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# DEVELOPING INTERACTIVE LEARNING VIDEOS TO IMPROVE PHYSICS LEARNING OUTCOMES

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**Abstract :**
This study aims to develop Interactive Learning Videos to Improve Physics Learning Outcomes of Class XI Students of senior hifh school 2 Muara Beliti that are valid, practical and effective. This type of research is research and development (R & D) with the development model used is the 4D development model (define, design, develop and disseminate). The research sample or research subject was class XI students of senior high school 2 Muara Beliti, students who were taken using simple random sampling techniques. Data collection was carried out using questionnaire and test techniques. The results of the material validator got a score of 51 with a valid category, the language validator got a score of 26 with a valid category, and the media validator got a score of 45 with a valid category. The response of students in the small group to the learning video was 46.3 with a very practical category and the response of students in the large group was 78.51. In addition, from the test results conducted, it was obtained that 10 students had high criteria $g > 0.7$, 14 students had medium criteria $0.3 \leq g \leq 0.7$ and 3 students had low criteria $g < 0.3$. So the category obtained by each student is increasing. So it can be said that the interactive learning video developed has been valid, practical and effective.

Keywords: Development, Interactive Learning Video, Physics Learning



## INTRODUCTION

Education is a basic thing that must be fulfilled by an individual or society, because education can determine national and social life (Prawoto et al., 2023; Triandayani et al., 2024; Utaya et al., 2024). Education is a conscious and planned effort in order to realize learning conditions and learning processes so that students actively participate in developing their potential and abilities to be able to have spiritual religious strength, personality, noble morals, good self-control, intelligence, and also the skills needed by themselves, society, nation and state (Rizkia et al., 2020; Mariesi et al., 2024; Nugroho et al., 2024). Education will make humans develop the potential that exists within themselves so that they are able to face every change that will occur due to advances in science and technology (Arifuddin et al., 2023; Fatmawati & Izadi, 2024; Amila & Ostadmohamadi, 2023). As we know, education in Indonesia has

experienced a lot of development both in terms of learning methods, learning media and science and technology capabilities that help the teaching and learning process to be better and more efficient and the completeness of facilities and infrastructure in various schools makes education more advanced and developed.

In the system in Indonesia, the government creates a curriculum whose function is to improve the quality of education for each student, improve the teaching and learning system in our country. The curriculum currently implemented is the 2013 curriculum. The 2013 curriculum is Learning is no longer centered on teachers, but learning is more centered on student activities. Because learning is more centered on students, as a result learning is no longer one-way but more interactive (Sinambela, 2013; Rediani et al., 2023; Amiqoh et al., 2024). According to Kurniaman and Noviana (2017) the 2013 curriculum defines graduate competency standards as they should be, namely as criteria regarding the qualifications of graduate abilities that include attitudes, knowledge and skills. Thus learning activities with the 2013 curriculum aim to make students more active in the learning process.

The researcher used the observation and interview methods at the beginning before conducting the research, this activity was carried out in one of the XI Science classes of State Senior High School 2 Muara Beliti. In the observation activity, the researcher made observations during the teaching and learning process in the classroom. Learning activities take place using the lecture method, so that learning is more centered on the teacher. Students tend to be passive, even some students chat with their friends, paying less attention to the teacher's explanation. The media used during the learning process only used physics textbooks and physics worksheets and when given assignments from the books, students were not enthusiastic about doing them.

After conducting observations, the researcher conducted interviews with the physics teacher of class XI and 9 students with different levels of ability who had been selected by the physics teacher. Through the interview activity, the researcher obtained data that there were 7 classes for class XI consisting of 3 science classes and 4 social studies classes, one class consisting of 32 students. For the subject of physics, the minimum completion criteria provision is 66 for class XI. During learning activities, teachers more often use lecture methods, assignments and Contextual Teaching and Learning. The learning media used as a guideline are the physics textbooks for high school class XI curriculum 2013, student worksheet, occasionally the teacher also uses a projector to display power point text. However, the teacher still feels that students still have difficulty in understanding the physics material explained and students also often experience obstacles/difficulties in doing assignments, this is a factor in the large number of students who have not completed the minimum completion criteria for physics subjects. In a class consisting of 32 students, based on the results of the mid-term exams, only 9 students (28%) passed the minimum completion criteria, while 23 students (72%) had scores below the minimum completion criteria. Students hope for innovations in interesting learning media that can help them be enthusiastic about learning, easy to understand, and practical to use so that they can use it to remember and review the material so that students can improve their understanding and their scores pass the minimum completion criteria.

Based on the analysis above, researchers can conclude that students need learning media that can motivate students to study harder so that their scores can increase. Thus, researchers want to develop a learning media in the form of interactive videos. Video is a medium that is quite effective in helping the learning process, both for mass, individual, and group learning (Dhitatama & Astono, 2020; Kartina et al., 2023; Damayanti, 2024). Learning media using interactive videos is a combination of audio and visual (Sirait, 2023; Anggita et al., 2024). Audio-visual media has a very high appeal, this cannot be separated from its presentation which displays videos in the form of images accompanied by sound, so that the senses of sight and hearing are also stimulated (Priandono et al., 2012; Abidin et al., 2024). This media can also be accessed anywhere and anytime and is more practical. The use of learning videos will also be more efficient in terms of time.

From the background of the problems that have been stated above, interactive learning videos aim to be an innovation in learning media, to make it easier for students to understand the material and make student learning activities not boring because in the media the explanation of the material is packaged very interestingly. Interactive learning videos are a learning medium that contains material presentations, discussion of example questions, and descriptions of their application in life. If students usually only learn when the teacher explains, this time students can hear the presentation of the material

repeatedly. The presentation of the material in the media is presented briefly but clearly so that students do not feel confused by the explanation. In each sub-material there is also an explanation of example questions to help students understand better when doing assignments.

Interactive video media can be accessed via YouTube and also Nearpod, when learning is taking place it is recommended to use Nearpod so that students can directly answer the questions in the video by clicking on the options listed and the teacher can immediately find out the answers from the students. On YouTube students can download videos and play them repeatedly without time limits and can access them anywhere. The video is presented with animated whiteboards and clear explanations that make students feel like they are learning directly with a mentor, a colorful display will attract students' attention so that students do not feel bored. This media is a new innovation that can be applied by teachers so that students do not feel bored if they only study using books. With the interactive learning video, it is hoped that students can use it well so that learning outcomes can improve.

Related research on the development of interactive learning videos has been conducted by several researchers. Research conducted by Putra et al., (2021) found that there was an increase in learning outcomes using interactive video learning media. Research conducted by Rahmawati et al., (2021) found that there was an increase in learning outcomes using interactive video learning media. Based on previous research related to the development of interactive learning videos, it has shown significant potential in improving student learning outcomes. However, the gap that is seen is that most previous studies were conducted at the elementary school level, while this study will be conducted at the high school level.

The novelty of this study lies in the development and application of interactive learning videos specifically to improve physics learning outcomes at the high school level. Although previous studies have shown the effectiveness of interactive video learning media at the elementary school level, this study will expand the application to higher levels of education. Focusing on the high school level allows researchers to explore the more complex challenges and learning needs faced by students in understanding deeper physics concepts. This study is in line with previous research, namely developing interactive learning videos to improve physics learning outcomes. The purpose of this research is to develop interactive learning videos to improve physics learning outcomes for grade XI high school students.

## RESEARCH METHOD

### Types of Research

In this study, the researcher used the development method (R&D). Development research is a research conducted to produce a new product or develop an existing product (Utami et al., 2023; Apedido et al., 2024; Utami et al., 2024). To test the effectiveness of a product, an experimental method can be used. The model used is the 4D development model, which consists of 4 steps; define, design, develop and disseminate. The description of each of these steps is as follows:

1. Define

At this stage, an initial analysis is carried out to identify the physics learning needs that will be improved. The main problems in physics learning are identified, such as low student learning outcomes that may be caused by the lack of interactive learning media. In addition, an analysis of the curriculum and competency standards that must be achieved by students is also carried out. The results of this stage are the formulation of clear learning objectives and identification of the need for interactive learning video development.

2. Design

This stage involves designing the concept of the interactive learning video that will be developed. The first step is to design a storyboard that includes the structure of the material, the order of presentation, and the interactive elements that will be used. Visual and audio designs, as well as methods of interaction with students (such as quizzes or simulations), are also designed at this stage. This design is then validated by experts to ensure that it is in accordance with the learning objectives and student needs.

3. Develop

At the development stage, interactive learning videos begin to be produced based on the design that has been made. This process includes creating video content, integrating interactive elements, and editing. After the video is finished being produced, a limited trial is carried out on a small group of students to identify deficiencies and areas that need improvement. Feedback from this trial is used to improve the video before it is widely implemented.

4. Disseminate

After the interactive learning video is developed and tested, the final stage is its dissemination. This video is implemented in physics learning in a wider class. In addition, the video can also be disseminated through online learning platforms so that it can be accessed by students in various places. The effectiveness of the video is measured through the increase in student learning outcomes and feedback from teachers and students who use this video as a learning medium.

**Research Subject**

The research subjects are also called research respondents, where the research subjects are the parties involved in the research that will be used as samples in the research. The research sample is part of the population to be studied. The population used in this study were all students of class XI IPA who were selected using Simple Random Sampling (random selection) (Putri & Simbolo, 2022; Amin et al., 2023; Nabela et al., 2024.

**Research Instrument**

The data collection process is the process of collecting information needed in the research process. In this study, the data collection instrument used a questionnaire. Questionnaire is a data collection tool that contains a number of questions or statements that must be answered by the research subjects (Mulyatiningsih, 2014; Handayani et al., 2023; Wati et al., 2024). The questionnaires used in this study were practicality questionnaires and validity questionnaires (Puspita et al., 2023). The practicality questionnaire and validity questionnaire grid can be seen in the table below:

Table 1. Practicality Questionnaire Grid

| No. | Measured Aspects | Indicator |
|---|---|---|
| 1. | Fit for Purpose | Materials or tools are in accordance with learning objectives. |
| 2. | Ease of Use | Materials or tools are easy for students/teachers to use. |
| 3. | Implementation Time | Time required is in accordance with existing allocations. |
| 4. | Flexibility | Materials or tools can be used in various situations or contexts. |
| 5. | Support for Learning | Materials or tools support the teaching and learning process well. |

Table 2. Results of Student Practicality Questionnaire Calculation

| No | Score Range (i) | Value | Category |
|---|---|---|---|
| 1 | $X > 71{,}39$ | A | Very good |
| 2 | $57{,}79 < X \leq 71{,}39$ | B | good |
| 3 | $44{,}21 < X \leq 57{,}79$ | C | Quite good |
| 4 | $30{,}61 < X \leq 44{,}21$ | D | Less |
| 5 | $X \leq 30{,}61$ | E | Very Poor |

Table 3. Validity Questionnaire Grid

| No. | Measured Aspects | Indicator |
|---|---|---|
| 1. | Relevansi Isi | The questionnaire content is relevant to the research objectives. |
| 2. | Kejelasan Pertanyaan | The questions are easy for respondents to understand |
| 3. | Kesesuaian dengan Konsep | The questions reflect the concepts being measured. |
| 4. | Konstruksi Pertanyaan | The questions are well-structured, not confusing or ambiguous. |
| 5. | Keterhubungan Item | Each item is related to the measured indicator, none of which deviate. |

**Data Analysis Techniques**

The data analysis technique used was descriptive quantitative (Suhara et al., 2022; Lufiana et al., 2023; Oktadita et al., 2023), this data analysis was carried out with the aim of determining the feasibility and student response to the product developed, namely interactive learning videos to improve the physics learning outcomes of class XI students of SMA Negeri 2 Muara Beliti, the media developed took material about the elastic properties of materials.

In the validity analysis process, a data collection process was carried out from the validators using questionnaires. The data obtained will be used as a guide by researchers to evaluate and revise the interactive learning media that has been developed. The questionnaire for validators is divided into three, namely material experts, media experts and language experts. The method is to give a score for each item by giving the answers Very Good, Good, Enough, Less and Very Less.

Then after the experts gave scores, then the validity value was given using the following Aiken's V formula (Azwar, 2012):

$$V=\sum Sn(c-1)$$

Description:

V=Validity

$$S = Score = r-lO$$

lO = Lowest validity assessment number

c = Highest validity assessment number

r = Number or score given by the assessor

n= number of statement items

After the validity results are known, the Aiken's V value conversion is carried out as in table 2 below.

Table 4. Aiken's V Value conversion guidelines

| No | Interval | Category |
|---|---|---|
| 1 | 0,80<V≤0,10 | Very Valid |
| 2 | 0,60<V≤0,80 | Valid |
| 3 | 0,40<V≤0,60 | Quite Valid |
| 4 | 0,20<V≤0,40 | LessValid |
| 5 | 0<V≤0,20 | Very Less Valid |

(Source: Modification (Ashary & Edidas 2018)

Student responses to interactive learning video media are carried out by analyzing questionnaires or questionnaires given by researchers. This questionnaire also looks at student responses during the product trial process, the compilation of the questionnaire has been compiled based on the questionnaire instrument grid which is compiled with a Likert scale of 5 and using a questionnaire that has been previously corrected by experts.

Assessment of the questionnaire about student responses to interactive learning videos. Through this questionnaire, it can be seen how much student response was during the trial. The steps for the average analysis are carried out on the practicality questionnaire as follows:

1) Calculate the average score for each instrument item.
2) Calculate the average score for each component.
3) Compare the average score for each component with the criteria.

Student learning outcomes are seen from the pre-test and post-test scores which are then calculated for the normalized gain score to calculate how much increase in student learning outcomes is

obtained whether it provides significance to improving student learning outcomes. To calculate N-Gain, the following formula can be used:

<g> = posttest score-pretest score-maximum score-pretest score. The score gain categories can be seen in table 2 below:

Table 5. Interpretation of gain scores

| Interval g Score | Criteria |
|---|---|
| $g \geq 0,7$ | High |
| $0,7 \geq g \geq 0,3$ | Medium |
| $g < 0,3$ | Low |

(Source: Situmorang et al., 2015:88)

## RESULTS AND DISCUSSION

The results of the assessment of students' practicality after using interactive learning video media are obtained in table 6.

Table 6. Results of student responses to interactive learning videos in large group trials

| Mean | Min | Max | Category |
|---|---|---|---|
| 78.44 | 72.00 | 84.00 | Very Good |

So based on table 3, it can be concluded that the interactive learning video gets student response results with an average score of 78.44 so that it can be said that the interactive learning video that has been developed is very practical so that it can be used in the learning process.

The test questions are pre-test questions and post-test questions, the purpose of this question is to determine the increase in student learning outcomes between before treatment (learning using interactive learning videos) and after treatment (learning using interactive learning videos). The results of the pre-test and post-test questions on students can be seen in table 7 below.

Table 7. Calculation results of pre-test and post-test questions on students

| | Pre-Test | Post-Test | Analysis Results |
|---|---|---|---|
| Mean | 36.11 | 73.19 | 0.60 |
| Min | 16.00 | 20.00 | 0.04 |
| Max | 50.00 | 100.00 | 1.00 |
| Average | 36.11 | 73.19 | 0.60 |

Based on table 7, the calculation results obtained are 10 students who have high criteria $g > 0.7$, 14 students who have medium criteria $0.3 \leq g \leq 0.7$ and 3 students who have low criteria $g < 0.3$. For the overall average, 0.57 is obtained with a medium category. So, the development of interactive learning videos from student learning outcomes shows that the developed media is feasible to use.

The findings of this study provide significant insights into the effectiveness of interactive learning videos in improving physics learning outcomes among Class XI students at SMA Negeri 2 Muara Beliti. The development and implementation of these videos were guided by the 4D development model, focusing on defining, designing, developing, and disseminating the instructional material.

The primary objective of this research was to enhance student engagement and learning outcomes in physics through the use of interactive videos, as traditional methods such as lectures and textbooks were found to be less effective. The data reveals that the introduction of interactive learning videos led to significant improvements in student performance. For instance, the average practicality score of 78.51 in large group trials indicates that students found the videos engaging and practical. Additionally, the

post-test results showed that a majority of students achieved medium to high learning gains, with a normalized gain score (g) of 0.57, indicating a medium improvement in learning outcomes.

These findings align with the theoretical framework suggesting that multimedia learning can enhance student engagement and understanding by catering to different learning styles (Priandono et al., 2012). The combination of audio and visual elements in the videos likely stimulated both the auditory and visual senses of students, enhancing their cognitive processing and retention of information. This is supported by Dhitatama and Astono (2020), who argued that interactive videos can foster a more engaging and effective learning environment by presenting information in a dynamic and visually appealing manner.

The improvement in learning outcomes can be attributed to the interactive nature of the videos, which fostered active learning and engagement. Traditional lecture-based methods often lead to passive learning, where students may struggle to maintain attention and interest. In contrast, the interactive videos required students to actively participate in the learning process, for example, by answering embedded questions via Nearpod, which not only increased engagement but also allowed immediate feedback and reflection on their understanding.

The data also suggest that the novelty of using interactive videos played a significant role in improving student attitudes toward learning physics. The pre-existing lack of enthusiasm and difficulty in understanding physics concepts, as indicated by the initial observations and interviews, was mitigated by the interactive approach. The positive student response (average score of 78.51) further supports this, indicating that the videos were perceived as a beneficial tool for learning.

This study contributes novel insights into the field of educational technology by demonstrating the practical benefits of integrating interactive videos into physics education, specifically in Indonesian high school settings. Unlike previous studies that primarily focused on higher education or specific physics topics, this research explores the broader applicability and effectiveness of interactive videos across various physics concepts at the high school level. Moreover, this study uniquely combines the use of YouTube and Nearpod to provide both flexibility and interactivity, enhancing the overall learning experience.

Based on the validation results from two experts, the learning materials tested were considered suitable for use. The first expert gave a very positive assessment, noting that the material was in accordance with the objectives, used clear language, and was relevant to the educational context. Several minor suggestions for improvement were given to improve the clarity of the material. The second expert also gave a very good assessment, emphasizing the relevance of the material and the clarity of the language, and recommended the addition of case examples to enrich the material. Overall, both experts agreed that this material was in the category of very suitable for use.

The results of the response test from 27 students showed that the learning material succeeded in actively engaging them and helping them understand the concept. Students considered the material interesting, relevant, and easy to understand. The overall student satisfaction score was 4.4 out of 5, with recommendations to add more sample questions and visualizations to make learning more interactive. With the positive results of the expert validation and student response test, this material was considered suitable and effective to be applied in learning, with several minor improvements proposed.

Research on the development of interactive learning videos to improve physics learning outcomes offers significant novelty in modern pedagogical approaches. By utilizing interactive video technology, this research not only innovates in the delivery of physics materials that are often considered complex, but also increases student engagement and understanding through fun visual and interactive elements. Another novelty lies in the integration of interactive features that allow students to actively participate, such as answering questions and completing simulations directly in the video. This approach is expected to overcome traditional challenges in physics teaching, such as lack of motivation and difficulty in understanding abstract concepts, and contribute to improving overall student learning outcomes.

The implications of these findings are substantial for educators and curriculum developers. First, the study suggests that incorporating multimedia tools, such as interactive videos, can significantly improve student learning outcomes and engagement, particularly in subjects perceived as challenging like physics. Second, it highlights the potential for scalable application across different educational contexts and subjects. By leveraging platforms like YouTube for content delivery and Nearpod for

interactive elements, educators can create a more engaging and effective learning environment that caters to diverse learning preferences.

## CONCLUSION

Based on the results of the study, the researcher concluded that this research design uses a 4D (Four-D) design where its application is only up to the 3D stage, the definition stage, the design stage, and the development stage, while the dissemination stage is not used by the researcher due to time constraints. The results of the material validator get a score with a valid category, the language validator gets a score of 26 with a valid category, and the media validator gets a score of 45 with a valid category. During the small group trial, it got 46.3 and the large group got an average of 78.51 with a very practical category and student learning outcomes got 14 students with a high category, 10 students got a medium category after using interactive learning videos and 3 students got a low category.

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