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Effectiveness of Interactive Learning Videos Based on Problem-Based Learning to Increase Student Motivation and Critical Thinking Skills

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Abstract

The purpose of the study was to determine the effectiveness of the product to improve student motivation and critical thinking skill. The research employs a quantitative research method, involving expert validation, small group trials, and field implementation with students at the MTs level. The results of the validation process indicate that the videos are highly valid, achieving a validity score of 93%, demonstrating alignment with the curriculum, appropriate material presentation, and user-friendly language. Effectiveness testing using N-Gain analysis shows a significant improvement in student motivation and critical thinking skills after using the videos compared to conventional methods. Independent Sample T-Test results further confirm the significant positive impact of the videos on learning outcomes. Student responses indicate that the videos are engaging, interactive, and supportive of independent learning. This study concludes that interactive learning videos based on PBL are effective educational tools for enhancing students' understanding of complex topics, such as the body's defense system, while fostering critical thinking and motivation. The findings highlight the potential of integrating technology-based media in classroom learning to achieve better educational outcomes.

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INTRODUCTION

The development of science, itechnology and communication (S&T) continues to grow rapidly. This shows that the development of education cannot be far from technology. This development is often referred to as the industrial revolution era 4.0. Syamsuar & Reflianto (2019) state that the digital era, in which all machines are connected through an internet system or cybernetic system, has brought about major changes in society. Zidniyati (2019) explains that the fourth industrial revolution is a time when northerners may communicate and exchange information and southern hemispheres is very fast, and they feel very close to each other. The results of technological development have been widely used in various aspects of people's lives, one of which is education (Nasfovi et al., 2023). The use of products resulting from technological developments greatly helps the entire field of education, starting from educators, students, school administration and infrastructure in the educational sector (Risdianto et al., 2020).

The teaching and learning process is where digital technology use in education has changed the most. The execution of learning must be designed as well as possible to provide good and appropriate service to students (Budiyono, 2020). A similar point was made by Yuniati & Saputra (2019) that The role of education in Industry 4.0 requires learning to be developed according to students' needs, not merely transferring knowledge, and focusing on the importance of optimizing technology in education. Therefore, The ability to recognize, adapt to, and use technology advancements in the teaching and learning process is a prerequisite for educators.

The increasing use of mobile technology provides additional opportunities to harness this learning potential from any location and even while traveling (Terras & Romsay, 2012). The rapid development of technology demands learning related to technology, which supports the emergence of one the pillars of digital learning.

Media is defined as something that can disseminate information from the source of information to the recipient of information (Karwono, 2018). Meanwhile, Learning is the process of interaction between teachers and students. Media can serve as a platform for educators and students to interact socially. Media can accommodate social interactions in unlimited space and time, now known as social media. According to Ganggi (2018), social media not only provides a space for interaction but also for disseminating information.

The context of critical thinking is intimately linked to social media literacy (Budiyano, 2020). Critically thinking students will be able to discern the veracity of content on social media (David et al., 2017). However, Social media enables students to access a variety of information sources quickly and easily (Andara et al., 2022). Critical thinking is a high-level thinking talent that encompasses the processes of analyzing (C4) and assessing (C5), according to Lewy (2009) in Mira (2018). Identifying or creating questions, separating out factors or causes of an issue, and analyzing data to find patterns or links are all steps in the analysis process.

Interactive videos serve as dynamic educational tools that enhance engagement and facilitate learning through visual and auditory elements. Among various types of interactive videos, vlogs—sometimes known as video blogs—stand out as a compelling format. A vlog, sometimes known as a video blog, is a daily video report, story, or exercise that is typically posted on a blog (David et al., 2017). At the moment, videos are one of the most popular content on YouTube (Harahap, 2019). Videos can draw people's attention in general, whether they are young children, adults, or members of the academic community (Ganggi, 2018). As a teaching tool, videos can be used rather well. According to research by Karamina (2020), using educational media based on YouTube videos helps teachers be innovative and can create engaging learning materials. Videos are useful for teaching science, especially biology, because of its lengthy benefits (Harahap, 2019).

Problem-Based Learning is a teaching approach that is based on real-world problems and encourages students to explore, think critically, learn, and solve problems (Killi et al., 2023). This is because iniproblem-basedilearning (PBL) education, students are given a problem to solve, and then they conduct research, inquiry, and problem-solving to develop concepts and ideas from a subject by using their own abilities to integrate concepts and information that they already comprehend (Karwono & Heni, 2018). In order to foster critical thinking abilities, the problem-based learning (PBL) style of education also encourages students to actively engage in the learning process and provides them with the chance to express and apply their own ideas when solving issues (Anis, 2023).

According to Farisi et al. (2017), The PBL approach's main objective is to help students become more adept at solving problems and thinking critically while also improving their capacity

to actively expand their knowledge. Higher Order Thinking Skills (HOTS), or the capacity for critical thought, are the main focus of the current curriculum, yet this is not its most significant component (Maulidiya & Ixora, 2023). As a result, something that can aid students in acquiring critical thinking abilities throughout the educational process is required (Mambetalina et al., 2023).

This study fills the gap between previous studies that only examined the effect of problem-based learning (PBL) or video separately by combining both in the form of interactive learning videos for the body's defense system material. The novelty of this study lies in the use of PBL-based interactive videos that not only teach concepts, but also encourage students to be actively involved in problem solving and improve critical thinking skills (Mira, 2018). The urgency of this research is very high, considering the importance of developing learning methods that can improve students' motivation and critical thinking skills, especially in today's digital era, where technology can play a big role in creating a more interesting and effective learning experience.

The use of Problem Based Learning Videos is an attempt to raise the standard of education (Rachmavita, 2020). To become a resilient future generation, the nation's potential successors need to be critical when examining social media (Oktariani et al., 2020).

METHOD

This study used a quantitative research method that provides detailed data collection and analysis to measure the effectiveness of interactive learning videos in improving student motivation and critical thinking skills. A quantitative approach would allow for the use of pre- and post-assessments, surveys, or experimental designs to gather measurable data on how the videos influence these outcomes. By incorporating statistical analysis, the study would be able to provide a more objective and empirical evaluation of the impact of interactive learning videos on students' motivation and critical thinking abilities.

The implementation phase includes video trials at a small scale with 10 students and a large scale with 38 students. Input from trials is used to evaluate products in order to meet educational needs in the best possible way. After that, the evaluation phase is carried out to assess the effectiveness of the instructional film using the pretest and posttest. The purpose of this evaluation is to ensure that the video can significantly increase students' motivation to learn and their critical thinking skills.

Methods for gathering data that use tools like exams, questionnaires, and needs analysis of interviews The questionnaire instruments needed in this study include material expert validation sheets and teacher and student questionnaire sheets (Richi et al., 2023). The test instrument is in the form of a test to measure the readability of textbooks that have been tested on a small scale. The calculation of the level of validity of the test used following formula:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Information:
r_{XY} = Product moment Coefficient
N = Number of samples
X = Item Score
Y = Total Score

Susanto & jaya (2023) a question is considered valid if its correlation coefficient (r_xy) exceeds the r-table value at a 5% significance level.

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1-\frac{M\,(k-M)}{kV_t}\right)$$

Information:
r_{11} = Instrument Reability
V_t = Total Score Variant
k = Number of questions
M = Average Score

Yusuf (2023) a question reliability is determined by comparing r_{11} value to r-table value; a question is considered reliable if $r_{11} > r_{table}$. The analysis of effectiveness of interactive learning video can be calculated using the formula below.

$$\text{<N-gain>} = \frac{Spost - Spre}{Smax - Spre}$$

Explanation:
<N-gain> = Effectiveness product
S_{pre} = Pre-test Score
S_{post} = Post-test Score
S_{max} = Maximum Score

Table 1. N-Gain Criteria

Value <g>	Criteria
g ≥ 0.7	High
0.3 ≤ g < 0.7	Medium
g < 0.3	Low

RESULT AND DISCUSSION

Result the Characteristics of Interactive Video Learning Media on Body Defense System Material

Problem Based Learning (PBL) learning videos on the body's defense system material are

designed with the aim of increasing students' motivation and critical thinking skills (Risidianto et al., 2020). This video has a systematic structure, starting with an introduction to learning objectives, explanation of basic concepts, to the presentation of real problem scenarios that are relevant to everyday life. The characteristics of this video include the presentation of problem scenarios related to bacterial, viral, or allergic infections, as well as unique facts about the immune system. This video is also equipped with animated simulations of the immune system mechanism, problem-based exercises, and everyday life contexts, such as healthy lifestyles and vaccinations (Shimizu et al., 2019). The use of local illustrations makes the material closer to the students' experiences, making it useful for the educational process (Thung & Kyao, 2017).

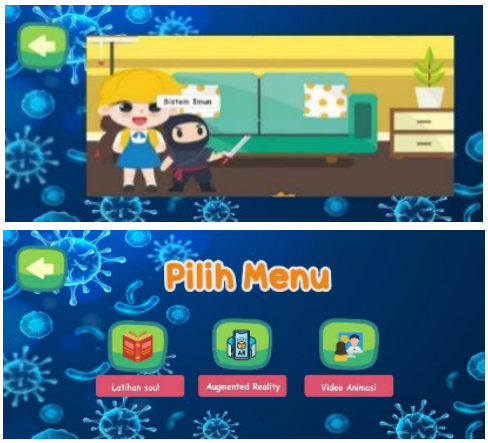

Figure 1. Interactive Video Learning Video Visualization Based on Problem Based Learning on Body Defense System Material

Result of The Feasibility Analysis of Interactive Video Learning Media on the Body's Defense System Material

Expert material validators' assessments serve as the basis for evaluating the validity of interactive learning films that employ problem-based learning. The assessment by the validator covers 3 aspects, namely curriculum, material design, and language use.

Table 6. Verification of Interactive Education Problem-Based Learning-Based Videos
(a) Material Expert Test Result

Aspect	Persentage (%)	Criteria
Curriculum	85 %	Valid
Material Design	95 %	Valid
Language Use	96 %	Valid

(b) Media Expert Test Result

Aspect	Persentage (%)	Criteria
Programming	94 %	Valid
Views	95 %	Valid
Average	94 %	Valid

Based on Table 5 presents the verification results of theiProblem-BasediLearningi(PBL)-based learning video from two main aspects, namely material experts and media experts. Based on the results of the material expert test, this video was considered very valid with high scores in various aspects. The curriculum aspect scored 85%, indicating its compliance with the applicable curriculum standards. Material design and language use scored 95% and 96% respectively, indicating that the material was presented clearly and easily understood by students (Yuliati & Saputra, 2019). Meanwhile, the media expert test showed very positive results. The programming aspect scored 94%, indicating good technical quality of the video, and the display aspect scored 95%, indicating that the video has an attractive visual design (Yuningsih et al., 2022). The overall average score was 94%, meaning that this video is very valid and meets the quality criteria in terms of both material and media, making it an effective and worthy learning tool.

Table 7. N Gain Result

Variabel	Mean	%	Criteria
Control	0.5647	56.47	Medium
Experiment	0.8049	80.49	High

Based on the table above, it shows that the control has a value of 0.5467, the value is $0.3 < g < 0.7$, meaning that the effect of Interactive Learning Videos on the Body's Defense System material in increasing the motivation and critical thinking skills of MTs Matholi'ul Huda Pucakwangi students has a moderate value criteria.

The utilization Interactive Learning Videos based on PBLon the Body Defense System material for MTs students shows that this learning media has many advantages thaticaniimproveithe quality of learning (Susilowati, 2017). This video is designed with interesting characteristics, presents material systematically and clearly, and uses dynamic visualizations that help students understand. The delivery of material that connects biological concepts with everyday life makes it easier for students to understand and is relevant to their experiences (Oktarina dan Fauziah, 2020).

The validation results of this video show

that the product developed is very valid. The assessment of expert validators shows that this video is in accordance with the applicable curriculum, has an attractive material design, and uses language that is easy for students to understand. With an average validity score of 93%, this video is suitable for use in the classroom learning process, meeting the educational standards applied at MTs (Zidniyati, 2019).

Additionally, this instructional film has been shown to be successful in raising students' motivation for learning and critical thinking abilities. Students who use PBL-based learning videos demonstrate a considerable boost in their motivation and critical thinking skills when compared to students who use traditional learning techniques, according to the results of the N-Gain test (Aqshal dan Asri, 2023). These results indicate that this media can help students be more active in the learning process, encouraging them to think analytically and find solutions to the problems they face (Hasanah et al., 2023).

The Independent Sample T-Test statistical test also supports this finding by showing that the application of interactive PBL-basedilearning videos has a significant positive impact on student understanding. This proves that this learning media not only improves conceptual understanding, but also enriches students' learning experiences, encouraging them to be more active and involved in learning materials.

Students' responses and reactions to this video were also very positive. Students felt that this learning video provided a fun and interactive experience, much more interesting than traditional learning methods (Ainiyah, 2018). The aspects of video presentation, completeness of materials, and benefits felt by students scored very well, reflecting student satisfaction with the quality and effectiveness of this learning video (Asrial et al., 2020).

Overall, the use of interactive PBL-based learning videos has proven to be very effective in improving students' conceptual understanding and developing critical thinking skills. This video, with its appealing design and relevant approach, makes it easier for students to grasp material that was once considered challenging, such as concepts in the body's defense system (Sinaga, 2024). In addition, this media also helps students in linking theory to real problems in everyday life, which increases their involvement in the learning process.

This learning video also provides convenience in terms of learning flexibility. Students can access this video anytime and anywhere, allowing them to learn according to their own pace and learning style. This supports more independent learning and can be tailored to the individual needs of students.

In the current digital age, the innovation of using PBL-based learning materials is highly pertinent. The use of video as a learning aid not only improves students' understanding of the material being taught, but also introduces them to more interesting and applicable learning methods (Kepakisan, 2024). This creates opportunities for the development of more interactive and technology-driven learning media.(Sudarsana et al., 2020).

According to the study's findings, PBL-based interactive learning videos are a highly successful teaching tool for raising MTs' learning standards. This video has excellent validity, a favorable effect on students' motivation and critical thinking abilities, and highly positive student feedback, making it a worthy substitute for creative and successful teaching strategies in the classroom.

CONCLUSION

Based on the research results and discussion, that interactive learning videos based on Problem Based Learning (PBL) on the Body Defense System content for MTs students are highly successful in enhancing their critical thinking abilities, learning motivation, and conceptual understanding. This video is designed with a systematic structure, dynamic visualization, and simple language, so that complex material becomes easier to understand. The presentation of the material is equipped with animation, infographics, and relevant problem-based case studies, making students more interested and actively involved in learning. The validation results show that this video is very much in accordance with curriculum standards, has an attractive design, and uses communicative language, with an average validity percentage reaching 93%. Its effectiveness is proven through N-Gain analysis and statistical tests, where the experimental class using interactive learning videos showed a significant increase compared to the control class. In addition, students gave very positive responses, assessing this video as a fun, informative, and relevant media to their learning needs. Overall, Interactive Learning Videos based on PBL are innovative, effective, and feasible learning media to be applied in the classroom. This media not only helps students understand the material in depth but also trains them to think analytically and find solutions in dealing with problems, making it a relevant alternative in the

digital era to create active, creative, and meaningful learning.

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