Development of Physics Learning Video Using STEM Approach on Measurement Material at SMAN 1 Muaro Jambi

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DOI: https://doi.org/10.33369/pendipa.7.3.373-377

ABSTRACT

The problem that is often encountered in learning at school, especially physics subjects, is the large number of students who say physics subjects are difficult to understand and are less interested in physics subjects, This is due to the not optimal learning media used by teachers, causing students not to understand the concepts and not interested in physics lessons. This lack of interest can be overcome with videos, so learning videos are needed that can increase students' understanding of concepts and learning interests. This study aimed to develop physics learning videos based on the STEM approach to measurement material. This research method uses a research and development design with a 4D development model. The subjects in this study were 30 students in class XI MIPA 1 at SMA Negeri 1 Muaro Jambi who had studied measurement material. This study used data collection in the form of initial needs questionnaires, interviews, media expert validation questionnaires and material experts as well as student response questionnaires. From the results of this study the media validation stage I obtained a score of 80.91% and stage II obtained a score of 97.36%. In material validation I obtained a score of 81.94% and stage II obtained a score of 96.52% and student responses to all indicators obtained a score of 83.86%. This study concludes that physics learning videos based on the STEM approach in measurement materials meet the eligibility criteria, which are very valid and very effective for learning physics measurement materials.

Keywords: *Learning Video; STEM; Measurement.*

INTRODUCTION

The learning process in schools is closely related to learning media. Learning media is a tool used to stimulate students' thoughts, attention and learning interests, as well as a tool to convey information and knowledge between teachers and students (Priyadi, 2018). Interesting learning media is needed in the learning process because it can increase students' motivation and interest in learning (Firdaus, et al 2022). Learning media is used in various fields of science, one of which is Physics. Physics is an integrated science with symptoms of natural phenomena that exist in everyday life. In order for physics to be conveyed well, it requires learning media that is easy to understand and effective. One of the learning media that is effectively used and easy to understand is video (Firdaus, et al 2023).

Video is an audio-visual media that contains learning messages both concepts, principles, procedures, and theories that apply students' knowledge to help understand learning materials (Riyana, 2007). The advantages of learning videos are that they help students understand the subject matter, help teachers in the learning process, and are also simple and fun learning media, because videos can be accessed on the Youtube application and these videos can also be used in the long term and at any time if you want to review the material (Fatmawati, 2018).

Based on preliminary observations made at SMAN 1 Muaro Jambi, it was found that there were 60.6% of students stated that measurement material was difficult to understand, and there were 78.1% of students who wanted learning media in the form of videos to facilitate learning,

then based on the results of interviews with physics teachers at SMAN 1 Muaro Jambi, it was found that the media that had been used so far only focused on printed books from schools and E-modules. The teacher usually writes down formulas and does not explain the physics concept. In addition, the media used by teachers is quite difficult for students to understand measurement material well. Therefore, it is necessary to make efforts to improve learning media on the measurement material. One of the efforts that can be done is to develop learning media in the form of learning videos that can understand measurement material well and can solve existing problems, so that learning objectives are achieved.

Based on these problems, a study was conducted to develop a physics learning video based on the STEM approach to measurement material so that it can support the learning process and become a learning resource and tool to understand the concept of measurement material and foster students' enthusiasm for learning, especially measurement material.

RESEARCH METHODS

This research uses the type of R&D or *Research and Development* method (Sugiyono, 2013). The research was conducted at SMA Negeri 1 Muaro Jambi for 2 months, from May 2023 to July 2023. The population of this study were all students of class XI MIPA SMAN 1 Muaro Jambi. The sample in this study were 30 students from class XI MIPA 1.

The research design or research design is using the 4D development model which consists of define, design, develop and disseminate. Data collection techniques come from observations, interviews, media expert validation questionnaires and material experts and student response questionnaires. Data analysis techniques come from qualitative and quantitative data. Qualitative data is obtained from suggestions and comments from a team of material and media experts. Determination of assessment criteria is at the stage of validation of media experts and material experts on the learning videos that have been developed. While quantitative data consists of numbers obtained from initial observations, material and media expert validation questionnaires that have been filled in by a team of experts and response questionnaire scores given to students. The data obtained is assessed using a Likert scale. The assessment of two validators consisting of media validators and material validators includes aspects, namely content, learning, appearance and presentation and programming. After obtaining the percentage of validation assessment of material and media experts, then look for response criteria / perceptions from students.

RESULT AND DISCUSSION

The results of research and development carried out in the form of physics learning videos based on the Science, Technology, Engineering, and Mathematics (STEM) approach to measurement material. The learning video follows the stages in the approach (STEM) Video development is adapted to the 4D development model which consists of several stages including: define, design, development;, and disseminate.

The initial stage that researchers do is the definition stage. This process is done to determine and define the needs in learning. This stage aims to collect and determine the requirements in learning by analyzing. Analysis activities can be defined as an initial activity carried out by researchers which aims to find out the problems faced by the research subjects, namely students in class XI MIPA 1 at SMA Negeri 1 Muaro Jambi. The results of the analysis are in the form of a needs analysis where students use the 2013 curriculum in the learning process.

Based on the results of interviews with physics teachers at the school, it is known that the methods that teachers apply are still conventional such as lecture methods, discussions and there is still a lack of learning media used by teachers, the media used by teachers are only in the form of printed books and *e-modules* so that students are less interested in learning and learning media are needed that can improve students' understanding of concepts and interest in learning. One of them is applying physics learning videos based on the STEM approach. This is in line with research conducted by Khairul (2022) obtained the results of STEM-based learning videos on temperature and heat material can improve students' concept understanding where the video presents examples

of application in everyday life and is equipped with sample problems and practice questions that are easily understood by students. In addition, STEM-based physics learning videos have been proven to increase students' interest in learning (Berliana, 2021).

The next stage in the development carried out is design. At this stage everything needed will be made in accordance with what is in the definition stage. Researchers design and make learning videos according to the applicable curriculum and basic competencies, as well as formulate learning objectives and materials that are displayed sequentially with each example of application in everyday life, then engineer or make a simple measuring instrument and practice questions in each episode in the video with the aim of *feedback* or *feedback* given by students to the products developed by researchers.

According to Rizani (2016) the steps in making learning videos include: 1) outline the media program; 2) make a synopsis; 3) make a *treatment;* and 4) make a script or program script. After these steps are taken, the next activity is video shooting, editing and mixing.

After the initial design of the learning video has been designed, enter the development stage where at this stage validation is carried out by a team of validators to assess whether the learning video is valid or invalid. The learning video developed consists of 6 videos with details of 1 introductory video and 4 videos of measurement learning material and 1 video of measurement practicum. In the introductory video, researchers briefly explained the meaning of learning media, Basic Competencies (KD) and learning objectives. The first video contains learning about the concept of accuracy and precision. The second video contains learning about the use of measuring instruments. The third video contains learning about errors in measurement, and the fourth video contains learning about the use of significant figures.

The four videos use the STEM approach, namely: first, students are given an explanation of the concept of science that studies natural science or natural phenomena that exist in it. Second, students are invited to apply the concepts of science that exist in everyday life and also students work on questions that have a *youtube* description link as an assessment or *feedback* from students to researchers, third students are invited to make or design a tool from simple materials in the surrounding environment and fourth students are invited to calculate the results of these measurements. To measure the feasibility of video learning media developed in terms of media validity. For this reason, indicators are needed that can measure this aspect. Expert validation instruments are used to measure the level of validity of the learning videos developed.

Validation of media experts and material experts was carried out by two Jambi University Physics Education lecturers. In this validation process, assessments and improvements were made to the inappropriate parts of the video and also to the wrong material so that after validation the media and material could be declared worthy of being tested on students. The assessment used a questionnaire consisting of 19 questions for media validation and 18 questions for material validation.

The results of the media expert and material expert validation phase I and phase II can be seen in Tables 1, 2, 3 and 4.

Table 1. Phase I Media Expert Validation

Expert	Validation	Criteria
Media Expert I	67.10%	Not good
Media Expert II	94.73%	Very good
Average	80.91%	Good enough

Table 2. Media Expert Validation Phase II

Expert	Validation	Criteria
Media Expert I	94.73%	Very good
Media Expert II	100%	Very good
Average	97.36%	Good enough

Tabel 3. Stage I Material Expert Validation

Expert	Validation	Criteria
Material Expert I	68.05%	Not good
Material Expert II	95.83%	Very good
Average	81.94%	Good enough

Table 4. Phase II Material Expert Validation

Expert	Validation	Criteria
Material Expert I	93.05%	Very good
Material Expert II	100%	Very good
Average	96.52%	Good enough

Based on the quantitative analysis conducted, it appears that at each stage of expert validation there is an improvement. This is in line with the qualitative input and suggestions given to improve the developed product. Furthermore, to measure the level of validity of the learning video referring to the results of the second stage validation, the learning video obtained an average quantitative value of 97.36% for validation by media experts and an average quantitative value of 96.52% for validation by material experts. So based on the provisions in table 1, the learning video developed is declared to be in the "Very Valid" category or can be used without revision. This is in line with research conducted by Ernauli (2021) which obtained the results of animated videos based on the STEM approach on sound wave material at SMAN 13 Medan in the "Very Valid" category with quantitative results of 97.37% for media expert validation and 95.83% for material expert validation. The video development was carried out using the Kinemaster application.

Furthermore, to measure the effectiveness of the media, it is seen from the students' response to the physics learning video based on the STEM approach on measurement material. To measure the effectiveness of the learning video, obtained from a small group trial involving 30 students of class XI MIPA 1. Data collection using a student response questionnaire consisting of 28 questions covering four aspects, namely: 1) Material content; 2) Learning; 3) Display and presentation and 4) programming. The results of this small group trial obtained a total average percentage obtained 83.86%. So based on the provisions in table 2, it can be concluded that the learning video developed is classified as "Very Effective" in terms of the students' response questionnaire. To see the comparison of the results of the learner response questionnaire on each aspect of the assessment assessment is presented in the graph in Figure 1 below

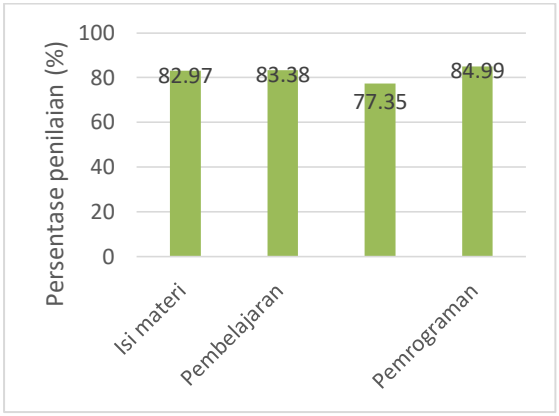

Figure 1. Learner Response Graph

Figure 2. STEM based video display

Based on the graph in Figure 1, it appears that in terms of each aspect, the results are very good. From the content aspect, it gets a percentage score of 82.97%, meaning that in terms of video it can increase students' understanding, examples of problems and applications in measurement material are clear and easy to understand, and the image display attracts students' attention in the learning process so that it can be categorized as very good. From the learning aspect, it gets a percentage score of 83.88%, meaning that in terms of material delivery it can help students understand the material, the language used in the video is easy to understand and can motivate students and foster curiosity in learning. This aspect is in the very good category. Furthermore, from the aspect of appearance and presentation, it gets a percentage score of 77.35%, which

means that in terms of the appearance of the letters in the video, the distance and space used in the video are appropriate and appropriate, then the text in the video is easy to read and in terms of the narrator's voice sounds clear, and the accompanying music is appropriate. This aspect is in the good category. Furthermore, the programming aspect gets a percentage of 84.99%, meaning that in terms of STEM-based videos can run well, and this STEM-based video can attract the attention of students in learning measurement material. This aspect is in the very good category.

CONCLUSIONS

Based on the research results obtained, it can be concluded that:

1. The making of this physics learning video uses the STEM approach, namely science, technology, engineering and mathematics on measurement material using the 4D development model consisting of define, design, development and disseminate.
2. The feasibility of this learning video is based on the results of the validation questionnaire of media experts and material experts. The results of media expert validation were declared very valid with an average value of 97.63% and the results of material expert validation were declared very valid with an average value of 96.52%.
3. Learner's response to this STEM based physics learning video was categorized as very good with an average score of 83.86%.

ACKNOWLEDGMENTS

Thanks to the parents who always support us and all parties of SMAN 1 Muaro Jambi who have allowed to carry out research. We also thank the respondents and friends who have helped in conducting this research.

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