

# The Effectiveness of Video-Assisted Multi-Representation Approach Learning Tools to Improve Students' Critical Thinking Ability

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**Abstract:** This development research aims to produce a product in the form of a video-assisted multi-representation approach learning device to improve students' critical thinking skills of sound wave concepts that are effective. The research design used is a 4D model consisting of Define, Design, Develop and Disseminate. The products developed are syllabus, Lesson Plans, Student Worksheets, Learning Videos and Critical Thinking Ability Assessment Instruments. Data collection techniques using validation sheets, critical thinking skills evaluation tool. Data on the validity and efficiency of the device were analyzed using the li scale. Product effectiveness data were analyzed using Gain standards. The average result of the N Gain test for critical thinking skills is 0.62 in the medium category, while the average N Gain test value for concept mastery is 0.73 in the high category. So, it can be concluded that the video-assisted multi-representation approach physics learning device to improve critical thinking skills in the sound wave material of students is effective.

**Keywords:** Learning Tools; Multirepresentation Approach; Critical Thinking Ability.

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## Introduction

The facts on the ground show the ineffectiveness of the teaching and learning process in schools. One of them is the teaching and learning process which is still conventional so that students have limitations in active and creative learning. This is in accordance with the results of interviews with physics subject teachers at SMAN 3 Mataram on October 22, 2020. He stated that the limitations of the learning process during this pandemic resulted in teachers having difficulty in developing learning tools so that it had an impact on students' interest in learning and difficulties in understanding subject matter. He also said that students had difficulty understanding the subject matter because the teacher could not control the learning process optimally. This is also supported by the results of a field

study conducted by Ramdani et al., (2020) which states that the learning strategies implemented by teachers have not been able to facilitate students to improve critical thinking skills because learning uses the lecture model so that learning tends to be passive and boring.

Physics is a branch of natural science that studies natural phenomena related to matter and energy. This phenomenon is formed from various physical quantities and to explain emerging phenomena, scientists build concepts and theories in an abstract form (Ismet, 2013). This abstract symbol causes students difficulty in understanding it because physics requires understanding and the ability to represent different ways of understanding it (Doyan et al., 2018). To understand physics, different representation skills are needed in the form of experiments, graphics, conceptual, formulas, diagrams, and pictures (Mahardika, 2013).

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The multi-representation approach is an approach that presents information in various forms, making it easier for students to understand the subject matter in different forms of representation. Multiple representations can describe different aspects of a real situation or describe the same aspect in different ways (Meij, 2007). Multi-representation means re-presenting the same concept in different formats, including verbal, pictorial, graphic and mathematical. The most general sense, representation is a configuration that can describe something else in some way (Kartini, 2009; Putri, 2012)

In addition to using a multi-representation approach, in the era of the industrial revolution 4.0, teachers must also be able to take advantage of the development of Science and Technology. One of them that can support a multi-representation approach is to use learning videos because the learning videos include various representations that can make it easier for students to understand the subject matter. Video is one type of learning media that uses images, sounds, and animations or illustrations of events from the material being studied (Rozie, 2013).

The functional relationship of a phenomenon is usually formulated with mathematics and described visually. Therefore, the teacher has an important role as a facilitator to improve student learning outcomes by creating an active and multi-directional learning atmosphere. Students' thinking skills are also rarely honed, especially critical thinking skills (Hidayatullah et al., 2018). Critical thinking ability is the ability of students to compare two or more information with the aim of gaining knowledge through deviant symptoms and scientific truth (Setyowati et al., 2011). Therefore, in learning, improvements need to be made, one of which is by using a multi-representation approach.

Based on these problems, it is necessary to do active and fun learning to stimulate critical thinking skills. Critical thinking skills are needed in solving problems, making decisions and can be a supporter in developing broad knowledge (Herliandry et al, 2018). Critical thinking ability is the most important problem-solving ability for everyone who is used in everyday life through serious, active and thorough thinking in analyzing information, (Ridho et al., 2020). The development of science and technology has a negative side that affects a person's moral ethics and has become a serious problem in society. According to Jamaluddin (2019), students need to be equipped with critical thinking skills to care and be responsive in dealing with these problems so that students participate in taking responsibility for the development of science and technology.

**Method**

The type of research used in this research is development research. In this case, the learning tools developed are: Learning Implementation Plans, Student Worksheets, teaching materials, learning videos and test instruments. Research and development is a research method that aims to develop learning media and test the effectiveness of the product. This development model refers to the development model proposed by Thiagarajan, also called 4-D which consists of defining, designing, developing, and disseminating (Sugiyono, 2014). The learning device developed is in the form of a multi-representation approach with the help of learning videos on sound wave material to improve students' critical thinking skills.

The research subjects in this study were 25 students of class XI MIPA 2, SMAN 3 Mataram. The instruments used in this study were validation sheets, student response questionnaires and tests of critical thinking skills.

The validity data collection technique uses a validity test by 6 validators with an assessment using a Likert scale. Then the effectiveness data obtained from the results of the N Gain test and efficiency data obtained from the results of the student response questionnaire.

The data analysis technique on validity uses a Likert scale and the effectiveness of learning devices is analyzed using N Gain, it can be seen in equation 1.

$$N - gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{min}} \dots\dots\dots (1)$$

Information:

- S<sub>post</sub> : Posttest Score
- S<sub>pre</sub> : Pre-test Score
- S<sub>max</sub> : Maximal Score
- S<sub>min</sub> : Minimal Score

Based on the results obtained using N Gain, the effectiveness categories are grouped according to Table 1.

**Table 1.** Interpretation of N Gain Index

No	Interval	Criteria
1.	g > 70	High
2.	30 ≤ g ≤ 70	Medium
3.	g < 30	Low

**Result and Discussion**

The definition stage aims to obtain information about the condition of students, problems that arise when learning, learning methods used by teachers,

supporting media and curriculum studies used. At this stage, an initial analysis was carried out by conducting interviews with physics teachers at SMAN 3 Mataram to find out the initial state. Then determine the content in the lesson plan by detailing the task of teaching material content, Core Competencies and Basic Competencies as well as indicators developed from Basic Competencies. The material developed in this research is Sound Waves. Furthermore, the formulation of learning objectives is carried out.

The design stage is the stage of making the initial draft of the learning device used in learning the sound wave material. The resulting drafts are Syllabus, Learning Program Plans, Student Worksheets, Test Instruments, Learning Videos. The development stage is the stage to produce product development which is carried out by testing the effectiveness of the developed device using a critical thinking ability test instrument. The visual of the video that has been developed can be seen in Figure 1.

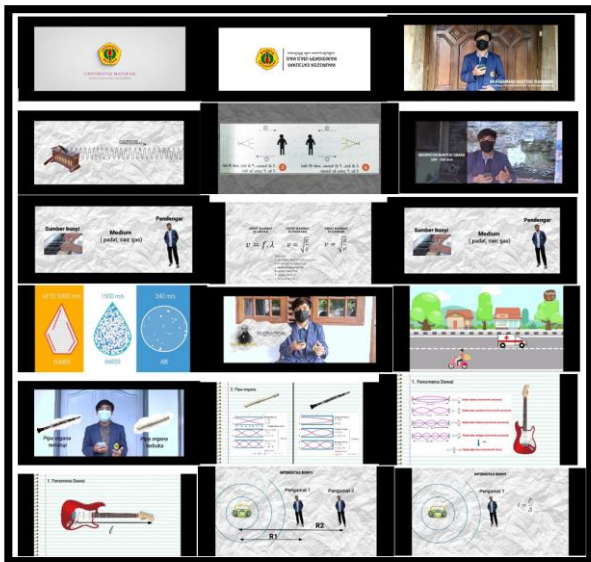


Figure 1. Display of Multi-Representational Approach Learning Video.

The critical thinking ability test instrument consists of pretest and posttest which is used to determine the improvement of critical thinking skills of students in class XI MIPA 2 which consists of 10 questions. The results of the pretest and posttest were obtained before and after the offline learning activities at SMAN 3 Mataram. The average N-Gain for class XI MIPA 2 students, totaling 25 people, can be seen in Table 2.

Table 2. Average acquisition of Critical Thinking Skills test with N Gain Test

$\bar{X}$ Pretest	$\bar{X}$ Posttest	N-Gain	Category
2.95	63.16	0.62	Medium

Table 2 above shows the increase in critical thinking skills of students in class XI MIPA 2 in the medium category with an N-Gain of 0.62. Kosim et al (2019) conducted a study using a multi-representation design that was able to improve critical thinking skills which was marked by a very strong correlation between the two variables. Khasani (2019), Kartini et al, (2019) also revealed that critical thinking skills can also be improved by giving test sheets that are prepared based on indicators of critical thinking skills and adapted to the material being taught. To find out the achievement of increasing the highest critical thinking ability indicator, the following describes the results of the N Gain test for each indicator which can be seen in Table 3.

Table 3. Average Gain per Indicator of Critical Thinking Skills with N Gain Test

Indicator	$\bar{X}$ Pre	$\bar{X}$ Post	N-Gain	Categories
Recognizing Problems	3.73	63.87	0.62	Medium
Revealing the Facts	3.60	59.60	0.58	Medium
Giving Arguments	1.20	59.73	0.59	Medium
Draw a conclusion	3.60	56.00	0.54	Medium

Table 3 shows that the critical thinking ability indicator for the N-Gain value is in the medium category. In addition, the increase in critical thinking skills for 25 students of class XI MIPA 2 in Table 2. shows an N-Gain value of 0.62 in the medium category. So, it can be said that there is an increase in the critical thinking ability of students in class XI MIPA 2. Furthermore, from 25 students it is known that the highest increase in critical thinking skills is experienced by 13 people, then 10 people in the medium category and 2 people in the low category. The details of the data can be seen in Table 4.

Table 4. Specifications for Critical Thinking Skills Category with N Gain Test

Score N-Gain	Categories	Number of Students	Percentage (%)
0.70 < g < 1.00	High	13	52
0.30 < g < 0.70	Medium	10	40
0.0 < g < 0.30	Low	2	8

Table 4 above shows the percentage increase in critical thinking skills with a high category of 52%, a medium category of 40% and a low category of 8%. Based on these percentages, it can be said that the learning tools developed can improve the critical thinking skills of students in class XI MIPA 2.

The increase in critical thinking skills in this study is in accordance with the statement that critical thinking skills are high-level thinking skills that are able to activate the ability to analyze, evaluate, identify problems, conclude and understand the implications of

arguments. Critical thinking skills are very important to be developed in schools, therefore teachers need to carry out learning that can improve critical thinking skills, (Nasir et al., 2015). One way to improve critical thinking skills is to use a multi-representation approach in learning.

## Conclusion

Physics learning device with video-assisted multi-representation approach on sound wave material is effective for improving students' critical thinking skills.

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