted to assess whether the impact on the critical thinking skills of 11th-grade students at MAN 2 Mojokerto is statistically significant.

The quantitative approach involves the use of numerical data derived from structured measurements of qualitative data. A simple linear regression analysis is applied to evaluate whether there is a significant relationship between the independent (X) and dependent (Y) variables. In addition, descriptive percentage analysis is used to provide an overall picture of the research findings, allowing the data to be presented clearly and supporting a better understanding of the results.

This is a quantitative study that relies on data from a specific population or sample. The collected data, in the form of structured numerical measurements, aims to systematically and objectively identify relationships, patterns, or effects between variables. Appropriate statistical techniques are used to ensure the results are valid and representative.

Primary data is gathered directly from the field through methods such as observation, interviews, and questionnaires. Data collection and management are carried out on-site to ensure the accuracy and relevance of the information, reflecting the original conditions and perspectives of the sources involved.

Population and Research Sample The population in this study consists of all 11th-grade students at MAN 2 Mojokerto, totaling 511 students across 15 class groups. A sample of approximately 10% was taken 55 students using random sampling to ensure that every student had an equal chance of being selected. This method was chosen to gather accurate and representative data, allowing the researcher to generalize the findings to the larger population.

Purpose and Research Process The main goal of this research is to identify and compare how the use of technology-based learning media affects the critical thinking skills of 11th-grade students at MAN 2 Mojokerto. The data collected from the sample is analyzed to determine how much the use of such media contributes to improving students' critical thinking abilities, as well as whether it results in any significant differences.

Data Collection Techniques Data were collected using three primary methods: observation, interviews, and questionnaires. Observation was carried out at MAN 2 Mojokerto on October 18, 2023, to gain firsthand insight into the learning environment. Interviews were conducted with the Principal, the Vice Principal for Curriculum, and subject teachers, all of whom showed support for the research. Questionnaires were then distributed to 11th-grade students to gather information about their use of technology-based learning media and their critical thinking abilities (Agus, 2021).

The study used a 5-point Likert scale to measure the responses collected through the questionnaires. This scale allowed respondents to express their level of agreement with each statement, ranging from strongly disagree (1) to strongly agree (5). The collected data were then analyzed to understand the distribution and variation of responses, as well as to assess the impact of technology-based learning media on students' critical thinking skills.

Two main analysis techniques were applied: percentage-based descriptive analysis and simple linear regression. The descriptive analysis was used to provide an overview of the research results. Percentages were calculated using the formula: $P = (f/N) \times 100\%$**,** and the results were categorized as follows: Good (80–100%)**,** Fairly Good (68–79%)**,** Less Good (58–67%)**,** Poor (<58%)**.** Simple linear regression analysis was used to determine the cause-and-effect relationship between the independent variable (X) and the dependent variable(Y). The formula used was: $Y = a + bX$, where Y represents critical thinking skills and X refers to the use of technology-based learning media.

Data analysis was performed using SPSS PASW Statistics version 18.0, with a significance level of 5% (0.05). If the significance value is less than 0.05, it indicates that variable X has a significant effect on Y. If the significance value is greater than 0.05, it means there is no significant effect. This analysis provides insight into the strength and direction of the relationship between the two variables (Abdul, 2012).

3. FINDINGS AND DISCUSSION

Theoretical Review

1. Technology-Based Learning Media

Learning media play a vital role in enhancing the effectiveness of the teaching and learning process. When used appropriately, these tools not only present material in an engaging and interactive way but also help students gain a deeper understanding of concepts. Through various forms of media, such as text, images, videos, and interactive technologies teachers can accommodate different learning styles, increase student engagement, improve comprehension, and support the achievement of optimal learning outcomes.

Learning media refer to any tools or materials whether physical or digitalused to assist students in acquiring knowledge and skills. The primary goal of using such media is to facilitate the transfer of information, reinforce conceptual understanding, and enhance student engagement (Fauzi&Sari, 2019). These media operate through visual, auditory, or kinesthetic channels to stimulate students' thoughts, emotions, and motivation. When used effectively, learning media can create enjoyable learning experiences, boost motivation, and improve students' ability to absorb and retain content (Ani et all., 2023)).

Learning media can be classified into several categories based on how they deliver content:

- Visual media: such as images, charts, diagrams, and models.
- Audio media: such as voice recordings and podcasts.
- Audio-visual media: such as educational videos and animations.
- Digital media: including educational apps, e-books, and learning software.
- Interactive media: such as simulations, educational games, or e-learning platforms.

Learning media serve multiple important functions in the educational process. First, they help capture students' attention and spark interest by

presenting material in a more engaging and enjoyable way. Second, they clarify and enrich subject matter, making complex concepts easier to understand. Third, learning media aid in organizing and structuring information, enabling students to categorize and build knowledge more effectively. Additionally, media encourage active interaction with the content and among peers, which in turn enhances participation and understanding. They also help simplify complex information through visualization or simulation, and perhaps most importantly, they improve memory retention allowing students to better recall and apply what they've learned (Sardiman, 2018).

The effective use of technology-based learning media can be assessed through several key indicators that reflect both the quality and scope of its implementation in the learning process. The first indicator is availability and accessibility, referring to how easily teachers and students can access and utilize the learning media. The second is interactivity, which measures the media's ability to engage students in active learning experiencessuch as through simulations, educational games, or interactive quizzes. Another important indicator is the availability of high-quality content materials that are relevant to the curriculum, accurate, and easy to understand. In addition, assessment and evaluation tools embedded in the media allow educators to monitor student progress and evaluate their understanding in real-time. Motivation and engagement are also measured to determine how effectively the media inspires students to participate actively and maintain their interest in learning. Lastly, time and resource efficiency serves as a practical indicator highlighting whether the media helps save instructional time and reduces unnecessary use of resources.

2. Critical Thinking Skill

Critical thinking is the ability to process information in a logical, analytical, and objective manner. A critical thinker can evaluate ideas, arguments, and situations using evidence-based and structured reasoning. This includes the ability to judge the validity, reliability, and relevance of information, detect logical fallacies, and construct well-founded arguments. Critical thinking helps individuals make informed decisions, minimize bias, and develop more effective solutions (Hasanah&Rusdiana, 2018).

This skill is essential in both academic settings and everyday life. Its key benefits include (Fausza et all, 2020):

- Fostering analytical and reflective thinking.
- Solving complex problems.

- Making thoughtful and informed decisions.
- Facing challenges with clarity and structure.

Critical thinking makes the students become more independent, innovative, and capable of adapting to the fast-changing world around them. Several interrelated components contribute to critical thinking development:

- Identifying assumptions
  The ability to uncover underlying assumptions in arguments or decisions. Recognizing these assumptions helps ensure that reasoning is based on verified facts.
- Analyzing information
  The ability to deeply examine and evaluate information—identifying relevant data, understanding context, and recognizing patterns or relationships.
- Evaluating arguments
  Assessing the strength, clarity, and validity of arguments, as well as reviewing the evidence and logical consistency used to support them.
- Problem-solving
  Using a systematic and creative approach to identify problems, analyze root causes, develop alternative solutions, and evaluate outcomes.
- Reflective thinking
  Engaging in introspection to review past experiences and decisions, allowing individuals to improve future decision-making and outcomes.

Developing students' critical thinking skills requires a variety of instructional approaches designed to sharpen their analytical, evaluative, and reflective abilities. Several effective strategies include the following:

- Problem-Based Learning (PBL)
  This strategy presents students with complex, real-world problems that demand in-depth analysis and innovative solutions. It encourages learners to think critically as they face challenges, stimulating their analytical and evaluative skills, and motivating them to generate evidence-based responses.
- Group Discussion
  Group discussion enables students to exchange ideas and critically engage with diverse perspectives through interactive dialogue. This process teaches students to construct and defend arguments, explore differing viewpoints, and deepen their understanding by considering other opinions critically and respectfully.

- Case Analysis
  In this approach, students examine real-life or simulated scenarios, identify key issues, and formulate solutions based on critical consideration. It strengthens analytical skills by requiring students to weigh various factors and perspectives before making well-reasoned decisions.
- Project-Based Learning (PjBL)
  Project-based learning involves students in longer-term tasks that integrate problem-solving and critical inquiry. Through research, data collection, and presenting outcomes, students are trained to think analytically and creatively while applying their knowledge in practical contexts.
- Think-Aloud Modeling
  In this strategy, the teacher verbalizes their thought process while solving a problem, clearly outlining each step of critical thinking—from identifying the problem to generating and evaluating solutions. This allows students to observe and internalize structured thinking patterns, helping them build their own critical thinking habits by mimicking the modeled approach.

Critical thinking ability can be identified through five key components that serve as indicators of a student's critical reasoning process (Setyorini&Suparno, 2021):

- Basic Clarification
  The ability to understand and define the nature of a question or issue clearly, including recognizing the problem, identifying key terms, and setting the context.
- The Bases for a Decision
  This refers to the reasoning and evidence used to support a particular conclusion or judgment. It reflects the student's ability to explain why a decision is made and what rationale underlies it.
- Inference
  The skill of drawing logical conclusions based on available data, facts, or observations. It involves recognizing patterns, making connections, and extrapolating insights from the given information.
- Advanced Clarification
  This involves deeper analysis, such as evaluating arguments, questioning assumptions, and examining the implications of ideas. It demonstrates a student's ability to engage in high-level critical inquiry.
- Supposition and Integration
  The ability to make hypothetical assumptions and synthesize diverse pieces of information to form a cohesive understanding or decision. This component reflects the integration of logic, creativity, and contextual awareness.

These five indicators form a comprehensive framework that supports the development of deep, logical, and evidence-based critical thinking. They guide students in clarifying information, reasoning systematically, evaluating arguments, and integrating knowledge for effective decision-making (Dimas Sofri, 2020).

Analysis

1. Research Analysis Results on the Use of Technology-Based Learning Media

The research conducted at MAN 2 Mojokerto regarding the use of technology-based learning media revealed that the integration of technology in the classroom has been quite substantial. According to an interview with the Fiqh subject teacher, technology-supported media are widely used, particularly in Grade XI. However, to gain a more comprehensive understanding of how effective these media are from the students' perspective, a survey was conducted.

The survey was distributed via Google Forms to a sample of 55 students and consisted of 18 questions. The following are selected highlights from the students' responses:

1. Ease of Access:
   - 40% of students found the media very easy to access,
   - 34.5% said it was easy,
   - 25.5% found it moderately easy.
2. Frequency of Use:
   - 7.3% reported rarely or never using it,
   - 27.3% said rarely,
   - 30.9% said occasionally,
   - 25.5% said often,
   - 9.1% said very often.
3. Compatibility with Devices:
   - 20% stated it was very compatible,
   - 38.2% compatible,
   - 36.4% moderately compatible,
   - 3.6% not compatible,
   - 1.8% not compatible at all.
4. Satisfaction Level:
   - 18.2% felt very satisfied,
   - 27.3% satisfied,

- 45.5% moderately satisfied,
- 9.1% less satisfied.

5. Effectiveness in Learning:
   - 38.2% found it very effective,
   - 40% effective,
   - 18.2% moderately effective,
   - 3.6% ineffective.
6. Level of Interactivity:
   a. 18.2% rated it as very interactive,
   b. 40% interactive,
   c. 40% moderately interactive,
   d. 1.8% not interactive.
7. Student Engagement:
   a. 25.5% felt highly engaged,
   b. 38.2% engaged,
   c. 34.5% moderately engaged,
   d. 1.8% not engaged.
8. Impact on Learning:
   a. 34.5% said the media had a very strong impact,
   b. 41.8% said it had an impact,
   c. 23.6% said it had a moderate impact.
9. Ease of Understanding the Content:
   a. 27.3% found it very easy to understand,
   b. 45.5% easy,
   c. 23.6% moderately easy,
   d. 3.6% not easy.

Based on the percentage analysis using the descriptive formula:

$$P = 1881 / 2475 \times 100 = 76\%$$

it can be concluded that the utilization of technology-based learning media at MAN 2 Mojokerto reached 76%, which falls into the "fairly good" category (68%–79%). This result indicates that the implementation of technology in the learning process has been sufficiently effective in supporting classroom instruction.

2. Research Analysis on Students' Critical Thinking Skills

The findings from the research on students' critical thinking abilities revealed encouraging results**.** The survey responses reflect a generally positive perception and experience among students. Here is a breakdown of the key insights:

1. When asked to rate their overall critical thinking ability, 10.9% of students described it as *very good*, 52.7% as *good*, 29.1% as *fair*, and only 7.3% as *poor*. This suggests that the majority view their critical thinking skills in a positive light.
2. Regarding the *effectiveness* of applying critical thinking, 18.2% felt it was *very effective*, 40% said *effective*, 34.5% *somewhat effective*, and 7.3% found it *less effective*. This indicates that most students recognize a practical benefit in using their critical thinking abilities.
3. Students were also asked to assess how well they apply critical thinking in practice: 18.2% said *very well*, 38.2% *well*, 40% *fairly well*, and 3.6% *not well*. This reflects a strong sense of self-awareness and moderate confidence in their application skills.
4. In another aspect of self-evaluation, 16.4% rated their performance as *very good*, 30.9% *good*, 43.6% *fair*, and 9.1% *poor*. While most responses remain positive, this data suggests there is still room for improvement.
5. When evaluating their ability to draw conclusions or solve problems using critical thinking, 16.4% rated themselves *very good*, 45.5% *good*, 32.7% *fair*, and 5.5% *poor*. The high percentage of positive responses implies that students generally feel capable in this area.
6. Regarding their ability to evaluate arguments or information critically, 7.3% considered themselves *very good*, 34.5% *good*, 47.3% *fair*, and 10.9% *poor*. This suggests this skill may be more challenging compared to others.
7. Students' confidence in using critical thinking showed that 20% felt *very confident*, 32.7% *confident*, 40% *somewhat confident*, and 7.3% *less confident*. This indicates most students are at least moderately confident in their critical thinking abilities.
8. In terms of how well they thought critically when faced with new or complex problems, 16.4% said *very well*, 30.9% *well*, 45.5% *fairly well*, and 7.3% were *less confident*.
9. Students were asked how frequently they use critical thinking: 21.8% said *very often*, 36.4% *often*, 29.1% *sometimes*, 10.9% *rarely*, and only 1.8% *very rarely*. This indicates that a significant portion of students actively use critical thinking on a regular basis.

Based on the questionnaire analysis, the percentage score for students' critical thinking ability was calculated using the descriptive formula:

$$\mathbf{P = 1793 / 2475 \times 100 = 72.5\%.}$$

This result indicates that students' critical thinking skills fall into the "fairly good" category (within the 69%–79% range). These findings suggest that technology-based learning media has played a positive role in supporting the development of critical thinking skills among students at MAN 2 Mojokerto.

3. Research Findings on the Impact of Technology-Based Learning Media on Critical Thinking Skills

Based on the results of a simple linear regression analysis, the study examined the influence of using technology-based learning media on students' critical thinking abilities.

The alternative hypothesis (Ha) stated that: There is an influence of technology-based learning media on the critical thinking skills of students at MAN 2 Mojokerto. The null hypothesis (H_0) stated that: There is no influence of technology-based learning media on the critical thinking skills of students at MAN 2 Mojokerto.

The results of the ANOVA test show the following:

F-calculated (F_h): 39.83

F-table (F_t): 4.02

Significance value (p-value): 0.000< 0.05

Since the significance value (p-value) is less than 0.05, the null hypothesis (H_0) is rejected and the alternative hypothesis (Ha) is accepted.

The R Square value from the regression analysis is 0.269**,** indicating that 26.9% of the variation in students' critical thinking skills can be explained by the use of technology-based learning media**.**

Simple Linear Regression Analysis

The regression formula is as follows:

$$Y = 1.663 - 0.517 = 1.146$$

Based on the coefficients table, the significance value is 0.000, which is less than 0.050. This confirms that there is a statistically significant influence of technology based learning media on students' critical thinking skills.

The results of the simple linear regression analysis demonstrate that the use of technology-based learning media has a significant impact on the critical thinking abilities of students at MAN 2 Mojokerto. The integration of this media has effectively supported the improvement of students' thinking processes making them more engaged, analytical, and critical in solving problems.

4. CONCLUSION

Based on the findings of the study on the impact of technology-based learning media on the critical thinking skills of 11th-grade students at MAN 2 Mojokerto, the researcher concludes the following:

First, the use of technology-based learning media in the 11th grade at MAN 2 Mojokerto has shown fairly good results. This is reflected by a percentage score of 76%, which falls under the "fairly good" category.

Second, the students' critical thinking skills are also considered fairly good, with a score of 72.5%, placing them in the same category.

Third, the hypothesis testing indicates a significant influence between the use of technology-based learning media and students' critical thinking abilities. This is evidenced by a significance value of 0.000, which is below the threshold of 0.050. Therefore, it can be concluded that the integration of technology-based learning media has a significant impact on enhancing the critical thinking skills of 11th-grade students at MAN 2 Mojokerto.

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